# Allegheny County Parks Streams Assessment

# Phase 2 Report

## Deer Lakes, Round Hill, and Settlers Cabin Parks

December 2023

Penn State Extension

Allegheny Watershed Steward Program of Allegheny County

| TEAM | 2021 - 2022 Phase 1 | 2022-2023 Phase 2 | 2023-2024 Phase 3 |
|---|---|---|---|
| North | Hartwood Acres Park | Deer Lakes Park | North Park |
| East | Harrison Hills Park | Round Hill Park | Boyce Park |
| South/ West | White Oak Park | Settlers Cabin Park | South Park |

Allegheny County Parks Foundation

PennState Extension

Master Watershed Steward Program

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The following report details the findings of the **Allegheny County Parks Streams Assessment Phase 2** – a cooperative effort among the Allegheny County Parks Department, the Allegheny County Parks Foundation, Allegheny County GIS Department, and the Master Watershed Steward Program of Allegheny County. Funding for this project was provided by the Foundation for PA Watersheds. For additional project description, please refer to the Phase 1 Report.

## INTRODUCTION

- Purpose of Project

The current study of streams within the parks assesses the condition of the streams through the assessment of their chemistry, macro-invertebrate biological community, and physical condition using standardized procedures over a one-year period in each park. This process provides a limited baseline for comparison in the future. While a one-year study provides valuable data, it should be noted that a 3 to 5 - year study is recommended for baselines due to yearly fluctuations in weather conditions. This baseline information can be valuable in tracking benefits of site management strategies such as AMD treatment, erosion control measures, etc.

Conducting three types of assessments concurrently provides insight into short-term fluctuations in flows and chemistry, into the long-term stability of the stream channel as it is impacted by weather and land use over decades, and the health of the biological community occupying the stream which is impacted by both long- and short-term conditions.

The purpose of this study is to provide user-friendly information for Parks and Foundation staff and administration to guide decisions in land use, land management, or restoration activities. Toward that end, the Master Watershed Steward program submits its collected data to the county's GIS database so that the data and observations are readily available for review.

In line with the end-goal of enhancing the condition of the parks and visitors' experiences and the environmental quality of the natural resources, specific concerns that were identified and recommendations for addressing them are provided.

- 9 - Park Plan

The streams assessment is being conducted over a three-year period with three parks assessed for one year each. The schedule for assessment of the parks is:

| TEAM | 2021-2022 | 2022-2023 | 2023-2024 |
|---|---|---|---|
| North (Team 1) | Hartwood Acres | Deer Lakes | North Park |
| East (Team 2) | Harrison Hills | Round Hill | Boyce |
| South/West (Team 3) | White Oak | Settlers Cabin | South Park |

## PROTOCOLS

Stream assessments can face multiple challenges due to weather. Severely cold conditions can freeze low-flowing streams and/or prevent equipment from operating. Similarly, while high flow events might make conditions unsafe for conducting in-stream activities, dry conditions or leaf-filled channels can make flow/discharge or other measurements impossible.

Physical conditions in or around the stream can also make work hazardous or unfeasible. The presence of extremely dense brush, poison ivy and/or steep slopes or other barriers can make it difficult or impossible for stewards to safely access a stream channel. Safety is the priority of the Master Watershed Steward program and volunteers are encouraged to use their discretion in assessing the conditions in the field with that in mind.

Chemical and biological assessment sites were chosen for several considerations:

- to capture the most impact of park activity & management
- safe to access
- perpetual flow – if possible.

With the help of Braden Meiter, Lead Supervisory Park Ranger for Allegheny County Parks, the Steward Team Leaders selected sites for chemical and macroinvertebrate sampling. While visually assessing each stream and tributary would be ideal, the volunteers were hampered by steep inclines and thickets of thorny berry canes and multiflora rose. Those stream channels that were impassable did not receive any rating.

As in Phase 1, teams captured chemical and biologic data on Samsung tablets with paper record back-up. New for Phase 2 is the enabling of an additional app by the County GIS Team that permits the Master Watershed Stewards to color-code the visually assessed streams. This produces an online map complete with a key to the color-coding indicating overall stream health based on the USDA Stream Visual Assessment Protocol.

## - Chemical Assessment

Chemical assessments provide *snapshots* of the condition of the stream at the time of the sampling. Without ongoing monitoring by autonomous electronic probes installed in a stream, sampling captures an intermittent record that provides only a sketch of the performance of a stream as it reacts to weather, chemical impacts from road salt, etc. or land management activity.

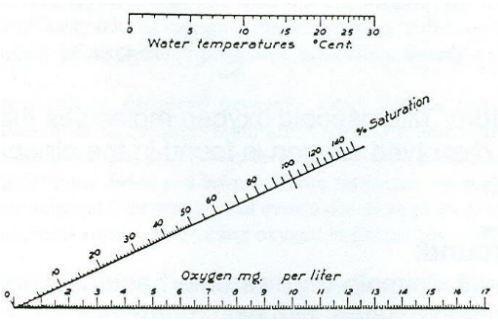
Each of the three teams of Master Watershed Stewards is equipped with Hach "Stream Kits" for measuring temperature, pH, dissolved oxygen, phosphates, and nitrates. "Expert CTS ThermoFisher" conductivity meters and "PCE Instruments" turbidity meters were used to measure those parameters. Flow (discharge) [cubic feet per second] was approximated by measuring the time a float took to travel a section of a stream with a defined/measured cross-section.

Chemical parameters were measured monthly as feasible, with duplicate testing conducted as staffing allowed. As the biological and visual assessments were launched, the time demands of chemical testing led stewards to modify their process as needed. If large disparities were seen, additional runs were conducted as necessary. If tests were not run or considered reliable because equipment was not calibrating correctly, for example, values of 9999 were entered when the database required a value to be recorded. If entered in the data, questionable values are denoted on a pink or blue field – see notes that accompany each table.

Chemical Parameters for Healthy Streams

- pH: Most aquatic organisms have adapted to survive in water that has a pH range between 6 and 9 but sensitive species prefer 6.5 – 7.5**.** The pH of the environment influences the ability of biological and chemical processes to function effectively.

- Dissolved Oxygen (DO): Dissolved oxygen in a stream may vary from 0 – 18 mg/L. DO is inversely proportionate to temperature: colder water can hold more dissolved oxygen than warm water. Water can be "super saturated" with oxygen.




To determine percent saturation: Multiply your DO level (mg/L) by an atmospheric pressure correction factor.

Elev. 542-1094 = .98 factor

Elev. 1094-1688 = .96 factor Find this corrected DO level on the bottom horizontal line and draw a straight line to connect to the water temperature (top line).

Source: Allegheny College Creek Connections

Dissolved oxygen gets into water by contact with the atmosphere, through aeration in turbulent areas, and through photosynthesis of aquatic plants. It is consumed during normal metabolic functions of aquatic organisms but can be depleted if excessive nutrients disrupt the balance and cause an excess of plant growth followed by decay. Dissolved oxygen levels in natural aquatic systems follow daily and seasonal cycles.

| Range of Tolerance for Dissolved Oxygen in Fish | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| mg/L dissolved oxygen | | | | | | | | | | |
| 0 | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10… |
| <3.0 mg/L too low for fish populations | | | 3.0 – 5.0 mg/L 12-24 hr. range of tolerance/ stressful condition | | | 6.0 mg/L supports spawning | > 7 ppm Supports growth/activity | >9 mg/L Supports abundant fish populations | | |

Adapted from the Water Research Center

Most aquatic organisms need at least 5 mg/L of dissolved oxygen to survive. Different aquatic insects and fishes have different oxygen demands. For example – some Northern Pike, a cold-water fish, require 6.0 mg/L DO and Black Bullhead catfish only need 3.3mg/L to survive. An animal's oxygen demands can change with environmental conditions. For example, a trout requires six times more DO at 75 degrees Fahrenheit compared with 41degrees Fahrenheit due to higher metabolic demands.

- Phosphate (Orthophosphate): Most unpolluted streams have levels below 0.03 mg/L. Phosphate levels can be elevated by fertilizer or detergent entering a stream through run-off or attached to sediment washed into the stream.
- Nitrate: Unpolluted waters have nitrate levels below 4.4 mg/L. Nitrate is another pollutant related to fertilizer or animal waste entering the stream. Both Phosphate and Nitrate can contribute to elevated algae growth which can deplete DO if/when killed off by low water levels or cold weather.

The Hach nitrate test uses a colorimetric measurement, comparing a treated sample to an untreated one. The amount of nitrate is indicated by the presence and intensity of a pink coloration in the test sample. Chloride is an oxidizing agent and disrupts the test by producing a peach/orange tone. Tests with that result are voided and recorded as 9999 -- an invalid score.

- Conductivity: Conductivity is the measurement of the ability of water to conduct a current and is an indicator the number of ions in a stream, such as those produced by road salt or other ionizing compounds entering the stream and going into solution. According to the EPA, inland fresh-water streams that support good mixed fisheries range from 150 -500 mS/cm (microsiemens per centimeter.)

- Turbidity is an optical measure of the clarity of water which can be impacted by solids suspended in the water column. The lower the NTU (nephelometric turbidity units) value for turbidity, the clearer the water.

  High levels of turbidity can affect stream health by warming the stream, thus reducing Dissolved Oxygen levels and promoting algal growth. Furthermore, sediment can transport pollutants into the stream. Suspended materials can clog fish gills and affect egg and larval development. If the particles settle and blanket the stream bottom, they can smother fish eggs and benthic macroinvertebrates.

## - Visual Assessment

The physical condition of streams was scored using the USDA's Stream Visual Assessment Protocol. This protocol prescribes a 10 – 1 (best – worst) score for attributes of:

- Water appearance (clear, cloudy, discolored, or filmy)
- Channel condition (extent of manmade alteration or armoring)
- Bank stability (presence or severity of erosion)
- Embeddedness (extent of sediment deposition on stream floor)
- Fish barriers (presence of man-made barriers to fish movement up/downstream)
- In-stream fish cover (types of shelter from predators)
- Invertebrate habitat (types of structure for egg-laying and sheltering)
- Riparian zone (condition of streamside vegetation)
- Canopy cover (extent of shade by forest vegetation)
- Nutrient enrichment (indication of excess algae or other growth)

The presence of any indication of AMD (abandoned mine drainage), manure, or sewage is captured as well.

A score of 10 would be the condition met in an undisturbed forest stream with a healthy trout population, while a 1 would be a concreted drainage canal in California. *Segments* are areas that have consistent overall character and land use around them. Scores are based on the overall score for the segment's condition, recognizing that some specific areas might differ, which is recognized in the scoring parameters. (See Bank Stability example below.)

| Bank Stability | | | |
|---|---|---|---|
| Banks are stable; at elevation of active flood plain; 33% or more of eroding surface area of banks in outside bends is protected by roots that extend to the base-flow elevation. | Moderately stable; at elevation of active flood plain; less than 33% of eroding surface area of banks in outside bends is protected by roots that extend to the base-flow elevation. | Moderately unstable; banks may be low, but typically are high (flooding occurs 1 year out of 5, or less frequently); outside bends are actively eroding (overhanging vegetation at top of bank, some mature trees falling into stream annually, some slope failures apparent). | Unstable; banks may be low, but typically are high; some straight reaches and inside edges of bends are actively eroding as well as outside bends (overhanging vegetation at top of bare bank, numerous mature trees falling into stream annually, numerous slope failures apparent). |
| **10 9 8** | **7 6 5 4** | **3 2** | **1** |

Photographs were taken of notable features or conditions within the stream channel and at waypoints designating segment start- and endpoints.

- Biological Assessment

Biological assessments survey the living aquatic community of a waterbody. Several techniques are available for this process. A common one was applied here to inventory the types of benthic (bottom-dwelling) macroinvertebrates (animals lacking vertebral columns that can be see without a microscope). These can include crayfish, clams, snails, aquatic worms and leeches, and an array of insects' larval stages. Because all these organisms spend extended periods to all their lives in the water and have recognized tolerance levels to water conditions, they provide a gauge of the conditions of a stream over a long period. Benthic macroinvertebrate insects are generally less than one inch in length, and most have external gills that are vulnerable to sediment and chemical disruption. They provide the primary food source for many fish and other aquatic life and are valuable in breaking down organic debris entering the stream. Sensitive species native to streams in southwest Pennsylvania generally prefer sediment-free rocky bottoms in flowing streams where they have high levels of oxygen and can be safe from predation. Macroinvertebrate insect populations generally peak in the spring and fall as over-wintering species or summer-maturing species are approaching "emergence" as flying adults. Surveys are generally conducted during spring and fall months.

Macroinvertebrate surveys were conducted using a 1mX1m kick net which is anchored in the bottom of the stream. A 1- meter square area of substrate immediately upstream of the net is "kicked" (disturbed) for a set length of time to flush animals into the net. Sampling is done in different types of habitats to identify animals with different feeding and habitat preferences. Animals captured were scored using the "Hoosier Riverwatch Biological Monitoring" score sheet which weighs each taxonomic order present based on their sensitivity to pollution and generates a Pollution Tolerance Index (correlated to water quality) of "poor", "fair", "good", or "excellent". The scoring system applied does not address individual counts for each taxonomic Order but provides an appropriate level of assessment for this study.

- Quality Assurance and Control

Duplicates run at each assessment for dissolved oxygen were prioritized as this parameter is key for determining invertebrate viability in a stream. A mid-year meeting of team leaders provided a check-in on confidence in results and an opportunity to address difficulties with the calibration sample for one team's conductivity meter and order a replacement vial. Year-end scrutiny of results provided an opportunity to identify gaps and irregularities in the on-line data and allowed for correction or explanation of the posted results. See notes under Chemical Assessment above regarding the validity of data.

