PITHOLE CREEK WATERSHED ASSESSMENT REPORT and COLDWATER CONSERVATION PLAN

Venango and Forest Counties

October 28, 2020

REDHORSE Environmental
PO Box 148
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Project Funders and Collaborators

This project was financed in part by a grant from the Coldwater Heritage Partnership on behalf of the PA Department of Conservation and Natural Resources (Environmental Stewardship Fund), the PA Fish and Boat Commission, the Foundation for Pennsylvania Watersheds, and the PA Council of Trout Unlimited. Assistance and in-kind contributions were made by Three Rivers Quest/ColCom Foundation, Brian Ensign at the PA Fish and Boat Commission (Tionesta Office), Dr. Andy Turner at Clarion University, Joe Broncato at the PA Department of Environmental Protection (Northwest Division), and Wes Ramsey at the Penn Soil Resource Conservation and Development (RC&D) Council.

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Pithole Creek Assessment Project Origins:

In late 2017 a limited investigation of stream conditions in Pithole Creek in Venango and Forest County was completed as part of the Three Rivers Quest (3RQ) Northern Allegheny River Basin water quality monitoring initiative. 3RQ water quality grab samples showed elevated levels of parameters associated with oil and gas production - specifically bromide, chloride, and sodium - that exceeded concentrations found at other 3RQ sites collected in the northern portion of the Allegheny River basin since 2013. Logger data also showed conductivity well above the norm for a healthy Allegheny Plateau stream.

In 2018 Pithole Creek became a 3RQ targeted study watershed because of the preliminary findings discussed above and its history related to the early oil industry, current oil and gas production activity, and brine application on dirt and gravel roads occurring at that time throughout the watershed. As a targeted study grab samples were collected at sites on Pithole Creek and selected tributaries to document water quality from 2018 through 2020.

These preliminary findings prompted the initiation of a Coldwater Heritage Grant application submitted by Penn Soil RC&D. Penn Soil received a grant in 2018 to assess the Pithole Creek watershed.