## RESULTS – YEAR 2

- GIS Data map:

All data and photo images for the three parks studied are available at the following interactive link.

https://alcogis.maps.arcgis.com/apps/dashboards/de70025d4c8943d383d6e266dd8579dd

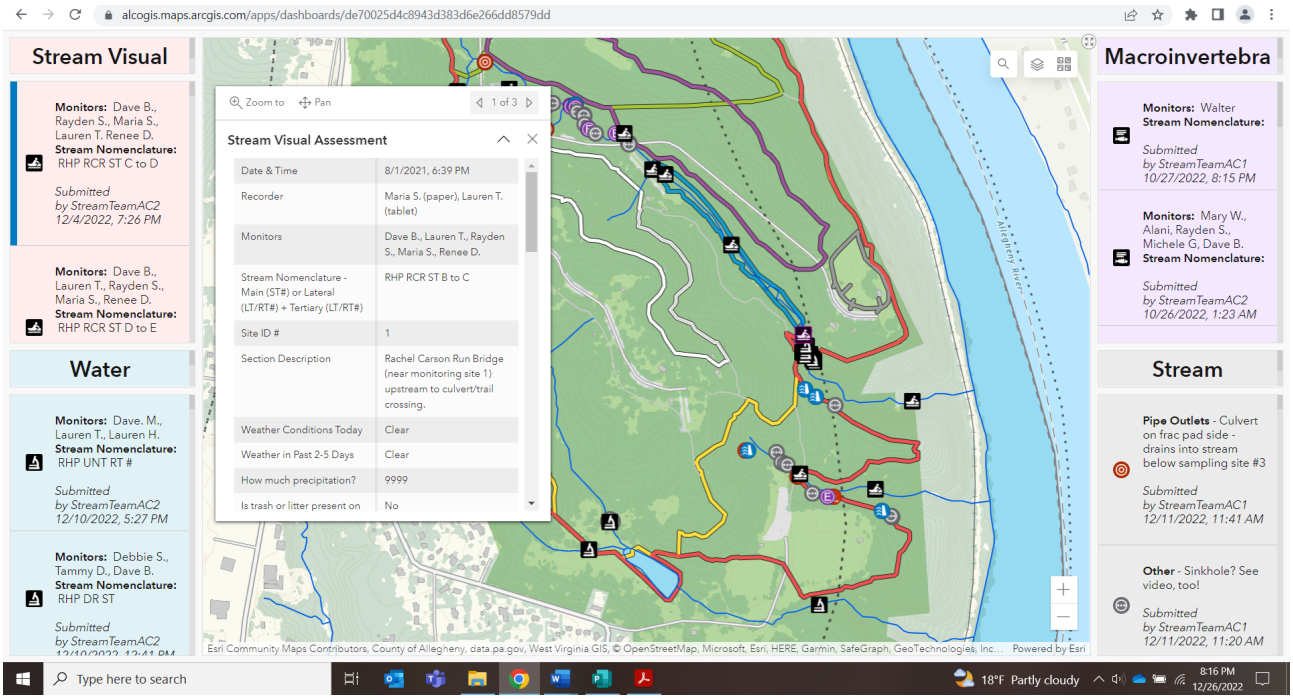
**** This website is not currently intended for public access. ****

You will need to log onto an ARCGIS account to access the link above. Using the cursor, you can drag the map image to the park in question and then use the + and – buttons to zoom in or out on the map.

The side panels of the dashboard display the different icons corresponding to the different assessments conducted. Icon locations indicate where the data was captured. To reveal the data or photograph for that location, click on the data point. Photographs or waypoints may be coded for the type of image content captured such as erosion, debris jam, outflow, etc.

A new mapping tool has been developed that allows teams to color code segments of streams based on their score in the visual assessment. Captured images from this too are included in this report.

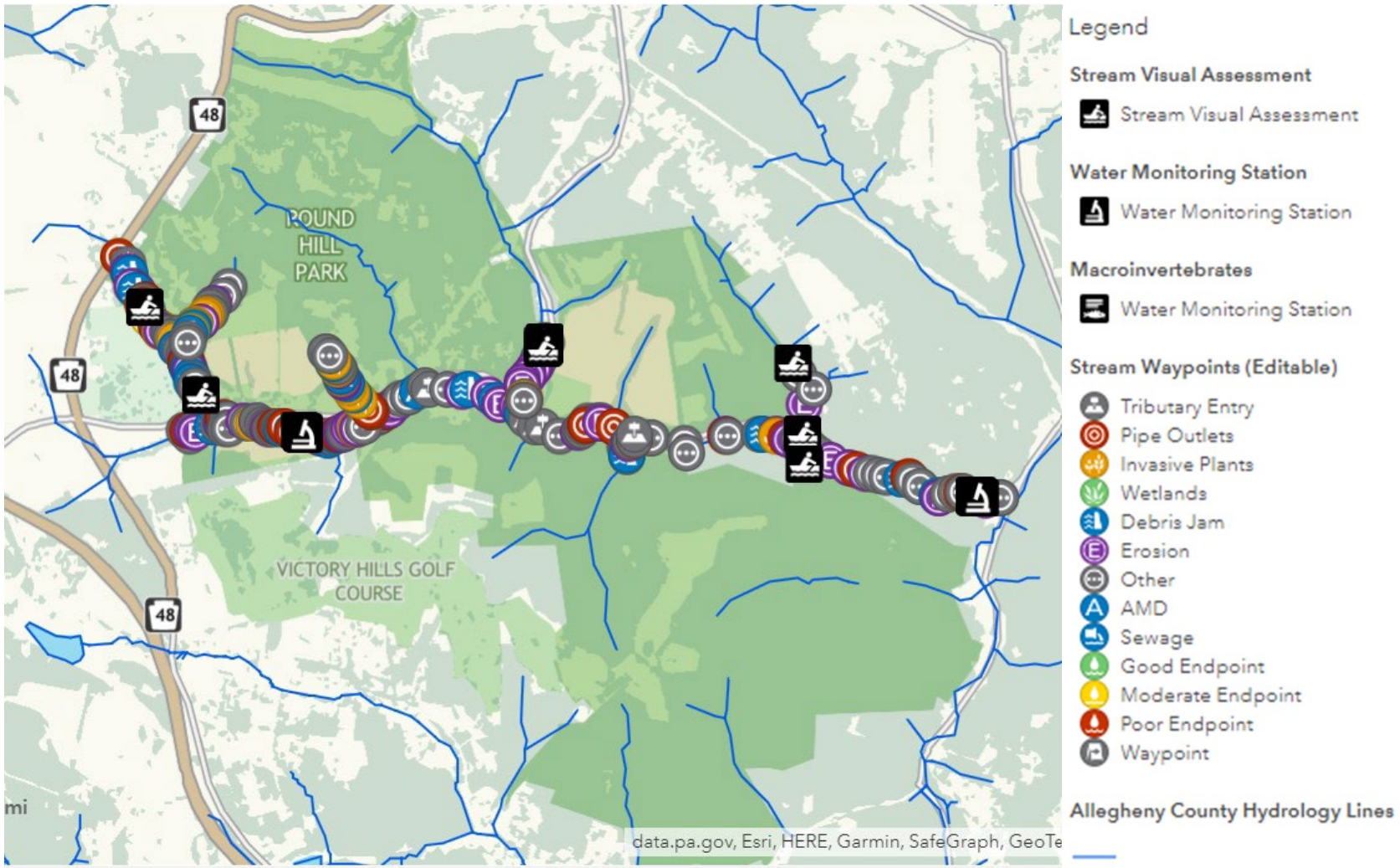
NOTE: The GIS Department staff would like to modify the map format for external viewers in the future with input from prospective viewers. The format seen below is active for the current data set.



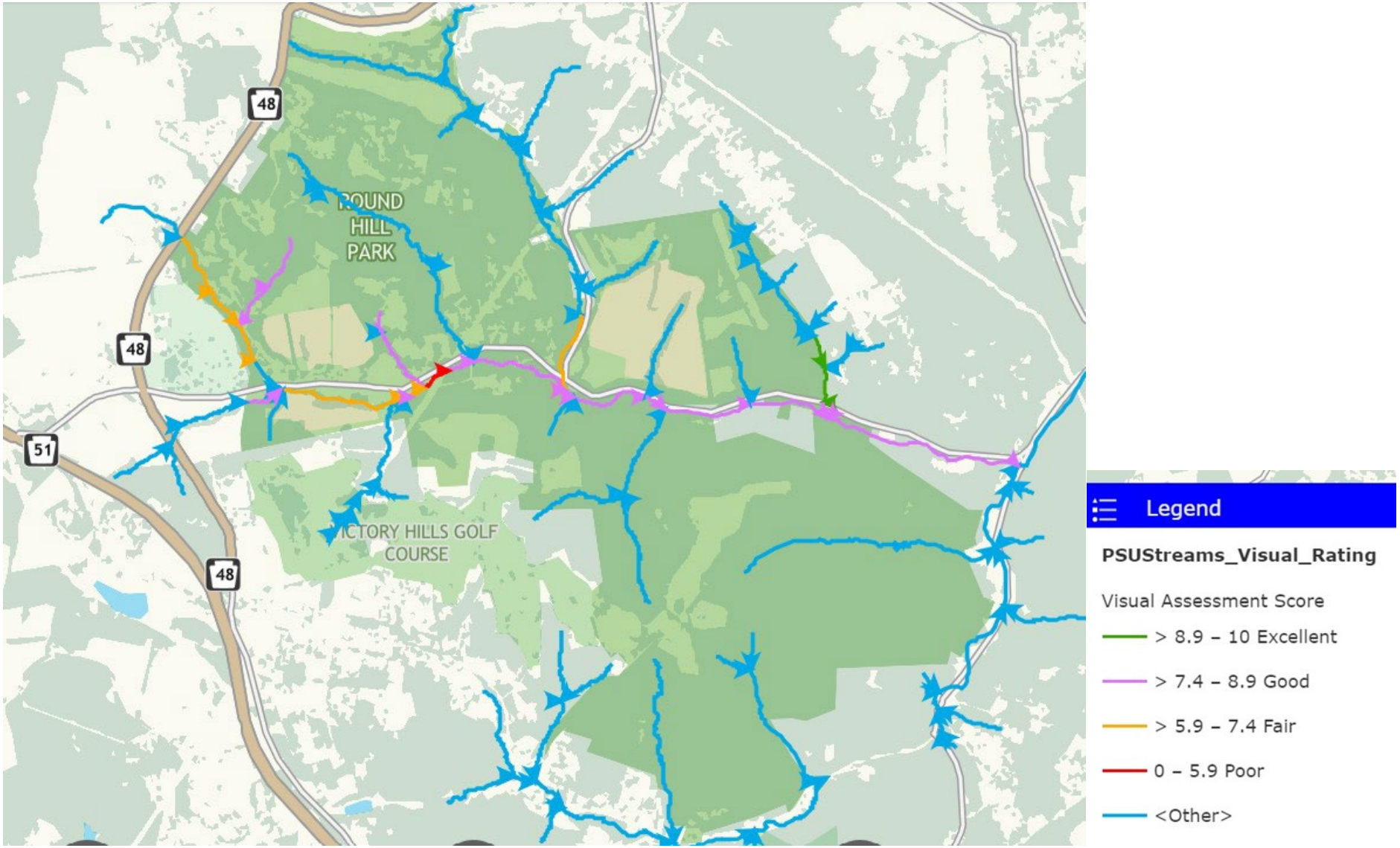

Results for each park are captured here in four components:

- Screen shot of the GIS-based map with icons indicating photographs and type of data available
- Chemical Assessment:  Tabulated data for the principal parameters assessed
- Physical Assessment: Tabulated data for the 13 parameters within the scoring protocol and final score
- Biological Assessment:  Tabulated results for the presence/absence of 22 benthic macroinvertebrate Orders surveyed and final score of Pollution Tolerance Index

ROUND HILL PARK AGGREGATED DATA POINTS



Round Hill Park - STREAM RATINGS MAP



# Round Hill Park - VISUAL ASSESSMENT RESULTS

| Date | Section Description | Channel condition | Riparian zone | Bank stability | Water appearance | Nutrient enrichment | Fish barriers | In-stream fish cover | Embeddedness | Insect/Invertebrate habitat | Canopy cover | Acid Mine Drainage (if applicable) | Sewage (if applicable) | Manure presence (if applicable) | Total score |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Nov-22 | Unnamed trib to farm pond RHP UNT1 LTB to RHP UNT2 LT C. | 8 | 5 | 6 | 10 | 8 | 6 | 5 | 8 | 7 | 6 | 0 | 0 | 0 | 6.9 |
| Nov-22 | Unnamed trib upstream of farm pond section RHPUNT1LTA to RHPUNT1LTB | 6 | 6 | 3 | 10 | 8 | 6 | 8 | 6 | 9 | 9 | 0 | 0 | 0 | 7.1 |
| Jan-23 | Douglas Run Main Stem, most downstream reach (segment AB) | 7 | 9 | 8 | 9 | 9 | 9 | 10 | 8 | 9 | 9 | 5 | 0 | 0 | 8.4 |
| Jan-23 | Unnamed, mapped Trib Rt to Douglas Run | 9 | 9 | 8 | 10 | 9 | 9 | 8 | 8 | 9 | 9 | 0 | 0 | 0 | 8.8 |
| Jan-23 | Unnamed, mapped trib on right to Douglas Run follows park border | 9 | 9 | 9 | 10 | 9 | 9 | 9 | 9 | 9 | 9 | 0 | 0 | 0 | 9.1 |
| Jan-23 | Unnamed, unmapped trib to Douglas Run second on Right; two tribs convene here then enter Douglas Run. Seep like but there is a defined channel. Ephemeral? | 9 | 9 | 8 | 9 | 9 | 8 | 4 | 9 | 8 | 9 | 0 | 0 | 0 | 8.2 |
| Feb-23 | Douglas Run Main Stem, downstream reach (segment BC) | 8 | 9 | 7 | 9 | 10 | 9 | 9 | 8 | 10 | 9 | 0 | 0 | 0 | 8.8 |
| Feb-23 | Douglas Run Main Stem, mid-stream reach (segment CD) | 4 | 6 | 3 | 9 | 8 | 5 | 7 | 7 | 8 | 5 | 0 | 0 | 0 | 6.2 |
| Feb-23 | Douglas Run Main Stem, most downstream reach (segment DE) | 4 | 5 | 3 | 8 | 8 | 5 | 7 | 7 | 7 | 5 | 0 | 0 | 0 | 5.9 |
| Feb-23 | Douglas Run Main Stem, most downstream reach (segment EF) | 7 | 7 | 9 | 8 | 5 | 8 | 7 | 7 | 7 | 7 | 0 | 5 | 0 | 7.0 |
| Apr-23 | Trib(s) Left to Douglas Run Main Stem mid-stream reach. Too challening to complete this day/time of year. Need to return to complete. | | | | | | | | | | | | | | 9999 |
| May-23 | Douglas Run Main Stem, most downstream reach (segment FG) | 8 | 8 | 8 | 9 | 8 | 8 | 7 | 8 | 8 | 7 | 0 | 0 | 0 | 7.9 |
| May-23 | Trib to Unnamed Trib to Douglas Run Right 7th, Left lateral 1 segment AB | 8 | 8 | 8 | 8 | 8 | 8 | 8 | 8 | 8 | 8 | 0 | 0 | 0 | 8.0 |
| May-23 | Trib to Unnamed Trib to Douglas Run Right 7th, Left lateral 1 segment BC | 9 | 9 | 9 | 8 | 8 | 6 | 8 | 7 | 7 | 9 | 0 | 0 | 0 | 8.0 |
| May-23 | Unnamed Trib to Douglas Run Right 4th, segment AB | 7 | 8 | 6 | 5 | 3 | 5 | 9 | 7 | 7 | 9 | 0 | 0 | 0 | 6.6 |
| Jun-23 | Unnamed Trib to Douglas Run Right 6th, segment AB | 7 | 8 | 7 | 9 | 9 | 8 | 9 | 8 | 8 | 9 | 0 | 0 | 0 | 8.2 |
| < 6.0 | Poor | | | | | | | | | | | | | | |
| 6.1 - 7.4 | Fair | | | | | | | | | | | | | | |
| 7.5 - 8.9 | Good | | | | | | | | | | | | | | |
| >9.0 | Excellent | | | | | | | | | | | | | | |

# Round Hill Park - CHEMICAL ASSESSMENT RESULTS

Values highlighted pink are outside normal range; Values highlighted blue lie outside of normal range but may have explicable but currently unidentified etiology.

| Date | Precipitation in the past 24 hours | How much precipitation? | Precipitation Current | Discharge (cf/s) | Air Temperature - Sample A (*F) | Air Temperature - Sample B (*F) | Water Temperature - Sample A (*F) | Water Temperature - Sample B (*F) | Dissolved Oxygen - Sample A (mg/L) | Dissolved Oxygen - Sample B | Total Phosphates - Sample A (mg/L) | Total Phosphates - Sample B | Nitrate Nitrogen - Sample A (mg/L) | Nitrate Nitrogen - Sample B | Conductivity - Sample A (µS/cm) | Conductivity - Sample B | pH - Sample A | pH - Sample B | Turbidity - Sample A (NTU) | Turbidity - Sample B |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **ROUND HILL PARK SITE 1 NEAR ROUND HILL ROAD X DOUGLAS RUN ROAD** | | | | | | | | | | | | | | | | | | | | |
| 7/31/2022 | Clear | 0 | Overcast | 1.01 | 73 | 73 | 62 | 62 | 11 | 11 | 0 | 0 | 9999 | 9999 | 1060 | 1000 | 8.1 | 8.1 | 50 | 190 |
| 9/5/2022 | Rain | 0.45 | Rain | 1.14 | 71 | 71 | 60 | 60 | 11 | 10 | 0.04 | 0 | 0 | 0.05 | 800 | 810 | 7.8 | 7.8 | 7.76 | 8.39 |
| 9/24/2022 | Clear | 0 | Clear | 0.44 | 56 | 56 | 56 | 56 | 11 | 11 | 0 | 0 | 0 | 8 | 1210 | 1220 | 8.1 | 8 | 21.51 | 11.1 |
| 10/30/2022 | Clear | 0 | Clear | 0.669 | 47 | | 46 | | 11 | 10 | 0 | | 0.05 | 0.05 | 1290 | 1290 | 7.5 | 7.5 | 0 | 0.4 |
| 11/19/2022 | Snow | 0.05 | Clear | 1.67 | 27 | 27 | 38 | 38 | 17 | 16 | 0 | 0 | 0.22 | 0.22 | 840 | 860 | 8.3 | 8.2 | 4.58 | 1.69 |
| 12/10/2022 | Rain | 0.08 | Overcast | 2.28 | 41 | 41 | 46 | 46 | 15 | 15 | 0 | 9999 | 0.88 | 0.748 | 810 | 800 | 7.5 | 7.5 | 1.87 | 2.56 |
| 1/14/2023 | Snow | 0.5 | Overcast | 3.79 | 25 | 25 | 39 | 39 | 12 | 12 | 0 | 9999 | 2.64 | 3.74 | 740 | 730 | 7 | 7 | 7.34 | 2.65 |
| 2/11/2023 | Overcast | 0 | Clear | 2.97 | 33 | 33 | 40 | 40 | 15 | 15 | 0 | 0 | 1.76 | 1.76 | 850 | 830 | 7 | 7.5 | 0.04 | 0 |
| 3/12/2023 | Snow | 0.5 | Overcast | 3.56 | 33 | 33 | 40 | 40 | 14 | 14 | 0 | 9999 | 0.66 | 1.32 | 790 | 790 | 7 | 7 | 0 | 0 |
| 4/23/2023 | Rain | 0.49 | Clear | 3.6 | 43 | 43 | 53 | 53 | 16 | 16 | 0 | 0 | 0.22 | 0.22 | 780 | 780 | 7 | 7 | 0.76 | 0.18 |
| 5/27/2023 | Clear | 0 | Clear | 2.13 | 70 | 70 | 50 | 50 | 11 | 9999 | 0.02 | 9999 | 0 | 9999 | 870 | 880 | 7.5 | 7.5 | 5.56 | 1.96 |
| 6/24/2023 | Rain | 0.37 | Overcast | 0.41 | 70 | 70 | 55 | 55 | 10 | 10 | 0 | 0 | 0.22 | 9999 | 940 | 930 | 7.5 | 7.5 | 7.85 | 7.06 |
| | | | | | | | | | | | | | | | | | | | | |
| | | | | | NOTES: pH meter malfunctioning. pH paper used in place of meter. | | | | | | | | | | | | | | | |

**Note:** Elevated turbidity (cloudiness) of the water can be caused by many factors – precipitation and upstream land activity. There can be a lag time between when precipitation occurs and water chemistry changes depending on the intensity and type of precipitation.

# Round Hill Park - CHEMICAL ASSESSMENT RESULTS (continued)

| Date | Precipitation in the past 24 hours | How much precipitation? | Precipitation Current | Discharge (cf/s) | Air Temperature - Sample A (*F) | Air Temperature - Sample B (*F) | Water Temperature - Sample A (*F) | Water Temperature - Sample B (*F) | Dissolved Oxygen - Sample A (mg/L) | Dissolved Oxygen - Sample B | Total Phosphates - Sample A (mg/L) | Total Phosphates - Sample B | Nitrate Nitrogen - Sample A (mg/L) | Nitrate Nitrogen - Sample B | Conductivity - Sample A (µS/cm) | Conductivity - Sample B | pH - Sample A | pH - Sample B | Turbidity - Sample A (NTU) | Turbidity - Sample B |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **ROUND HILL PARK SITE 2 OFF ROUND HILL ROAD ACROSS FROM EXHIBIT GARDEN** | | | | | | | | | | | | | | | | | | | | |
| 9/24/2022 | Clear | 0 | Clear | 1.3 | 65 | 65 | 60.5 | 60.5 | 9 | 9 | 0 | 0 | 0 | 0 | 540 | 550 | 8.1 | 8.1 | 8.63 | 20.38 |
| 10/29/2022 | Clear | 0 | Clear | 1.36 | 49.5 | | 44 | | 11 | 11 | 0.32 | 0.16 | 9999 | 9999 | 520 | 530 | 7.4 | 7.3 | 1.94 | 4.57 |
| 11/19/2022 | Snow | 0.05 | Clear | 1.33 | 27 | 27 | 40 | 40 | 15 | 13 | 0 | 0 | 0.66 | 0.66 | 660 | 640 | 7.3 | 8.2 | 1.09 | 1.3 |
| 12/10/2022 | Rain | 0.08 | Overcast | 0.86 | 41 | 41 | 44 | 44 | 12 | 12 | 0.1 | 0.1 | 1.65 | 1.98 | 580 | 570 | 7 | 7 | 3.15 | 0.73 |
| 1/14/2023 | Snow | 0.5 | Overcast | 3.64 | 25 | 25 | 40 | 40 | 11 | 11 | 0 | 0 | 3.52 | 0.88 | 1990 | 1930 | 7 | 7 | 4.57 | 3.63 |
| 2/11/2023 | Overcast | 0 | Clear | 1.76 | 34 | 34 | 40 | 40 | 13 | 12 | 0 | 0 | 2.64 | 2.64 | 710 | 710 | 7 | 7 | 2.78 | 2.16 |
| 3/11/2023 | Snow | 0.5 | Overcast | 2.49 | 33 | 33 | 42 | 42 | 14 | 13 | 0.26 | 0.06 | 0.08 | 0.198 | 720 | 740 | 7.5 | 7.5 | 3.41 | 3.57 |
| 4/23/2023 | Rain | 0.49 | Overcast | 1.74 | 43 | 43 | 54 | 54 | 15 | 15 | 0 | 0 | 1.1 | 1.32 | 560 | 660 | 7 | 7 | 2.7 | 6.88 |
| 5/27/2023 | Clear | 0 | Clear | 2.68 | 65 | 65 | 50 | 50 | 11 | 9999 | 0.06 | 0.2 | 0.22 | 0.22 | 580 | 560 | 7.5 | 7.5 | 29.34 | 26.05 |
| 6/24/2023 | Rain | 0.37 | Rain | 0.83 | 70 | 70 | 58 | 58 | 10 | 10 | 0.16 | 0.16 | 0.22 | 9999 | 750 | 720 | 7.5 | 7.5 | 20.69 | 20.87 |
| | | | | | | | | | | | | | | | | | | | | |
| | | | | NOTE: pH meter malfunction. Used pH paper instead. | | | | | | | | | | | | | | | | |
| | | | | Do these reflect AMD or earth disturbance? | | | | | | | | | | | | | | | | |

**Note:** The elevated discharge rates at this site that correspond with high turbidity values may suggest erosion or run off is contributing to the turbidity. There was a large rain event leading up to and during sample collection on June 24, 2023.

# Round Hill Park - CHEMICAL ASSESSMENT RESULTS (continued)

| Date | Precipitation in the past 24 hours | How much precipitation? | Precipitation Current | Discharge (cf/s) | Air Temperature - Sample A (*F) | Air Temperature - Sample B (*F) | Water Temperature - Sample A (*F) | Water Temperature - Sample B (*F) | Dissolved Oxygen - Sample A (mg/L) | Dissolved Oxygen - Sample B | Total Phosphates - Sample A (mg/L) | Total Phosphates - Sample B | Nitrate Nitrogen - Sample A (mg/L) | Nitrate Nitrogen - Sample B | Conductivity - Sample A (µS/cm) | Conductivity - Sample B | pH - Sample A | pH - Sample B | Turbidity - Sample A (NTU) | Turbidity - Sample B |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **ROUND HILL PARK SITE 3 OFF SIMPSON HOWELL ROAD** | | | | | | | | | | | | | | | | | | | | |
| 9/5/2022 | Shower | 0.55 | Rain | 9999 | 72 | 72 | 64 | 64 | 10 | 9999 | 0 | 9999 | 0.44 | 0.55 | 800 | 870 | 7.8 | 7.9 | 12.36 | 66 |
| 9/24/2022 | Clear | 0 | Clear | 0.37 | 61 | 61 | 57 | 57 | 10 | 10 | 0 | 0 | 0.22 | 0.66 | 940 | 960 | 8 | 8 | 6.07 | 2.49 |
| 10/29/2022 | Clear | 0 | Clear | 0.589 | 54 | | 50 | | 10 | 10 | 0 | | 99999 | 99999 | 1000 | 990 | 7.2 | 7.4 | 8.14 | 27.73 |
| 11/19/2022 | Snow | 0.05 | Clear | 0.99 | 28 | 28 | 43.5 | 43.5 | 14 | 13 | 0 | 0 | 0.66 | 0.22 | 930 | 920 | 8.2 | 8.2 | 6.72 | 4.04 |
| 12/10/2022 | Rain | 0.08 | Overcast | 0.76 | 40 | 40 | 44 | 44 | 13 | 9999 | 0 | 9999 | 0.22 | 1.98 | 890 | 870 | 7.5 | | 0.25 | 0.9 |
| 1/14/2023 | Snow | 0.5 | Overcast | 1.97 | 26 | 26 | 39 | 39 | 12 | 12 | 0 | 9999 | 2.2 | 2.2 | 830 | 790 | 7 | 7 | 2.8 | 2.81 |
| 2/11/2023 | Clear | 0 | Clear | 0.88 | 36 | 36 | 40 | 40 | 14 | 14 | 0 | 9999 | 0.66 | 0.66 | 960 | 950 | 9999 | 9999 | 2.49 | 2.14 |
| 3/11/2023 | Snow | 0.5 | Overcast | 1.62 | 33 | 33 | 40 | 40 | 14 | 14 | 0 | 9999 | 1.54 | 2.2 | 860 | 860 | 7.5 | 7.5 | 29.3 | 18.89 |
| 4/23/2023 | Rain | 0.49 | Overcast | 2.28 | 43 | 43 | 46 | 46 | 15 | 15 | 0.24 | 0.08 | 3.74 | 3.74 | 880 | 850 | 7 | 7 | 85 | 6.23 |
| 5/27/2023 | Clear | 0 | Clear | 0.95 | 69 | 69 | 51 | 51 | 10 | 9999 | 0 | 9999 | 0.22 | 9999 | 910 | 900 | 7.5 | 7.5 | 35.73 | 28.01 |
| 6/24/2023 | Rain | 0.37 | Overcast | 0.2 | 71 | 71 | 58 | 58 | 9 | 10 | 0.12 | 0.08 | 0.22 | 9999 | 950 | 960 | 7.5 | 7.5 | 14.38 | 13.22 |
| | | | | | | | | | | | | | | | | | | | | |
| | | | | | NOTES: pH meter not working; used pH strips instead | | | | | | | | | | | | | | | | |

**Note:** Significant sediment deposition occurred at this site over time that may have impacted the outlying Turbidity value in May 2023.