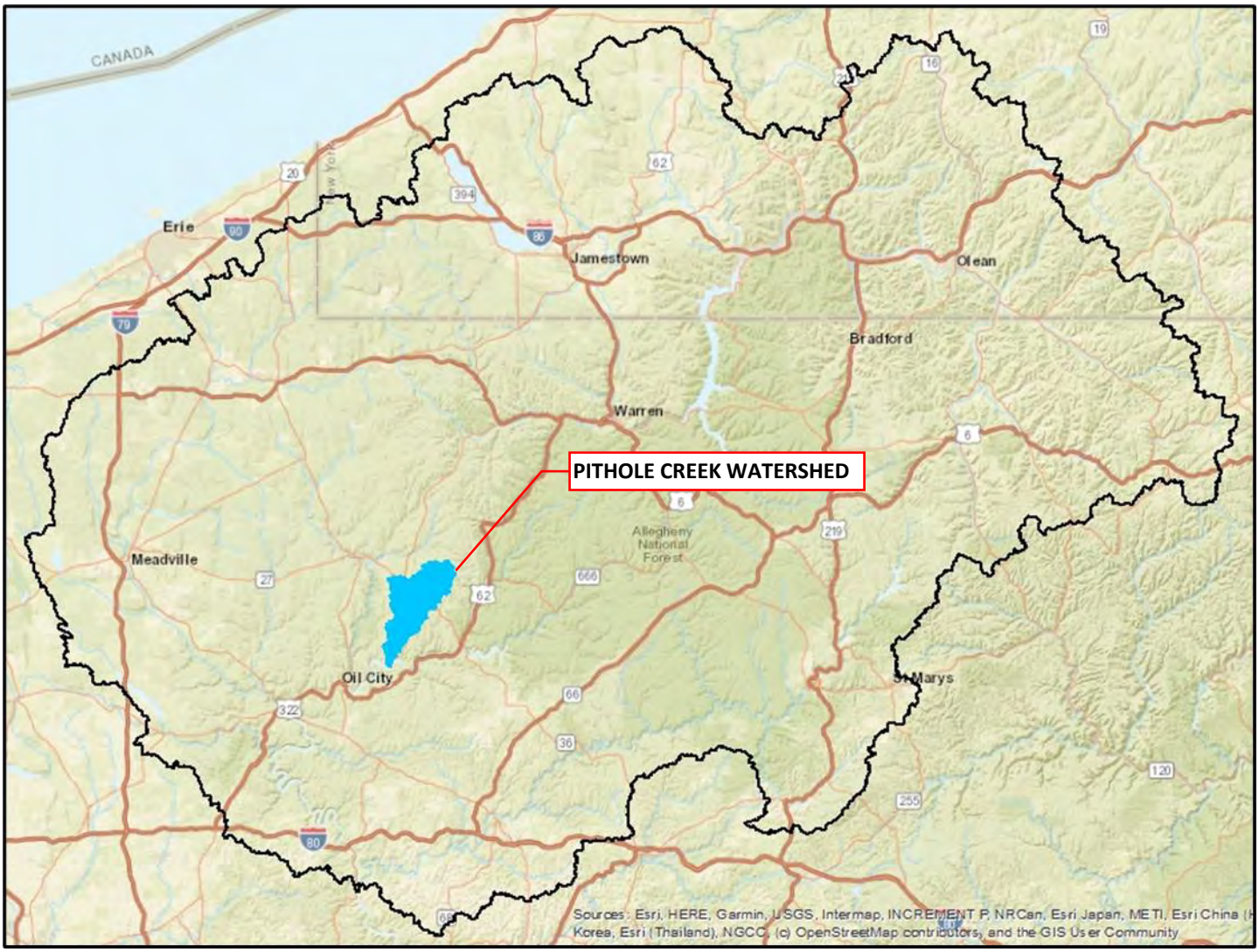

Figure 1. Location of the Pithole Creek watershed within in the Northern Allegheny River basin.

Pithole Creek History

Pithole Creek is a major tributary to the Allegheny River draining 41.8 square miles with a total of 77 miles of mapped streams (PA StreamStats). Today much of the watershed is forested (93%) with only limited urban development (3%) with Pleasantville being the largest developed area in the watershed. Rural residences are scattered throughout the watershed.

What defines Pithole Creek is its history of oil production. The Pithole Creek watershed is located immediately east of the Oil Creek watershed where Edwin "Colonel" Drake discovered oil near Titusville on August 27, 1859. The well in Titusville was only 69 feet deep but the pioneering method that Drake developed - using 32' long cast iron pipe and drilling inside the pipe to prevent bore hole collapse and water infiltration - what we call casing today, revolutionized oil extraction. This innovation spread rapidly in the Oil Creek valley and eventually along Pithole Creek.

Extensive oil production began in the Pithole Creek watershed on January 7, 1865 at the Holden Farm in what was to become Pithole City, approximately 8 miles from Titusville. That initial well was drilled into the Venango Third Sand about 450' to 550' below the surface. The oil in that formation was under high pressure enabling commercial production and initially produced 250 barrels/day which sold at that time for $8/barrel. Oil production would eventually involve all the Venango sands and thus created widespread drilling throughout the watershed.

Pithole was the quintessential boomtown. Oil strikes at nearby wells in January 1865 prompted a large influx of people to Pithole. On November 30, 1865 Pithole was incorporated as a borough with an approximate population of 15,000. At one-point Pithole had 54 hotels, 3 churches, the third largest post office in Pennsylvania, a newspaper, a theater, a railroad, and a red-light district.

Oil derricks and storage tanks occupied much of the area around Pithole and along Pithole Creek. Oil transport from Pithole to commercial buyers was difficult because of terrain and weather. Initially oil was transported in barrels with teams of horses that had a very high mortality rate. Due to recurring issues with Teamsters, Samuel Van Slyke designed and opened the world's first pipeline in Pithole. The pipeline was small by current standards being only 2 inches in diameter. Constructed from wrought iron pipe in 15-foot joints, the 5.5 mile pipeline extended from Miller Farm Rail Station on the west side of Oil Creek (south of Titusville) to Pithole and was completed on October 9, 1865. The pipeline revolutionized crude oil transportation.

The boom at Pithole would not last. By 1866 Pithole had less than 2,000 residents as the glut of oil from widespread drilling and the efficiency gains brought by pipeline transport pushed crude prices to $2.50/barrel. The United States Census recorded the population of Pithole as only 237 in 1870 and the borough was unincorporated in 1877. Today a museum and visitor center are located at the original site of Pithole City and is operated by the Pennsylvania Historical Museum Commission

This history remains relevant to the condition of Pithole Creek as oil production has remained a prominent part of the local economy and many wells remain active within the confines of the watershed. Additionally, there are many abandoned wells in the watershed that date to the boom of 1865 and thereafter.

Figure 2. Pithole City circa 1865.