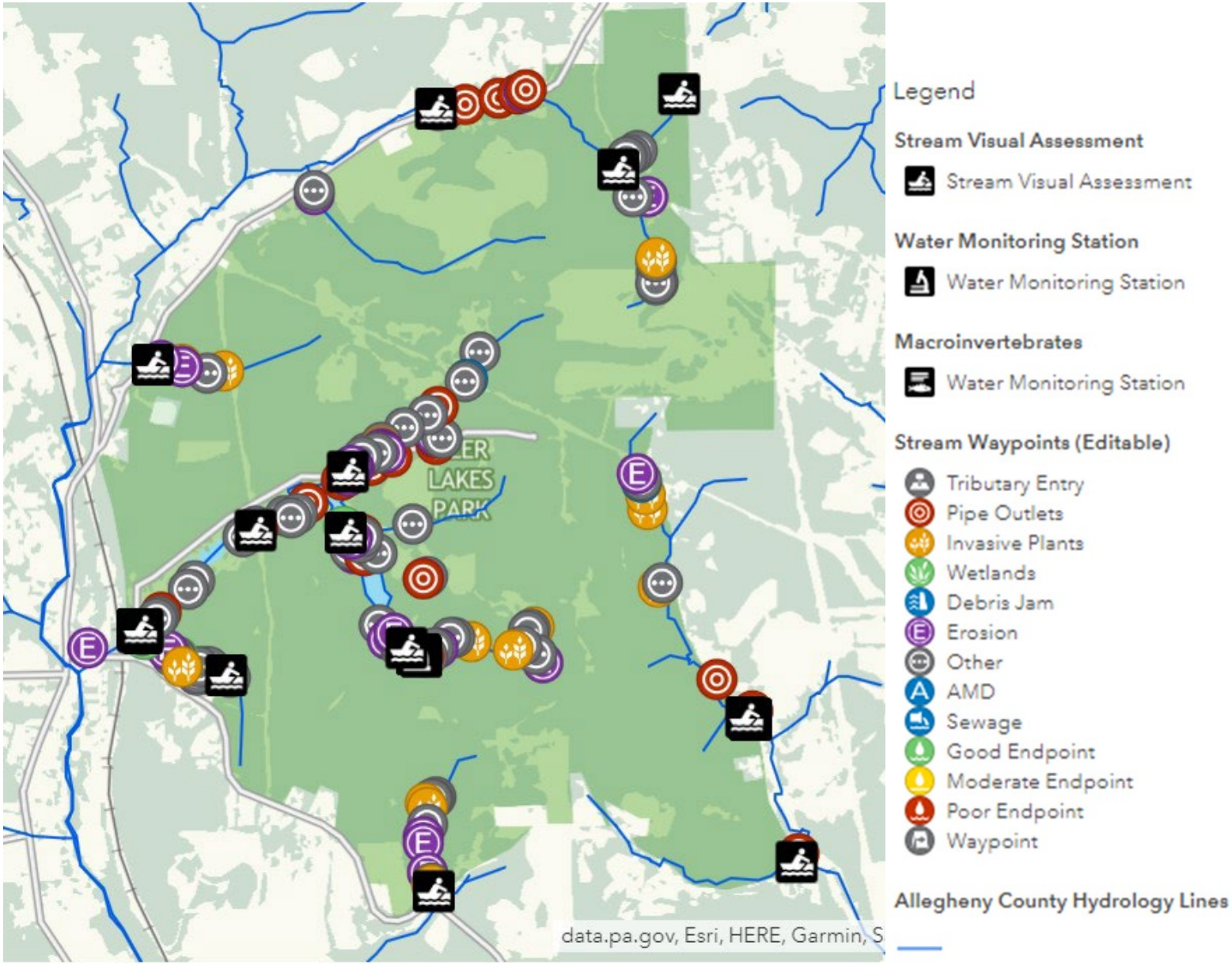
# Round Hill Park – BIOLOGICAL ASSESSMENT RESULTS

| Date | Site ID # | Are Stonefly nymph present? | Are Mayfly nymph present? | Are Caddisfly larva present? | Are Riffle Beetle present? | Are Dobsonfly larva present? | Are Right-handed or Gilled Snail present? | Are Water Penny present? | Number of Group 1 TAXA represented (Intolerant) | Are Damselfly nymph present? | Are Dragonfly nymph present? | Are Scud present? | Are Sowbug present? | Are Cranefly larva present? | Are Clam/Mussel present? | Are Crayfish present? | Number of Group 2 TAXA represented (Moderately Intolerant) | Are Leech present? | Are Midge larva present? | Are Planaria/Flatworm present? | Are Black fly larva present? | Number of Group 3 TAXA represented (Fairly Tolerant) | Are Aquatic worm present? | Are Blood midge larva (red) present? | Are Rat-tailed Maggot present? | Are Left-Handed or Pouch Snail present? | Number of Group 4 TAXA represented (Very Tolerant) | Pollution Tolerance Rating |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Oct-22 | 1 | No | Yes | No | Yes | No | No | Yes | 3 | Yes | No | Yes | No | Yes | No | Yes | 4 | No | Yes | No | No | 1 | Yes | No | No | No | 1 | 27 |
| Apr-23 | 1 | Yes | Yes | Yes | Yes | No | No | Yes | 5 | No | No | Yes | No | No | No | Yes | 2 | No | Yes | Yes | Yes | 3 | Yes | Yes | No | Yes | 3 | 35 |
| Oct-22 | 2 | Yes | No | No | Yes | No | No | Yes | 3 | No | Yes | No | Yes | Yes | No | Yes | 4 | No | Yes | Yes | No | 2 | No | Yes | No | No | 1 | 29 |
| Apr-23 | 2 | No | Yes | No | Yes | No | No | Yes | 3 | No | No | Yes | No | Yes | No | Yes | 3 | No | Yes | Yes | Yes | 3 | Yes | No | No | No | 1 | 28 |
| Apr-23 | 3 | Yes | Yes | Yes | No | Yes | No | No | 4 | Yes | No | Yes | Yes | Yes | No | Yes | 5 | Yes | Yes | No | No | 2 | No | No | No | Yes | 1 | 36 |

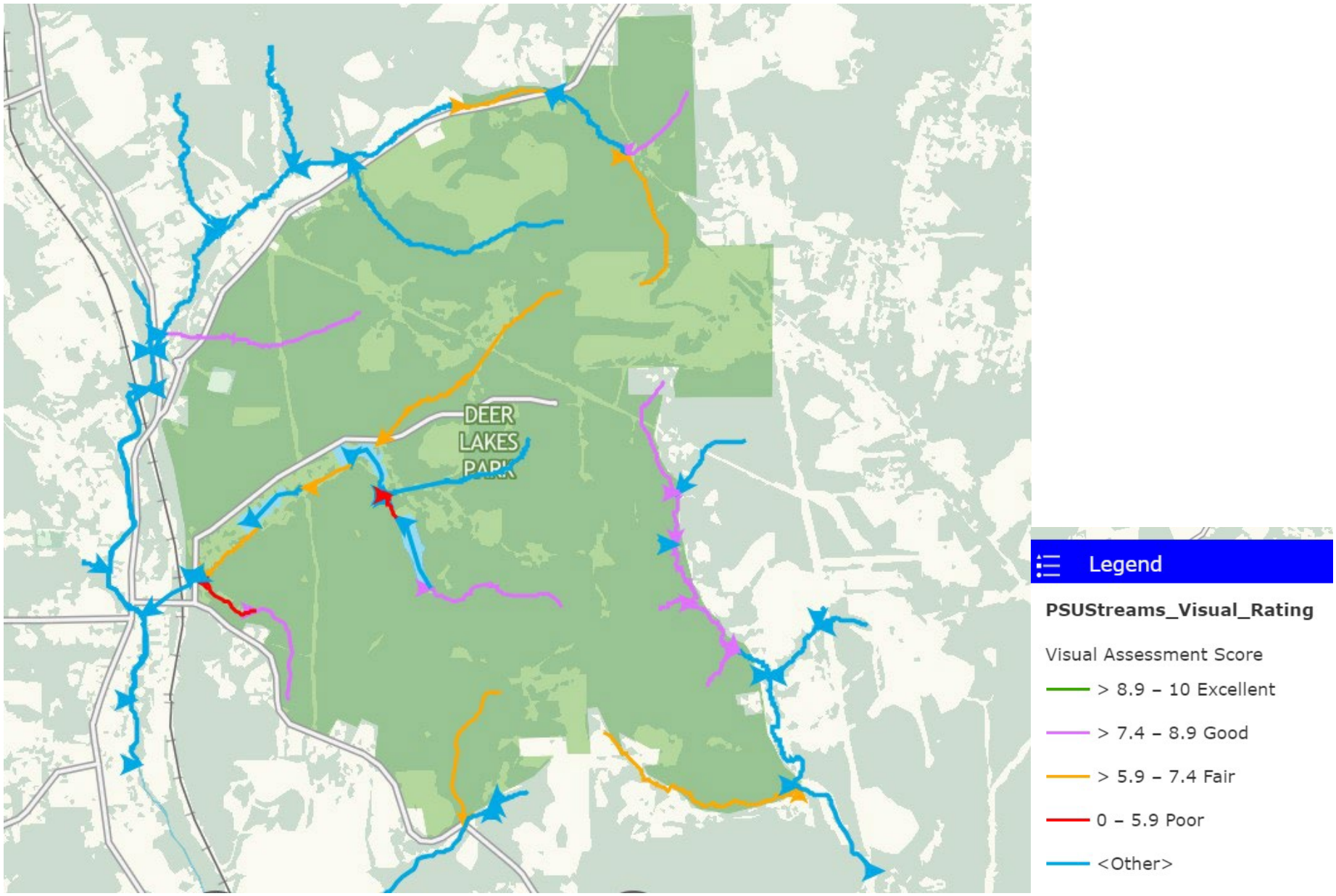
| Pollution Tolerance Index Ratings | |
|---|---|
| 23 or more | Excellent |
| 17-22 | Good |
| 11-16 | Fair |
| 10 or less | Poor |

**Note:** All sampled sites within Round Hill Park showed excellent diversity. The October 2022 sampling date occurred during the tail end of a significant rainfall from a tropical storm that was remnants of hurricane Ian.

DEER LAKES PARK AGGREGATED DATA POINTS



Deer Lakes Park - STREAM RATINGS MAP



# Deer Lakes Park - VISUAL ASSESSMENT RESULTS

| Date | Section Description | Channel condition | Riparian zone | Bank stability | Water appearance | Nutrient enrichment | Fish barriers | In-stream fish cover | Embeddedness | Insect/Invertebrate habitat | Canopy cover | Acid Mine Drainage (if applicable) | Sewage (if applicable) | Manure presence (if applicable) | Total_score |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Nov-23 | from where red trail meets the road to the headwater | 5 | 8 | 6 | 8 | 9 | 5 | 7 | 6 | 8 | 9 | 0 | 0 | 0 | 7.1 |
| Nov-23 | high side of Bakerstown Road | 8 | 7 | 7 | 9 | 9 | 9 | 5 | 7 | 8 | 9 | 0 | 0 | 0 | 7.8 |
| Nov-23 | from route 908 to end of reach | 9 | 10 | 5 | 9 | 9 | 9 | 7 | 8 | 8 | 9 | 0 | 0 | 0 | 8.3 |
| Nov-23 | from the culvert at the entrance to Cattail Drive to Crayfish Drive and above to end of reach | 6 | 9 | 3 | 8 | 8 | 1 | 8 | 5 | 9 | 9 | 0 | 0 | 0 | 6.6 |
| Nov-23 | from park entrance to half way up stream's length | 9 | 9 | 9 | 2 | 6 | 9 | 2 | 1 | 3 | 5 | 0 | 0 | 0 | 5.5 |
| Nov-23 | reach starts below the houses and continues uphill to the end | 9 | 9 | 9 | 9 | 9 | 9 | 3 | 7 | 9 | 9 | 0 | 0 | 0 | 8.2 |
| Nov-23 | reach starts above upper lake and runs all the way to the end, all tribs same score | 6 | 9 | 6 | 6 | 9 | 9 | 5 | 8 | 9 | 9 | 0 | 0 | 0 | 7.6 |
| Nov-23 | this area drains to Bailies Run Road at Russelton-Creighton Road | 9 | 9 | 2 | 3 | 9 | 9 | 3 | 2 | 5 | 9 | 0 | 0 | 0 | 6 |
| Nov-23 | stream and tribs along Fairfield Road | 8 | 9 | 7 | 10 | 10 | 6 | 8 | 10 | 7 | 10 | 0 | 0 | 0 | 8.5 |
| Nov-23 | Alongside Bailies Run Road | 8 | 9 | 7 | 10 | 9 | 6 | 2 | 9 | 5 | 8 | 0 | 0 | 0 | 7.3 |
| Nov-23 | DLP ST1 from park entrance on Mahaffey Road to the outlet of lowest lake | 4 | 8 | 7 | 9 | 9 | 9 | 8 | 9 | 9 | 2 | 0 | 0 | 0 | 7.4 |
| Nov-23 | reach starts at entrance to lower lake and goes to exit from middle lake | 6 | 7 | 8 | 9 | 9 | 3 | 8 | 9 | 10 | 2 | 0 | 0 | 0 | 7.1 |
| Nov-23 | this reach begins at the entrance to the middle lake along Cattail Drive and continues up to the outlet of the upper lake | 2 | 8 | 3 | 9 | 9 | 1 | 3 | 9 | 3 | 4 | 0 | 0 | 0 | 5.7 |
| Nov-23 | this reach begins on opposite side of rt 908 from the main park property and ends where the stream flows under rt 908 | 3 | 5 | 4 | 9 | 9 | 10 | 8 | 7 | 8 | 3 | 0 | 0 | 0 | 6.6 |
| < 6.0 | Poor | | | | | | | | | | | | | | |
| 6.1 - 7.4 | Fair | | | | | | | | | | | | | | |
| 7.5 - 8.9 | Good | | | | | | | | | | | | | | |
| >9.0 | Excellent | | | | | | | | | | | | | | |

# Deer Lakes Park - CHEMICAL ASSESSMENT RESULTS

Values highlighted pink are outside normal range; Values highlighted blue lie outside of normal range but may have explicable but currently unidentified etiology.

| Date | Precipitation in the past 24 hours | How much precipitation? | Precipitation Current | Discharge (cf/s) | Air Temperature - Sample A (*F) | Air Temperature - Sample B (*F) | Water Temperature - Sample A (*F) | Water Temperature - Sample B (*F) | Dissolved Oxygen - Sample A (mg/L) | Dissolved Oxygen - Sample B | Total Phosphates - Sample A (mg/L) | Total Phosphates - Sample B | Nitrate Nitrogen - Sample A (mg/L) | Nitrate Nitrogen - Sample B | Conductivity - Sample A (µS/cm) | Conductivity - Sample B | pH - Sample A | pH - Sample B | Turbidity - Sample A (NTU) | Turbidity - Sample B |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **DEER LAKES PARK SITE 1 NEAR ENTRANCE ON MAHAFFEY ROAD** | | | | | | | | | | | | | | | | | | | | |
| 10/21/2022 | Clear | 0 | Clear | 1.925 | 61 | 60 | 50 | 50 | 10 | 10 | 0.36 | 0.36 | 0 | 0 | 530 | 520 | 7.8 | 7.8 | 0.01 | |
| 11/13/2022 | Rain | 0.21 | Clear | 1.274 | 36 | 36 | 49 | 49 | 10 | | 0.8 | | 0 | | 370 | | 8.2 | | 9999 | |
| 12/11/2022 | Rain | 0.14 | Rain | 1.027 | 40 | 40 | 42 | 42 | 10 | | 0 | | 0 | | 400 | | 8.2 | | 1.98 | |
| 1/15/2023 | Clear | 0 | Clear | 2.869 | 26 | 26 | 38 | 38 | 15 | | 0 | | 0 | | 370 | | 8.2 | | 11.45 | |
| 2/18/2023 | Snow | 0.15 | Clear | 1.305 | 29 | 29 | 40 | 40 | 12 | 12 | 0 | 0 | 0 | 0 | 5.1 | | 8.2 | 8.2 | 7.75 | |
| 3/12/2023 | Clear | 0 | Clear | 1.56 | 32 | 33 | 41 | 40 | 12 | | 0 | | 0 | | 9999 | | 8 | | 1.65 | |
| 5/11/2023 | Rain | 0 | Clear | 0.648 | 57 | 57 | 58 | 58 | 11 | | 0 | | 0 | | 480 | | 7.9 | | 6.17 | |
| 7/29/2023 | Rain | 0.49 | Clear | 2.557 | 87 | 87 | 75 | 75 | 9 | | 0.72 | | 0 | | 470 | | 7.8 | | 3.39 | |
| | | | | | | | | | | | | | | | | | | | | |
| | | | Notes: Conductivity meter came apart on 3/12/2023 | | | | | | | | | | | | | | | | | |

**NOTE:** Scores highlighted in pink are questionable as they fall far outside usual ranges.

## Deer Lakes Park - CHEMICAL ASSESSMENT RESULTS (continued)

| DatE | Precipitation in the past 24 hours | How much precipitation? (in.) | Precipitation Current | Discharge (cf/s) | Air Temperature - Sample A (*F) | Air Temperature - Sample B (*F) | Water Temperature - Sample A (*F) | Water Temperature - Sample B (*F) | Dissolved Oxygen - Sample A (mg/L) | Dissolved Oxygen - Sample B | Total Phosphates - Sample A (mg/L) | Total Phosphates - Sample B | Nitrate Nitrogen - Sample A (mg/L) | Nitrate Nitrogen - Sample B | Conductivity - Sample A (µS/cm) | Conductivity - Sample B | pH - Sample A | pH - Sample B | Turbidity - Sample A (NTU) | Turbidity - Sample B |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **DEER LAKES PARK SITE 2 ABOVE THE WETLAND NEAR THE ENTRANCE TO THE UPPERMOST LAKE** | | | | | | | | | | | | | | | | | | | | |
| 10/21/2022 | Clear | 0 | Clear | 9999 | 68 | 67 | 49 | 49 | 9 | 9 | 0.42 | 0.42 | 0 | 0 | 410 | 400 | 7.7 | 7.6 | 4.52 | |
| 11/13/2022 | Rain | 0.21 | Clear | 0.167 | 41 | 41 | 44 | 44 | 10 | | 0.8 | | 0.01 | | 470 | | 8 | | 0.38 | |
| 12/11/2022 | Rain | 0.14 | Rain | 0.366 | 41 | 41 | 44 | 44 | 11 | | 0 | | 0 | | 400 | | 7.9 | | 1.94 | |
| 1/15/2023 | Clear | 0 | Clear | 0.745 | 28 | 28 | 38 | 38 | 14 | | 0 | | 0 | | 280 | | 7.9 | | 6.88 | |
| 2/18/2023 | Snow | 0.15 | Clear | 9999 | 29 | 30 | 40 | 38 | 11 | 11 | 0 | 0 | 0 | 0 | 3.8 | | 7.9 | 7.9 | 19.08 | |
| 3/12/2023 | Clear | 0 | Clear | 0.952 | 33 | 33 | 41 | 41 | 13 | | 0 | | 0 | | 9999 | | 7.8 | | 6.6 | |
| 5/10/2023 | Rain | 0.07 | Clear | 0.52 | 63 | 63 | 58 | 58 | 10 | | 0 | | 0 | | 390 | | 7.9 | | 4.91 | |
| 7/29/2023 | Rain | 0.49 | Clear | 0.068 | 78 | 78 | 68 | 68 | 9 | | 0 | | 0 | | 380 | | 7.5 | | 10.31 | |
| | | | | | | | | | | | | | | | | | | | | |
| | | | | | NOTE: unable to calculate discharge because channel was full of leaves. | | | | | | | | | | | | | | | |

**Note:** Scores highlighted in pink are questionable as they fall far outside usual ranges.

# Deer Lakes Park - CHEMICAL ASSESSMENT RESULTS (continued)

| Date | Precipitation in the past 24 hours | How much precipitation? (in.) | Precipitation Current | Discharge (cf/s) | Air Temperature - Sample A (*F) | Air Temperature - Sample B (*F) | Water Temperature - Sample A (*F) | Water Temperature - Sample B (*F) | Dissolved Oxygen - Sample A (mg/L) | Dissolved Oxygen - Sample B | Total Phosphates - Sample A (mg/L) | Total Phosphates - Sample B | Nitrate Nitrogen - Sample A (mg/L) | Nitrate Nitrogen - Sample B | Conductivity - Sample A (µS/cm) | Conductivity - Sample B | pH - Sample A | pH - Sample B | Turbidity - Sample A (NTU) | Turbidity - Sample B |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **DEER LAKES PARK SITE 3 ON FAIRFIELD ROAD** | | | | | | | | | | | | | | | | | | | | |
| 10/21/2022 | Clear | 0 | Clear | 9999 | 68 | 68 | 49 | 49 | 10 | 10 | 0 | 0 | 0 | 0 | 9999 | | 8.2 | 8.1 | 9999 | |
| 11/13/2022 | Clear | 0.21 | Clear | 0.962 | 41 | 41 | 43 | 43 | 11 | | 0 | | 0 | | 470 | | 8 | | 2.4 | |
| 12/11/2022 | Rain | 0.14 | Rain | 0.549 | 41 | 41 | 44 | 44 | 9 | | 0 | | 0 | | 460 | | 8.2 | | 2.95 | |
| 1/15/2023 | Clear | 0 | Clear | 1.545 | 27 | 27 | 38 | 37 | 16 | | 0 | | 0 | | 380 | | 7.9 | | 3.49 | |
| 2/18/2023 | Snow | 0.15 | Clear | 1.71 | 31 | 31 | 40 | 40 | 16 | 16 | 0 | 0 | 0 | 0 | 5.7 | | 8.3 | 8.3 | 2.75 | |
| 3/12/2023 | Clear | 0 | Clear | 0.725 | 34 | 34 | 41 | 41 | 15 | | 0 | | 0 | | 9999 | | 8.3 | | 3.66 | |
| 5/9/2023 | Rain | 0.07 | Clear | 0.298 | 72 | 73 | 60 | 59 | 10 | | 0.14 | | 0 | | 490 | 480 | 8.2 | | 5.35 | |
| 7/29/2023 | Rain | 0.49 | Clear | 0.58 | 81 | 81 | 69 | 69 | 10 | | 0.08 | | 0.22 | | 540 | | 7 | | 22.47 | |
| | | | | | | | | | | | | | | | | | | | | |
| | | | | Note: Channel full of leaves in October. | | | | | | | | | | | | | | | | |

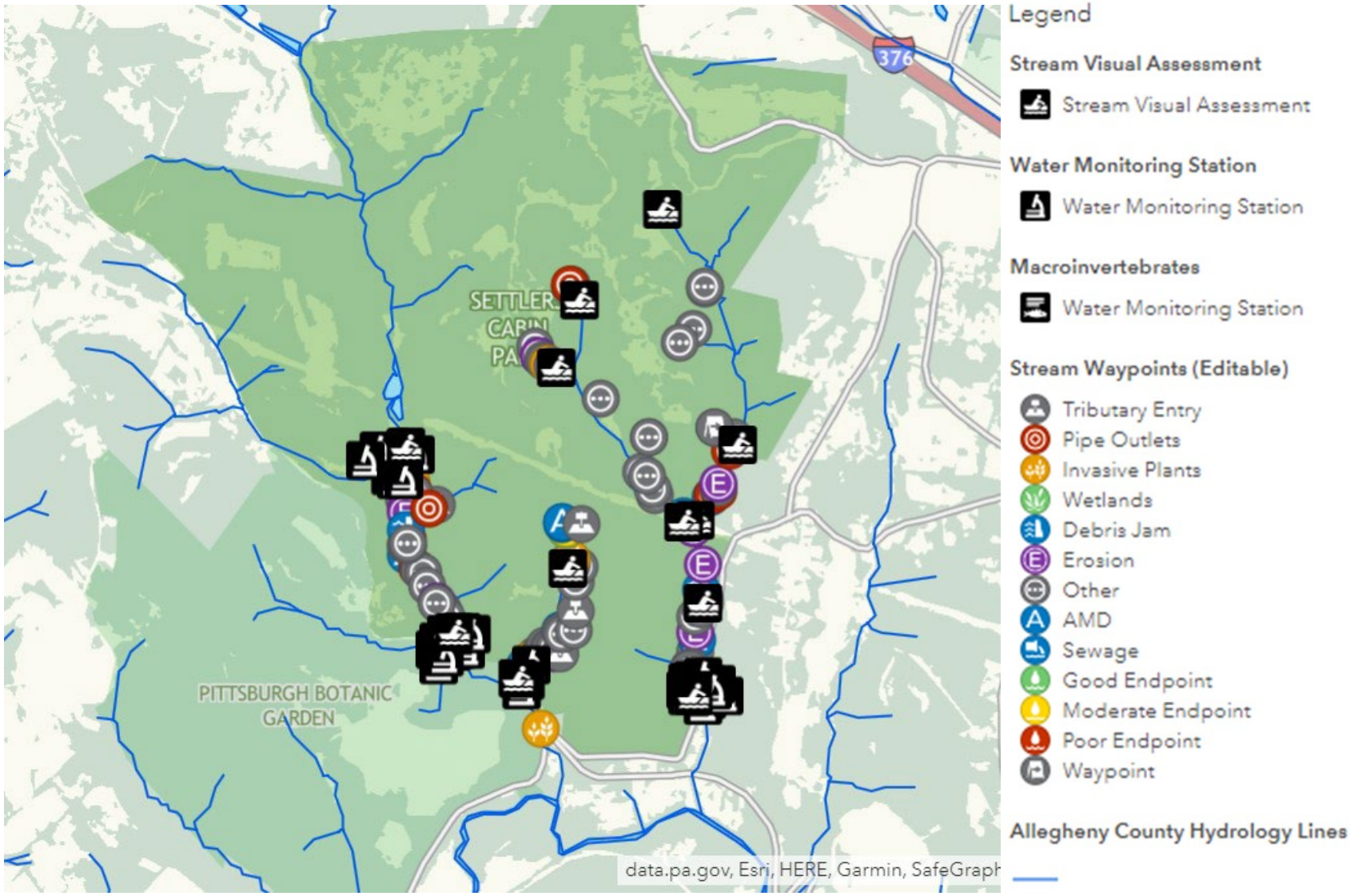
Notes: Scores highlighted in pink are questionable as they fall far outside usual ranges.

# Deer Lakes Park - BIOLOGICAL ASSESSMENT RESULTS

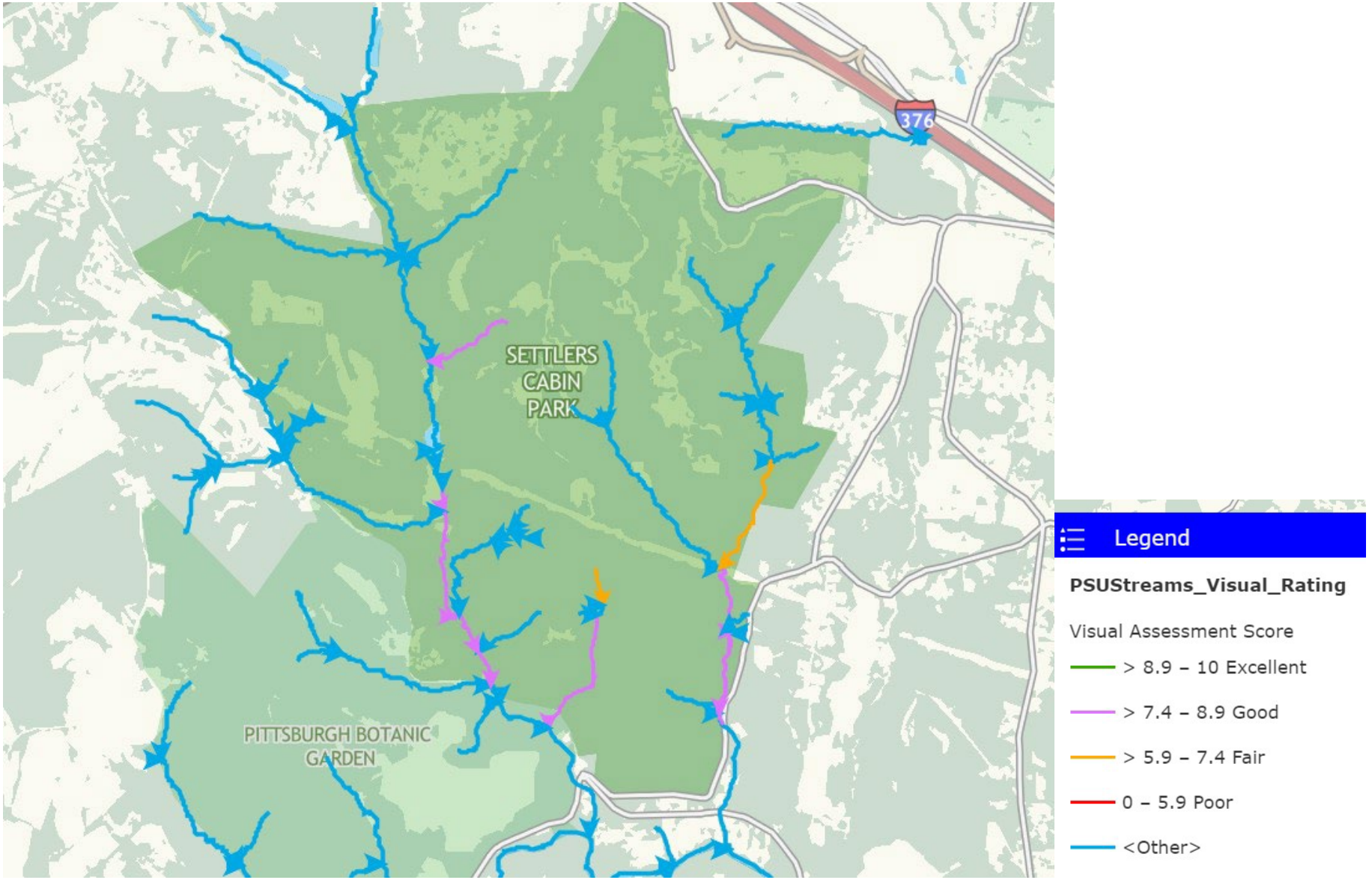
| Date | Site ID # | Are Stonefly nymph present? | Are Mayfly nymph present? | Are Caddisfly larva present? | Are Riffle Beetle present? | Are Dobsonfly larva present? | Are Right-handed or Gilled Snail present? | Are Water Penny present? | Number of Group 1 TAXA represented (Intolerant) | Are Damselfly nymph present? | Are Dragonfly nymph present? | Are Scud present? | Are Sowbug present? | Are Cranefly larva present? | Are Clam/Mussel present? | Are Crayfish present? | Number of Group 2 TAXA represented (Moderately Intolerant) | Are Leech present? | Are Midge larva present? | Are Planaria/Flatworm present? | Are Black fly larva present? | Number of Group 3 TAXA represented (Fairly Tolerant) | Are Aquatic worm present? | Are Blood midge larva (red) present? | Are Rat-tailed Maggot present? | Are Left-Handed or Pouch Snail present? | Number of Group 4 TAXA represented (Very Tolerant) | Pollution Tolerance Rating |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Oct-22 | 1 | No | No | Yes | No | No | Yes | No | 2 | No | No | No | Yes | Yes | No | No | 2 | No | No | Yes | No | 1 | Yes | No | No | No | 1 | 17 |
| May-23 | 1 | Yes | No | No | No | No | No | No | 1 | Yes | No | No | Yes | Yes | No | No | 3 | No | No | No | No | 0 | No | Yes | No | No | 1 | 14 |
| Oct-22 | 2 | No | Yes | Yes | No | Yes | No | No | 3 | No | No | No | No | Yes | No | Yes | 2 | No | No | No | No | 0 | No | No | No | No | 0 | 18 |
| May-23 | 2 | Yes | No | Yes | No | No | No | No | 2 | No | No | No | No | Yes | No | No | 1 | No | No | No | No | 0 | No | No | No | No | 0 | 11 |
| Dec-22 | 3 | Yes | Yes | Yes | Yes | Yes | No | Yes | 6 | No | No | No | No | No | No | Yes | 1 | No | No | No | No | 0 | Yes | No | No | No | 1 | 28 |
| May-23 | 3 | Yes | Yes | Yes | Yes | No | No | No | 4 | Yes | No | No | No | Yes | No | Yes | 3 | No | Yes | No | No | 1 | No | No | No | Yes | 1 | 28 |