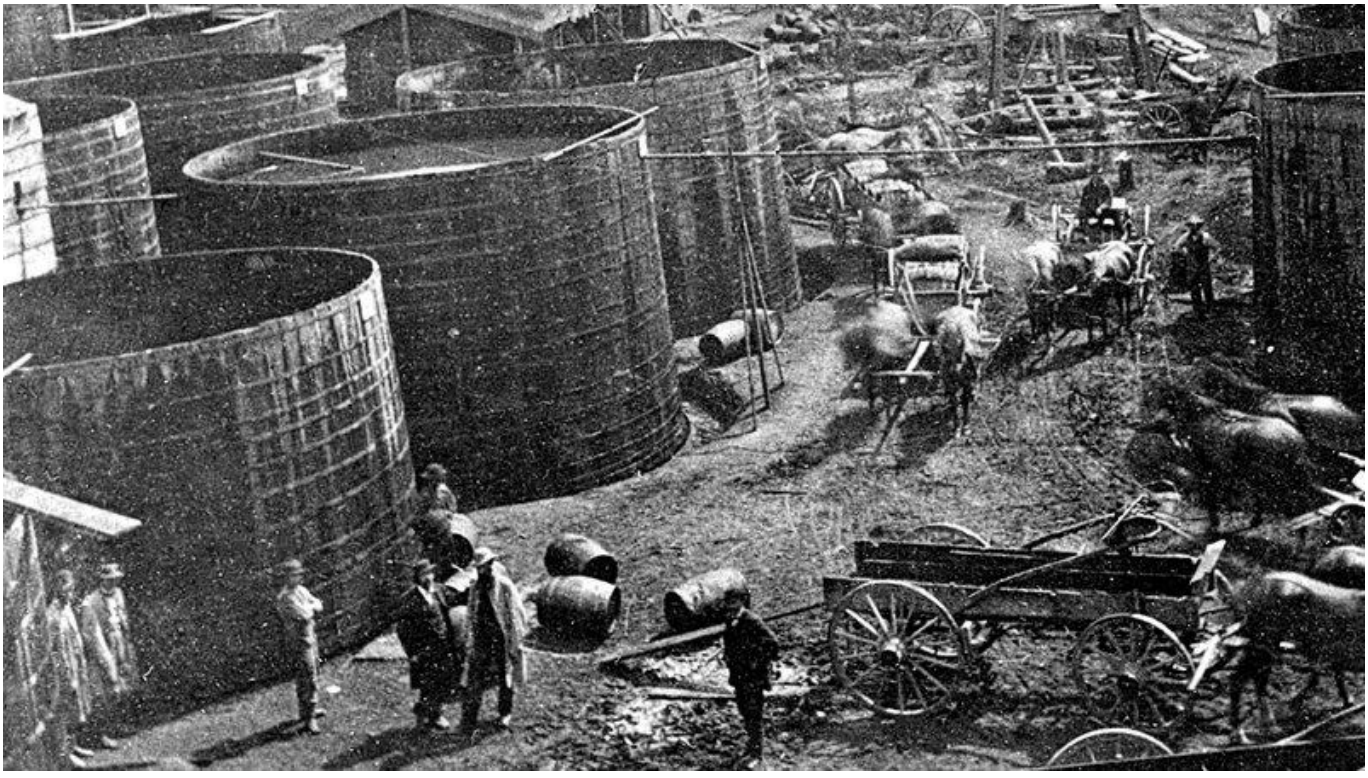

Figure 3. Oil holding tanks and horse drawn wagons in Pithole City prior to the establishment of the Van Slyke pipeline.

Figure 4. Miller Farm landing at the terminus of Van Slyke's pipeline, in 1868.

Pithole Creek Watershed

The Pithole Creek watershed is in northern Venango County and western Forest County. The watershed is on the Allegheny Plateau and drains approximately 26,752 acres directly to the Allegheny River at Oleopolis. Today much of the watershed is forested (93%) and supports oil and timber production. Mean annual precipitation is 43 inches.

Stream density in the watershed is 1.83 miles/sq. mi. and there is a total of 77 miles of mapped streams in the watershed base on 1:24,000 scale mapping (see graphic on next page). Many of the streams are coldwater fisheries supporting native populations of Brook Trout. The PA Fish and Boat Comission regularly stocks Pithole Creek with trout prior to the opening of the annual spring fishing season. The Pithole Creek mainstem has been, and remains, a popular trout fishing destination.

Figure 5. Pithole Creek watershed with 77 mile stream network, Venango and Forest Counties, PA.

Topography

The Pithole Creek watershed has a mean elevation of 155' above MSL with a mean basin slope of 4.6 degrees. The highest elevation in the watershed is at the Tionesta Fire Tower southeast of Pleasantville at 1744' above MSL. The lowest elevation is at the confluence of the Allegheny River near Oleopolis at approximately 1020' above MSL.

Figure 6. Pithole Creek watershed stream network with topographic map, Venango and Forest Counties, PA.