| | | Pollution Tolerance Index Ratings | |
|---|---|---|---|
| | | 23 or more | Excellent |
| | | 17-22 | Good |
| | | 11-16 | Fair |
| | | 10 or less | Poor |

SETTLERS CABIN PARK AGGREGATED DATA POINTS



Settlers Cabin Park - STREAM RATINGS MAP



# Settlers Cabin Park - VISUAL ASSESSMENT RESULTS

| Date | Section Description | Channel condition | Riparian zone | Bank stability | Water appearance | Nutrient enrichment | Fish barriers | In-stream fish cover | Embeddedness | Insect/Invertebrate habitat | Canopy cover | Acid Mine Drainage (if applicable) | Sewage (if applicable) | Manure presence (if applicable) | Total score |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| May-23 | Residential/Road and Forested - Minimal Aluminum run-off (picture) | 9 | 6 | 7 | 10 | 8 | 9 | 9 | 9 | 9 | 8 | 0 | 0 | 0 | 8.4 |
| Jun-23 | Forested, dense brush, nearby trails | 8 | 7 | 6 | 9 | 8 | 6 | 9 | 8 | 8 | 8 | 0 | 0 | 0 | 7.0 |
| Jun-23 | Forested Trails nearby | 9 | 7 | 6 | 10 | 9 | 6 | 9 | 8 | 9 | 9 | 0 | 0 | 0 | 8.2 |
| Jun-23 | Forested, dense brush, nearby trails | 9 | 7 | 6 | 10 | 9 | 6 | 9 | 8 | 9 | 9 | 0 | 0 | 0 | 8.2 |
| Jun-23 | Forested, steep ravine, | 9 | 8 | 6 | 10 | 9 | 6 | 8 | 7 | 8 | 9 | 0 | 0 | 0 | 8.0 |
| Jul-23 | Forested, trails nearby, walkable stream, small AMD area, remediation throughout reach | 8 | 7 | 7 | 9 | 9 | 8 | 8 | 9 | 9 | 9 | 5 | 0 | 0 | 8.0 |
| Jul-23 | Forested stream, Start of assessment wide access, narrows at site c, Riparian buffer plantings, Japanese knotweed | 7 | 9 | 8 | 8 | 9 | 7 | 7 | 8 | 8 | 9 | 0 | 0 | 0 | 8.0 |
| Aug-23 | Walked along the Red Trail. We could not get down to the creek. Brush impassable | | | | | | | | | | | | | | ### |
| Aug-23 | Walked along the Red Trail. We could not get down to the creek. Brush impassable | | | | | | | | | | | | | | ### |
| Aug-23 | Walked down from Red Trail. Able to see end of stream but not rate. Tire remediation along this part of stream. Invasive plants...impassable | | | | | | | | | | | | | | ### |
| Aug-23 | Forested trails, Invasive plants, Remediation areas, low flow | 9 | 9 | 8 | 8 | 7 | 7 | 9 | 5 | 9 | 9 | | | | 8.0 |
| Aug-23 | Some tree canopy, Wetland, Marshy near endpoint, runoff remediation, AMD Trib (end of section C and wetland area) | 9 | 6 | 8 | 8 | 9 | 7 | 5 | 5 | 8 | 6 | 4 | | | 6.8 |
| < 6.0 | Poor | | | | | | | | | | | | | | |
| 6.1 - 7.4 | Fair | | | | | | | | | | | | | | |
| 7.5 - 8.9 | Good | | | | | | | | | | | | | | |
| >9.0 | Excellent | | | | | | | | | | | | | | |

**Note:** Shrubs with briars prevented volunteer access to several reaches; those were not rated.

# Settlers Cabin Park - CHEMICAL ASSESSMENT RESULTS

Values highlighted pink are outside normal range; Values highlighted blue lie outside of normal range but may have explicable but currently unidentified etiology.

| Date | Precipitation in the past 24 hours | How much precipitation? (in.) | Precipitation Current | Discharge (cf/s) | Air Temperature - Sample A (*F) | Air Temperature - Sample B (*F) | Water Temperature - Sample A (*F) | Water Temperature - Sample B (*F) | Dissolved Oxygen - Sample A (mg/L) | Dissolved Oxygen - Sample B | Total Phosphates - Sample A (mg/L) | Total Phosphates - Sample B | Nitrate Nitrogen - Sample A (mg/L) | Nitrate Nitrogen - Sample B | Conductivity - Sample A (µS/cm) | Conductivity - Sample B | pH - Sample A | pH - Sample B | Turbidity - Sample A (NTU) | Turbidity - Sample B |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **SETTLERS CABIN PARK SITE 1 ALONG PINKERTON RUN ROAD** | | | | | | | | | | | | | | | | | | | | |
| 11/12/2022 | Rain | 2.57 | Overcast | 3.48 | 46 | 46 | 51.26 | 51.26 | 9 | 9 | 0 | 0 | 0 | 0 | 630 | 600 | 6.7 | 6.9 | 11.67 | 11.93 |
| 12/10/2022 | Shower | 0.04 | Overcast | | 35 | 35 | 41.2 | 41.2 | 12 | 12 | 0.02 | 0.02 | 0 | 0 | 840 | 830 | 6.3 | 6.3 | 1.41 | 1.48 |
| 3/12/2023 | Rain | 0.01 | Overcast | 0.87 | 33 | 33 | 37.7 | 37.8 | 6 | 5 | 0 | 0 | 0 | 0 | 3.8 | 9999 | 6.4 | 6.7 | 0.47 | 9999 |

**NOTE:** Scores highlighted in pink are outside the normal range and may be due to faulty equipment function.

| Date | Precipitation in the past 24 hours | How much precipitation? (in.) | Precipitation Current | Discharge (cf/s) | Air Temperature - Sample A (*F) | Air Temperature - Sample B (*F) | Water Temperature - Sample A (*F) | Water Temperature - Sample B (*F) | Dissolved Oxygen - Sample A (mg/L) | Dissolved Oxygen - Sample B | Total Phosphates - Sample A (mg/L) | Total Phosphates - Sample B | Nitrate Nitrogen - Sample A (mg/L) | Nitrate Nitrogen - Sample B | Conductivity - Sample A (µS/cm) | Conductivity - Sample B | pH - Sample A | pH - Sample B | Turbidity - Sample A (NTU) | Turbidity - Sample B |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **SETTLERS CABIN PARK SITE 2 PINKERTON RUN ROAD NEAR NORTH FAYETTE TOWNSHIP LINE** | | | | | | | | | | | | | | | | | | | | |
| 9/24/2022 | Clear | 0 | Clear | 2.11 | 51 | 51 | 53.2 | 53.2 | 10 | 10 | 0.02 | 0 | 0 | 0 | 1570 | 1620 | 7.7 | 7.7 | 1.95 | 2.35 |
| 11/22/2022 | Rain | 2.57 | Overcas | 10.72 | 46 | 46 | 52.7 | 52.7 | 9 | 9 | 0 | 0 | 0.22 | 0.22 | 820 | 810 | 7.8 | 7.7 | 14.62 | 14.88 |
| 12/10/2022 | Showers | 0.04 | Overcas | 3.42 | 35 | 35 | 42.5 | 42.5 | 4 | 4 | 0 | 0 | 0 | 0 | 1410 | 1440 | 7.39 | 7.53 | 3.31 | 2.15 |
| 1/28/2023 | Snow | 0.001 | Clear | 5.43 | 39 | 39 | 39.7 | 38.6 | 11 | 11 | 0 | 0 | 0 | 0 | 1390 | 1300 | 7.3 | 7.37 | 4.39 | 4.26 |
| 2/11/2023 | Overcast | 0.001 | Overcas | 3.72 | 31 | 31 | 40.5 | 31 | 12 | 12 | 0 | 0 | 0.22 | 0 | 3.5 | 2.7 | 7.6 | 7.7 | 10.67 | 21.8 |
| 3/12/2023 | Rain | 0.01 | Overcas | 2.32 | 33 | 33 | 38.4 | 38.6 | 6 | 6 | 0.01 | 0 | 0 | 0 | 1320 | 1340 | 6.8 | 6.9 | 1.97 | 1.68 |
| 4/8/2023 | Showers | 0 | Clear | 3.42 | 37 | 37 | 43 | 43 | 9 | 7 | 0.18 | 0 | 0 | 0 | 1270 | 1180 | 7.75 | 7.62 | 11.02 | 10.41 |
| 6/10/2023 | Clear | 0 | Clear | 1.42 | 59 | 59 | 57 | 57 | 11 | 11 | 0 | 0 | 0 | 0 | 1570 | 1620 | 6.5 | 6.7 | 22 | 22.09 |
| 7/8/2023 | Clear | 0 | Clear | 3.12 | 65 | 65 | 64.9 | 64.9 | 10 | 10 | 0.02 | 0 | 0 | 0 | 1490 | 1450 | 8 | 7.9 | 5.58 | 4.94 |
| 8/12/2023 | Rain | 0.03 | Clear | 1.75 | 76 | 76 | 70 | 70 | 10 | 9 | 0.16 | 0 | 0 | 0 | 1540 | 1560 | 8.5 | 8.4 | 2.35 | 2.09 |

**Note:** Scores highlighted in pink are questionable as they fall far outside usual ranges.

# Settlers Cabin Park - CHEMICAL ASSESSMENT RESULTS (continued)

| Date | Precipitation in the past 24 hours | How much precipitation? | Precipitation Current | Discharge (cf/s) | Air Temperature - Sample A (*F) | Air Temperature - Sample B (*F) | Water Temperature - Sample A (*F) | Water Temperature - Sample B (*F) | Dissolved Oxygen - Sample A (mg/L) | Dissolved Oxygen - Sample B | Total Phosphates - Sample A (mg/L) | Total Phosphates - Sample B | Nitrate Nitrogen - Sample A (mg/L) | Nitrate Nitrogen - Sample B | Conductivity - Sample A (µS/cm) | Conductivity - Sample B | pH - Sample A | pH - Sample B | Turbidity - Sample A (NTU) | Turbidity - Sample B |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **SETTLERS CABIN PARK SITE 3 NEAR LAKE** | | | | | | | | | | | | | | | | | | | | |
| 9/23/2022 | Clear | 0.7 | Clear | 9999 | 50 | 50 | 56.3 | 56.5 | 12 | 12 | 0.05 | 2.5 | 0 | 0 | 1650 | 1630 | 7.6 | 6.7 | 7.18 | 8.49 |
| 11/22/2022 | Rain | 2.57 | Overcast | 23.25 | 46 | 46 | 51.9 | 51.9 | 9 | 9 | 0 | 0 | 0 | 0 | 860 | 860 | 7.2 | 7.1 | 12.37 | 11.24 |
| 12/10/2022 | Showers | 0.04 | Overcast | 2.65 | 37 | 37 | 41.5 | 42.4 | 9 | 9 | 0.05 | 0 | 0 | 0 | 1480 | 1470 | 7.1 | 7.3 | 1.66 | 1.59 |
| 1/28/2023 | Snow | 0.001 | Clear | 7.24 | 39 | 39 | 39.5 | 40.5 | 11 | 10 | 0.02 | 0 | 0 | 0 | 1420 | 1390 | 7.9 | 7.8 | 3.85 | 3.98 |
| 2/11/2023 | Overcast | 0.001 | Clear | 2.07 | 31 | 31 | 39 | 38.8 | 6 | 9 | 0 | 0 | 1.32 | 0 | 3.8 | 3.5 | 7.8 | 7.8 | 10.25 | 11.91 |
| 3/12/2023 | Showers | 0.01 | Overcast | 4.03 | 30 | 41 | 43 | 30 | 10 | 9 | 0 | 0 | 0 | 0 | 1430 | 1400 | 7.6 | 7.9 | 7.58 | 3.62 |
| 4/8/2023 | Overcast | 0 | Clear | 2.56 | 37 | 37 | 42.7 | 42 | 7 | 7 | 0.52 | 0 | 0 | 0 | 1310 | 1290 | 7.4 | 7.6 | 19.43 | 25.16 |
| 6/10/2023 | Clear | 0 | Clear | 1.74 | 68 | 68 | 61 | 61 | 11 | 11 | 0.02 | 0 | 0 | 0 | 1630 | 1630 | 6.5 | 6.6 | 9999 | 9999 |
| 8/12/2023 | Overcast | 0.03 | Rain | 1.21 | 76 | 75 | 69.1 | 70 | 8 | 8 | 0 | 0 | 0 | 0 | 1520 | 1490 | 6.2 | 6.7 | 12.97 | 5.84 |
| 9/16/2023 | Clear | 0 | Clear | | 61 | 61 | 46 | 46 | 8 | 7 | 0 | 9999 | 0 | 9999 | 740 | 740 | 8.2 | 8.2 | 8.34 | 6.02 |
| 10/14/2023 | Rain | 0.3 | Rain | 2.35 | 54 | 49 | 49 | 54 | 5 | 5 | 0.6 | 9999 | 0.44 | 9999 | 729 | 750 | 8 | 7.85 | 38.28 | 46.69 |

**Note:** Scores highlighted in pink are questionable as they fall far outside usual ranges.

Settlers Cabin Park – CHEMICAL ASSESSMENT RESULTS (continued)

| Date | Precipitation in the past 24 hours | How much precipitation? (in.) | Precipitation Current | Discharge (cf/s) | Air Temperature - Sample A (*F) | Air Temperature - Sample B (*F) | Water Temperature - Sample A (*F) | Water Temperature - Sample B (*F) | Dissolved Oxygen - Sample A (mg/L) | Dissolved Oxygen - Sample B | Total Phosphates - Sample A (mg/L) | Total Phosphates - Sample B | Nitrate Nitrogen - Sample A (mg/L) | Nitrate Nitrogen - Sample B | Conductivity - Sample A (µS/cm) | Conductivity - Sample B | pH - Sample A | pH - Sample B | Turbidity - Sample A (NTU) | Turbidity - Sample B |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **SETTLERS CABIN PARK SITE 5 AT BALDWIN ROAD** | | | | | | | | | | | | | | | | | | | | |
| 9/23/2022 | Clear | 0.7 | Clear | 0.87 | 50 | 50 | 53.3 | 53 | 8 | 8 | 0.02 | 0 | 0 | 0 | 1090 | 1130 | 6.8 | 6.8 | 11.32 | 19.5 |
| 12/10/2022 | Showe | 0.04 | Overca | 0.78 | 41 | 41 | 35 | 35 | 5 | 5 | 0 | 0 | 0 | 0 | 880 | 880 | 7.88 | 7.91 | 21.22 | 7.45 |
| 1/28/2023 | Snow | 0.001 | Clear | 1.33 | 38 | 38 | 38 | 38.7 | 12 | 13 | 0.02 | 0 | 0 | 0 | 850 | 810 | 7.83 | 6.92 | 5.36 | 15.11 |
| 2/11/2023 | Overca | 0.001 | Overca | 1.53 | 31 | 31 | 39.1 | 39.1 | 8 | 8 | 0 | 0 | 0 | 0 | 9999 | 9999 | 7.8 | 9999 | 24.15 | 22.36 |
| 3/12/2023 | Rain | 0.01 | Overca | 1.69 | 33 | 33 | 38 | 37.7 | 9999 | 9999 | 0.01 | 0 | 0 | 0 | 880 | 870 | 8 | 7.9 | 0.03 | 0 |
| 4/8/2023 | Overca | 0 | Clear | 1.47 | 37 | 37 | 43 | 43 | 7 | 7 | 0.004 | 0 | 0 | 0 | 820 | 800 | 7.48 | 7.33 | 12.86 | 11.72 |
| 6/10/2023 | Clear | 0 | Clear | 1.19 | 59 | 59 | 61 | 61 | 13 | 12 | 0 | 0 | 0.22 | 0 | 1030 | 1030 | 7.6 | 7.9 | 18.38 | 22.67 |
| 7/8/2023 | Clear | 0 | Clear | 1.21 | 70 | 70 | 66.9 | 66.9 | 9 | 9 | 0 | 0 | 0 | 0 | 1060 | 1040 | 7.64 | 7.4 | 14.01 | 15.56 |
| 8/12/2023 | Rain | 0.03 | Overca | 0.88 | 76 | 76 | 70 | 70 | 7 | 7 | 0.26 | 0 | 0 | 0 | 1130 | 1150 | 8.3 | 8.2 | 9.21 | 15.48 |

# Settlers Cabin Park - BIOLOGICAL ASSESSMENT RESULTS

| Date | Site ID # | Are Stonefly nymph present? | Are Mayfly nymph present? | Are Caddisfly larva present? | Are Riffle Beetle present? | Are Dobsonfly larva present? | Are Right-handed or Gilled Snail present? | Are Water Penny present? | Number of Group 1 TAXA represented (Intolerant) | Are Damselfly nymph present? | Are Dragonfly nymph present? | Are Scud present? | Are Sowbug present? | Are Cranefly larva present? | Are Clam/Mussel present? | Are Crayfish present? | Number of Group 2 TAXA represented (Moderately Intolerant) | Are Leech present? | Are Midge larva present? | Are Planaria/Flatworm present? | Are Black fly larva present? | Number of Group 3 TAXA represented (Fairly Tolerant) | Are Aquatic worm present? | Are Blood midge larva (red) present? | Are Rat-tailed Maggot present? | Are Left-Handed or Pouch Snail present? | Number of Group 4 TAXA represented (Very Tolerant) | Pollution Tolerance Rating |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Sep-22 | 1 | Yes | Yes | Yes | No | No | No | No | 3 | Yes | No | No | Yes | Yes | No | No | 3 | No | No | No | No | 0 | Yes | No | No | No | 1 | 22 |
| Oct-22 | 2 | No | No | Yes | No | No | No | No | 1 | No | No | Yes | Yes | Yes | No | Yes | 4 | No | No | No | Yes | 0 | No | No | No | No | 0 | 16 |
| Apr-23 | 2 | No | Yes | Yes | No | No | No | No | 2 | Yes | No | No | No | Yes | No | No | 2 | No | No | No | No | 0 | No | No | No | No | 0 | 14 |
| Oct-22 | 5 | No | Yes | Yes | No | No | No | Yes | 3 | Yes | No | Yes | Yes | Yes | No | No | 4 | No | No | No | No | 0 | Yes | No | No | No | 1 | 25 |
| Apr-23 | 5 | Yes | Yes | Yes | No | Yes | No | No | 4 | Yes | No | Yes | No | Yes | No | No | 3 | No | No | No | Yes | 1 | No | No | No | No | 0 | 27 |

| Pollution Tolerance Index Ratings | |
|---|---|
| 23 or more | Excellent |
| 17-22 | Good |
| 11-16 | Fair |
| 10 or less | Poor |

## OBSERVATIONS & RECOMMENDATIONS

### - General Comments

The three parks under study contain headwater streams travelling steep gradients. Many streams flow only seasonally or intermittently and are not conducive to year-round chemical testing. Macroinvertebrate sampling is not feasible in those settings because the animals being surveyed need a consistently wet environment, and chemical testing was intermittent.

The pervasive presence of invasive plant species must be acknowledged, even if their impact on aquatic systems is not fully understood. Any opportunity to reduce, control or eliminate them in conjunction with streambank stabilization, riparian buffer installation or enhancement, or debris removal should be considered. Invasive species such as privet, multiflora rose, round leaf bittersweet, and non-native honeysuckles provide little food and shelter for native insect and animal species. White tail deer leave the park to feed in residential areas. Any effort to remove or contain these non-native plants would benefit the overall park environment and nearby residents.

### - Chemical Assessment

Streams tend to have characteristic chemical profiles or "norms" based on the geology, hydrology, and land uses of the area. More extended study would help to identify those norms and highlight changes due to storm events, etc.

The key parameter of Dissolved Oxygen (DO) fell within normal healthy ranges. Two sites at Settlers Cabin Park - sites 3 and 5 - had a reading of 5 once. DO in the 3-5 mg/L is a stressful condition.

Phosphate levels remained low, except for Deer Lakes Park twice at Site 1 below the lakes, once at Site 2 above the upper lake, and Settler Cabin Park at site 3. Phosphates often enter the stream through run-off or attached to sediment washed into the stream.

Nitrate levels all measured below 4.4mg/L which is the upper limit for unpolluted waters.

Turbidity levels spiked occasionally, with most elevated levels corresponding to recent rain events. If turbidity were consistently high, further data collection would be warranted.

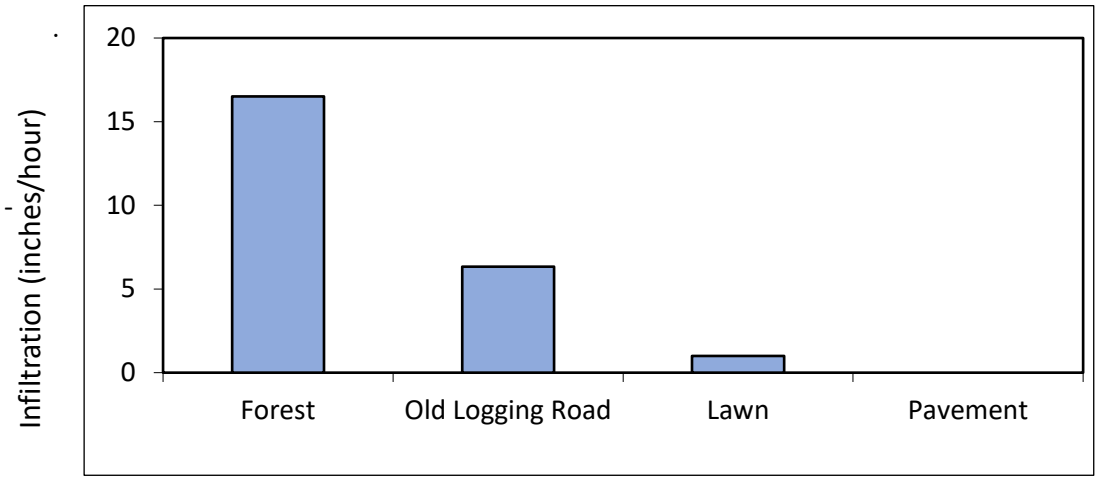
Baseline conductivity values in Round Hill Park and Settlers Cabin Park were consistently higher than the EPA inland fresh-water streams that support good mixed fisheries range of 150-500 µS/cm. Residual road salt is known to remain in concrete and to leech out slowly in urban settings. Whether a similar dynamic is at work in these parks is not clear. The Deer Lakes conductivity values were never higher than 540.

Looking at the chemical conditions in a stream tells only part of the story. With strong DO values in place consistently, we know that at least one condition is met for sustaining healthy biological communities. Looking at the condition of the physical environment helps to provide additional information for the full story. And as noted earlier, the type of biological community present is a result of the physical and chemical conditions combined.

- Visual Assessment

The topography and geology of western Pennsylvania's landscape impacts stream behavior significantly. Headwater streams naturally erode as they are the first line of collection in the system, but that erosion can be exacerbated by unstable soils, fractious bedrock, strong storms, and inadequate vegetation to stabilize streambanks. The region's history of logging, agriculture, and convention of laying sewer lines in stream channels can also factor into stream channel erosion.

More modern impacts of directing stormwater from roads to discreet outflows, and maintenance of extensive lawn areas can also impact stream channel conditions. Lawn is nearly as impervious as cement due to compression of soil pore spaces by repeated heavy mowing equipment and foot traffic.




Credit: Bryan Swistock, Penn State University

Due to safety and accessibility concerns and time constraints, not all streams in all parks received visual assessment. Streams that were assessed consistently had low scores for fish cover or the presence of fish barriers but as these streams generally were too small to support fish populations so those parameters scores are not a source of concern. Reduced scores due to erosion, sedimentation (embeddedness), and less than optimal riparian buffer or canopy coverage were also prevalent and of greater concern.

In light of the suburban context of these parks the overall condition of the streams was generally good. Specific opportunities for improvement are presented for each park after a review of the study's findings.

- Biological Assessment

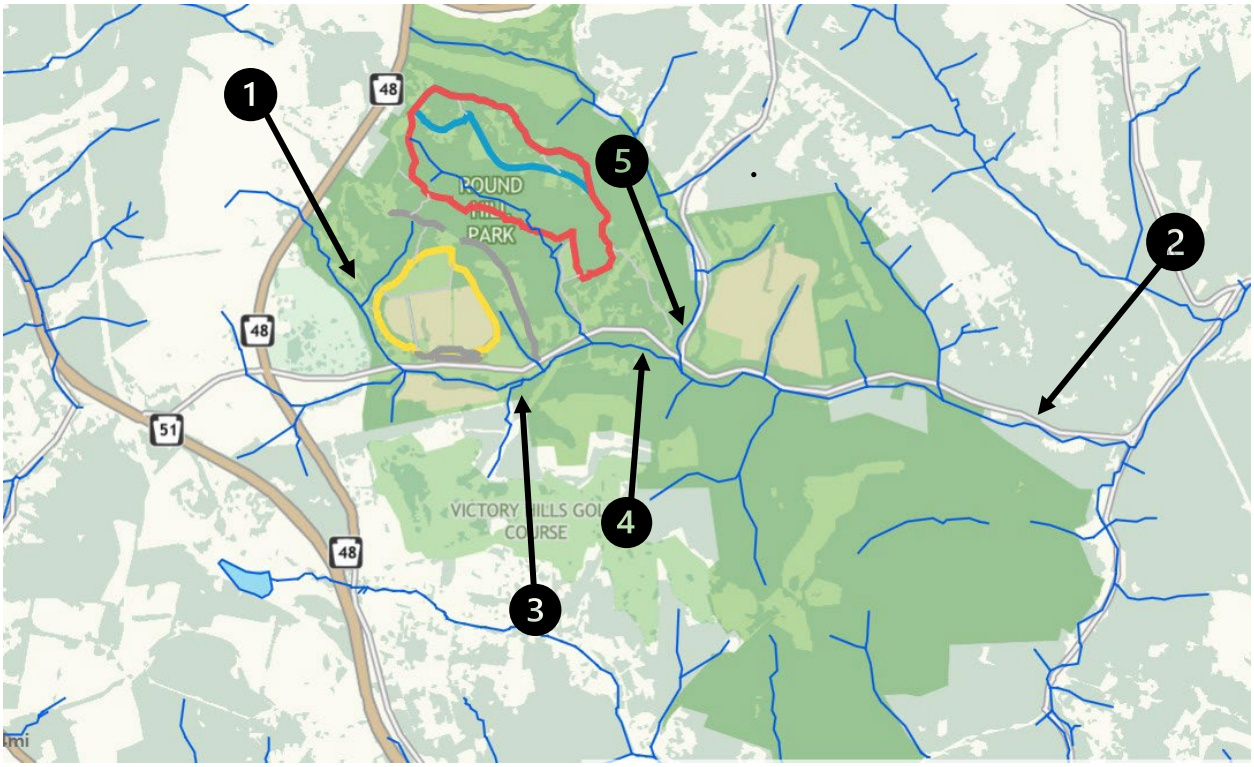
Round Hill Park received “Excellent” scores in all three sampling sites indicating that the streams can support animals requiring pollution-free water.