Geology and Oil Production

Much of the Pithole Creek watershed is underlain by sedimentary bedrock formations that are of Devonian, Mississippian, and Pennsylvanian origin. The lithography of these formations is primarily sandstones, siltstones, and shales.

These sedimentary formations are associated with the early development of the oil industry in Venango County. In particular, the Venango Formation contains reservoir rocks of thick sequences of interbedded sandstones, siltstones, and shales. The origin of these rocks is thought to be oceanic nearshore conditions that were associated with beaches, barrier bars, and tidal channels.

The sandstones in the Venango Formation have variable porosity and permeability. Oil saturations generally averaged less than 30 percent but could reach 50% (based on pre-World War II drilling data). These reservoirs were responsible for the early development of the oil industry in Venango County and Western Pennsylvania. By 1880 Pennsylvania supplied half of the total oil supply worldwide and would maintain this position until the early 1900s when oil was discovered in Texas.

Today most of the remaining reservoirs in Venango County are in marginal portions of the formation with limited oil reservoirs and high-water saturation. Most historic and current oil production is associated with the Venango First and Venango Third sandstones.

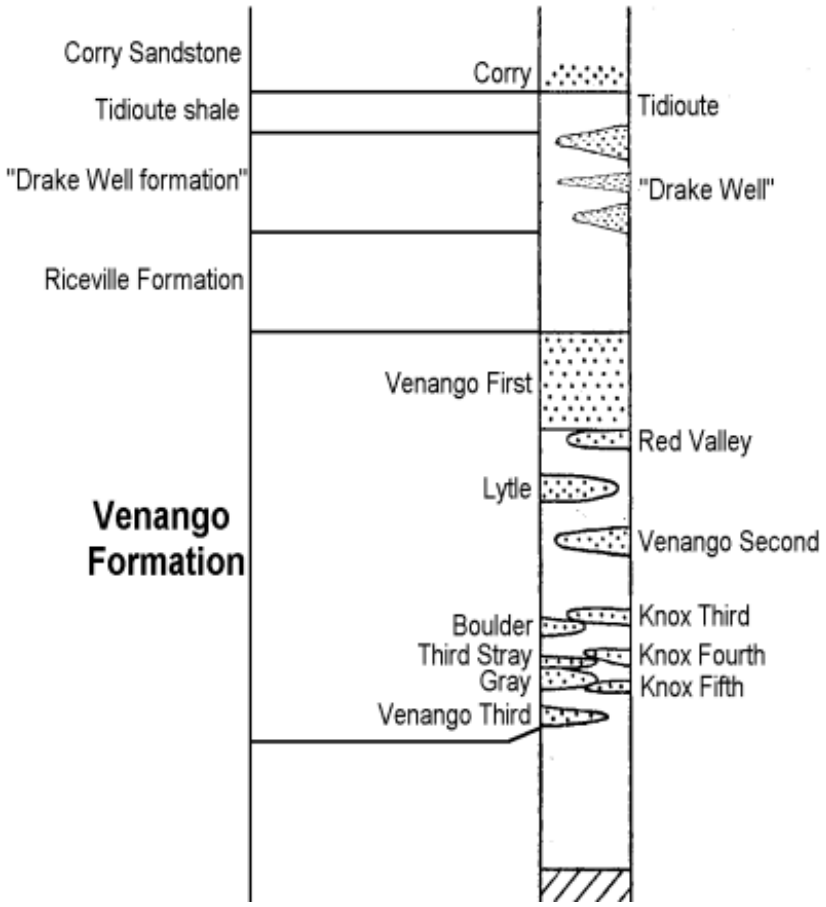

Figure 7. Stratigraphy of the Venango Formation with formal and local driller nomenclature.

Today oil from the Venango Formations is produced by vacuum pumping with small jacks powered by electric motors. These pumps bring fluid containing crude oil and brine water (saline water with varied chemical constituents) to the surface where the oil is segregated from the brine in “separators” and then sold into the local/regional market. This oil is a Pennsylvania light crude and differs from the current industry standard oils (Brent, West Texas Intermediate) traded worldwide in its chemistry and use. Pennsylvania crude is paraffin-based and is widely used in cosmetics and health products.

Current Oil Production

Early oil production in Western Pennsylvania was completely unregulated. Oil and brine spills were common, and producers were not concerned with pollution of local streams. Historically wells were drilled, produced, and then abandoned after they no longer produced viable amounts of oil.

Today drilling is regulated by the Pennsylvania Department of Environmental Protection (PADEP). New wells are permitted through PADEP and when they reach the end of viable production plugged.