Deer Lakes park received an “Excellent” score for one site, and “Good” and “Fair” for the other two sites.

Settlers Cabin Park received one “Good”, one “Fair”, and one “Excellent” score.

## RECOMMENDATIONS

- Round Hill Park




It is estimated that 70 to 80% of the Park's streams are mostly inaccessible by the general public with no nearby parking or trails. As a result, Visual Assessment was targeted at the streams and tributaries that would be most impacted by the recreational and mobility (roads, parking lots, trails) land use areas of the Park. The main stem Douglas Run was also a focus since it's the most downstream receiving water body within the Park.

Round Hill Park has a small Wastewater Treatment Plant (WWTP) that during significant wet weather events may discharge treated sewage flow to Douglas Run. Round Hill also has a spray Park and working farm. Bacterial and fecal impacts were not tested for in the streams.

In Douglas Run, the two most impaired sections were:

*upstream of sampling "site 2" where the Park maintenance facility is streamside, with farming on the other side and minimal riparian buffer;

* just downstream of sampling "site 2", there is a utility right-of-way / forest cut and private road resulting in a lack of riparian buffer. The utility crossing and culvert required for the road crossing are in the reach of the stream that is the most impaired with highly erosive stream banks; the road is collapsing into the stream channel in multiple locations. This location was going to be one of our selected sampling sites however access and conditions proved to be too treacherous.

Riparian Buffers

**1** The spray park lawn is mowed to the streambank; a buffer is needed here.

Douglas Run is eroding in many places. Many of these are due to channel constriction beside the roadbed. **2**. In one area, the road had been built upon a large stone wall which is now collapsing and depositing soil into the stream. There are a couple of areas where park maintenance structures or gravel storage were built next to the stream. All these areas should be considered for tree planting to stabilize the soil and to capture pollution from runoff. **3.** The streambank along Douglas Run beneath the power line right-of-way is bare and eroding. **4.** The area near point "4" has significant erosion.

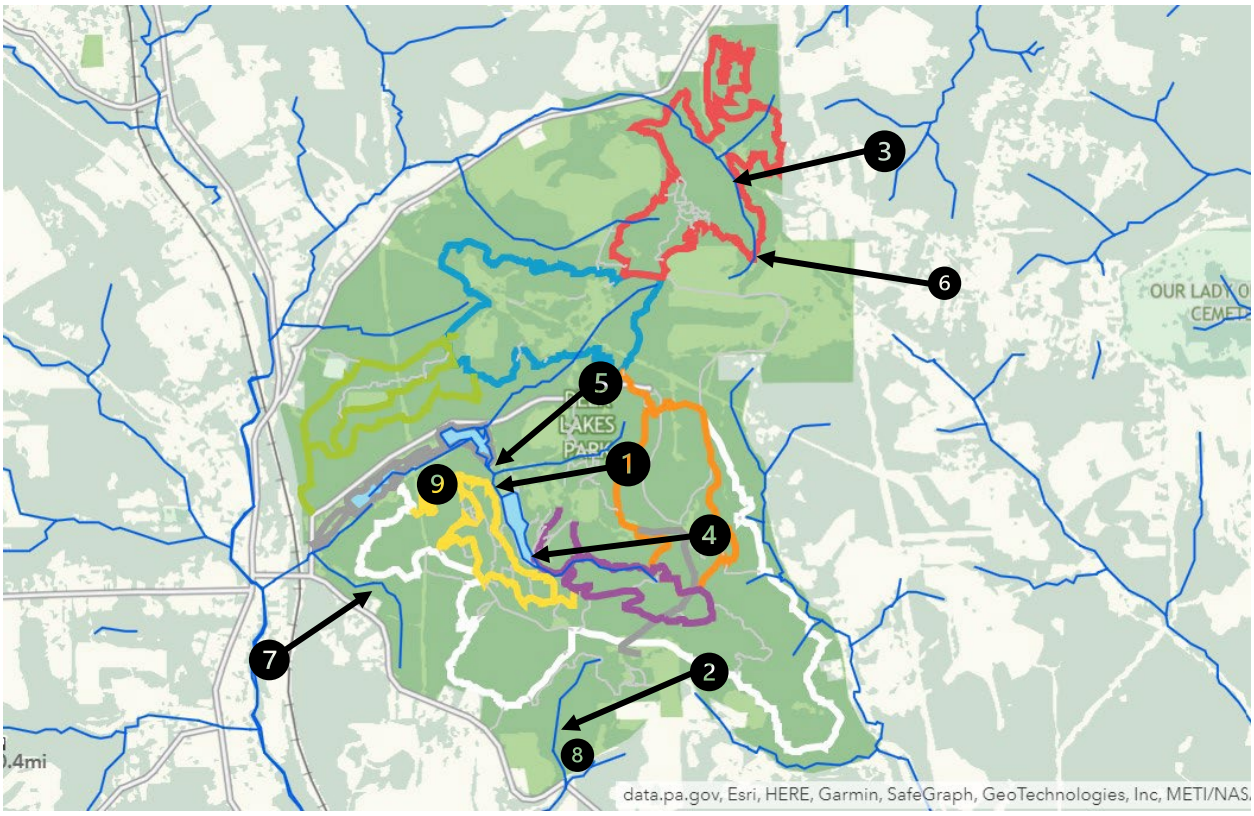
Restoration of any site with severe erosion at the scale of those along Douglas Run requires an engineering assessment to determine the causes and best restoration technique. Bioengineering could be appropriate but should be applied with a holistic understanding of the source and consequences of the erosion. Bioengineering is likely to be compatible with the management objectives of the park but does require permitting from the Allegheny County Conservation District or Department of Environmental Protection.

**5.** There are algae growing in the tributary along Simpson Howell Road. It may be from nutrient runoff from the agricultural field along this tributary. It is also impacted by excess sediment deposition from a private owner's sediment pile adjacent to the stream bed. Sediment is being carried via runoff into the stream resulting in a shallower stream channel. In the months with lower or no canopy cover, the sunlight is able to more easily reach the stream bottom and encourage algae growth.

Tree Debris

The visual assessment recorded many debris jams in Douglas Run. Whether due to age or insect damage or other factors, there are a lot of trees that have fallen in the park. While fallen trees across a stream are not inherently problematic in many cases – and often provide valuable habitat - if they are causing erosion because water is trying to circumvent them, selective removal of sections of trees can help to reduce erosion. A review of fallen timber in the park with that in mind is merited.

## Deer Lakes Park




Erosion Remediation

**1.** The man-made stream channel that flows from the spillway of the upper lake toward the waterfall needs immediate attention. This channel lies between the natural slope of the hillside and a pile of soil. During heavy rain events, the amount of water coursing through this channel is eroding this bank. The soil is loose. This area is prime for live staking to prevent avulsion through the bank as the stream will always seek its original course.

**2** Erosion in the stream that flows under Creighton Russelton Road at Russelton Airport Road is 10 feet deep in places.

**3** There is a culvert beneath Bakerstown Road that drains into the area near the Red Trail and is eroding the hillside.

**4** The disc golf path at the entrance to the upper lake needs to be addressed possibly with some geotextile material. Mud is forming a delta in the lake.

**5** Directly below the man-made waterfall where a tributary enters is badly eroded with a steep vertical bank.

Daylighting Opportunity

**6** In the park valley below the Red Trail off Bakerstown Road the stream is directed through a clay pipe for about 300 feet. This area could be daylighted to improve the quality of this small watershed.

Trash Cleanup

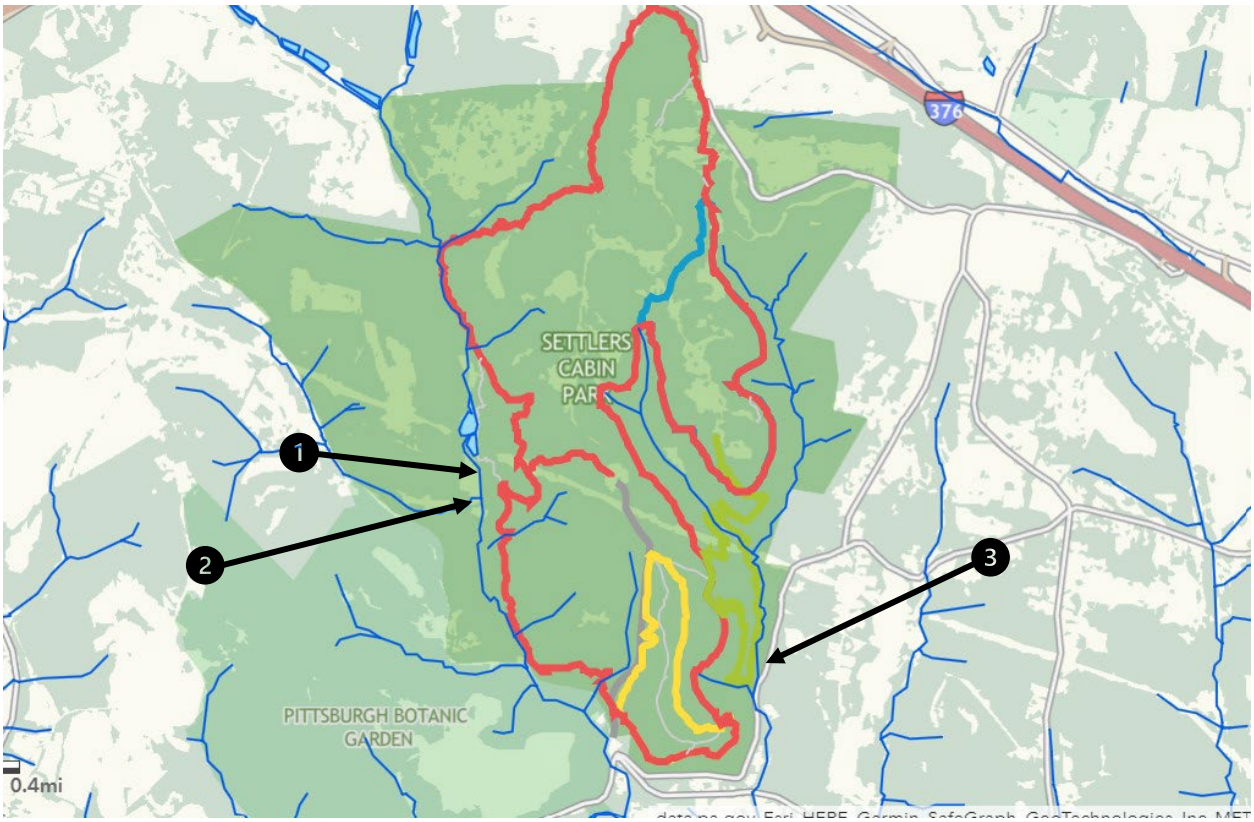
**7** Above the wetlands along Creighton-Russelton Road, there is significant household trash thrown on the hillside below the private property. This is making its way onto park property and into the stream there.

**8** The stream at Russelton Airport road is heavily littered with household waste.

Tree Canopy Needed

**9** The access road (grass) above the stream between the lower and middle lake leaves the stream without canopy cover. The hillside between this access road and the stream could use some trees.

## Settlers Cabin Park




**1** Strong gas odor here

**2** Milky-white aluminum precipitate (AMD) is obvious in the water at "Site 3". "Aluminum rarely occurs naturally in water at concentrations greater than a few tenths of a milligram per liter; however, higher concentrations can occur as a result of drainage from coal mines, acid precipitation, and breakdown of clays." (Hem, 1970)[i] This study did not include sampling for aluminum. Macroinvertebrate sampling did not occur at this site, but did occur downstream of this location at "Site 2" where the macroinvertebrate count scored this reach as only "Fair".

**3** Milky-white aluminum precipitate is consistently flowing into collection site "5" from SCST2LT01 tributary. Also, brown/orange AMD consistently emerging from stream embankment creating a small puddle near "Site 5" data collection area.

<u>Riparian Buffers</u>

Administration has created many new tree plantings in this park. Revisiting these is necessary as cages should be inspected and weed control measures taken. Many trees have died or have been overgrown with grasses and invasives.

*Sites where tires were used as stabilization should be revisited to ensure they are functioning as intended. Tires are escaping from their locations.

## SUMMARY

Erosion and sediment deposition are concerns in all three parks, but to varying degrees of severity. While stormwater management is the primary source of erosion, vegetation impacts from deer and invasive species play a significant role. Any effort to promote healthy forests or promote infiltration with conversion of lawn to meadow are valuable in combating the sources of erosion. Other strategies can be as minimal as debris removal or extensive as bioengineered restoration projects. While localized areas require attention, the results of this study indicate that most of the streams in the parks studied support pollution-sensitive insects and are fairly stable, structurally.

## RESOURCES

Live Staking for Stream Restoration, Penn State Extension 2019

Yochum, Steven E. 2018. **Guidance for Stream Restoration.** U.S. Department of Agriculture, Forest Service, National Stream & Aquatic Ecology Center, Technical Note TN-102.4. Fort Collins, CO.

Bioengineering Materials, Planting Guide. Ernst Seeds
https://www.ernstseed.com/products/bioengineering-materials/

## FOOTNOTES

[i] Stream investigations by the author have indicated that a combination of pH less than 5.5 and dissolved aluminum concentration greater than 0.5 mg/L will generally eliminate all fish and many macroinvertebrates. Fishflies, alderflies, and several genera of stoneflies, caddisflies, and true flies (particularly within the family Chironomidae) are tolerant of low pH and high dissolved aluminum. Mayflies are the aquatic insects most affected by a combination of low pH and acidic water. Aluminum is most toxic to fish at pH between 5.2 and 5.4 (Baker and Schofield, 1982). Streams with precipitated aluminum usually have lower numbers and diversity of invertebrates than streams with low pH and high dissolved aluminum. Precipitated aluminum coats the stream substrate, causing slippery surfaces and difficulty for insects to maintain position in the current. Aluminum precipitate can also be directly toxic to macroinvertebrates and fish. Rosemond et al. (1992) stated that deposition of aluminum hydroxide particles on invertebrates blocks surfaces important for respiratory or osmoregulatory exchange. Aluminum precipitate also eliminates most of the filter feeders, such as Hydropsychid caddisflies, which normally comprise a major portion of total stream macroinvertebrates. Precipitated aluminum can also accumulate on fish gills and interfere with their breathing (Brown and Sadler, 1989).