PADEP maintains a database of oil and gas wells in Pennsylvania that is available to the public and is updated regularly. Their data is available to the public and was used to create a set of maps showing well locations in the Pithole Creek watershed including the location of abandoned/orphaned wells, plugged wells, and actively producing wells. Based on PADEP data there are 546 abandoned/orphaned wells, 1857 plugged wells, and 1538 active wells in the Pithole Creek watershed (see figures below). These categories total 3,941 known wells in the 26,752-acre watershed or approximately 1 well/6.8 acres. This number is surely an undercount as many of the wells drilled from 1865 to the 1960s are not accounted for.

It is noteworthy that all the wells found in the Pithole Creek watershed are conventional oil and gas wells. There are currently no unconventional deep-shale wells in the watershed. While the Marcellus shale formation underlies the watershed, it is typically very thin and therefore not economically viable to produce at this time.

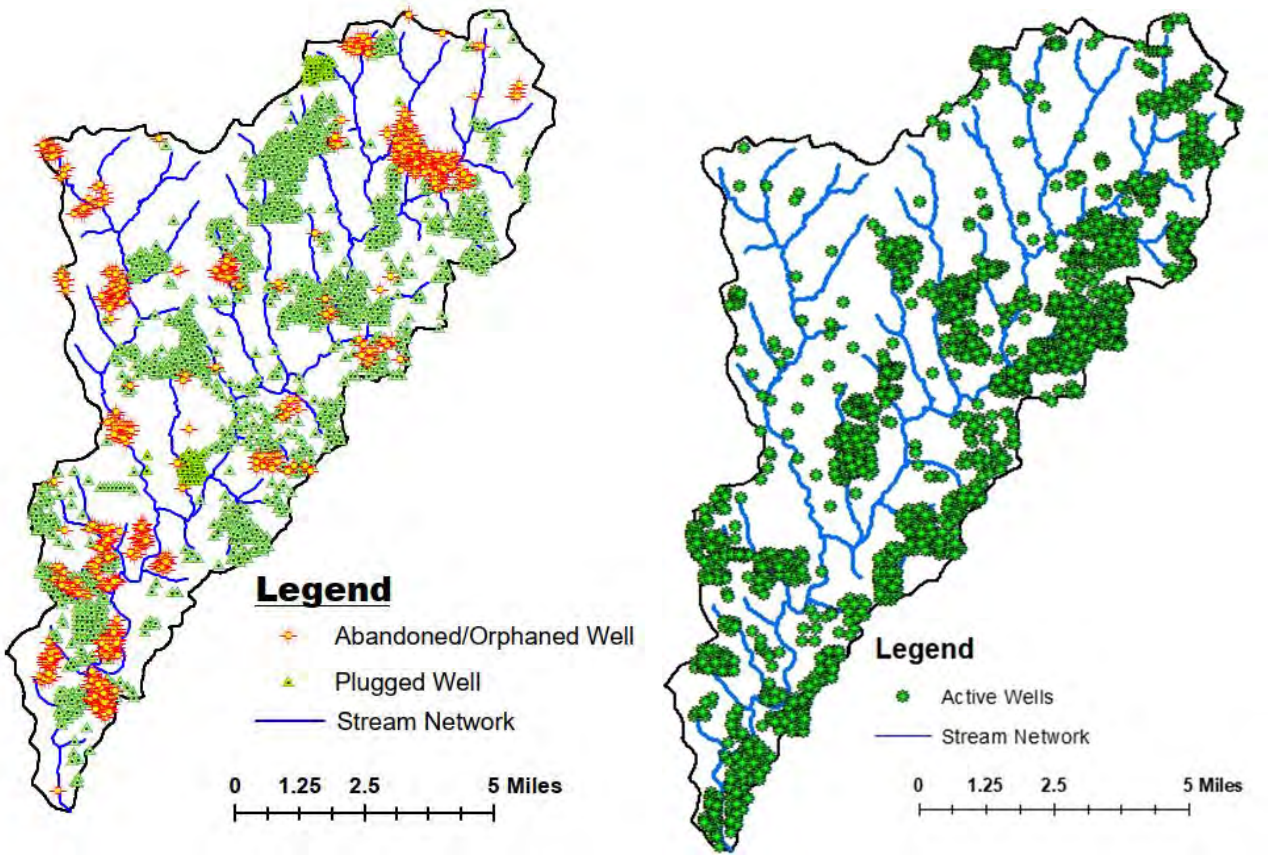

Figure 8. Locations of abandoned/orphaned wells (546) and plugged wells (1,857) (left graphic) and active/producing wells (1,538) (right graphic) in the Pithole Creek watershed. Data Source: PADEP 8/2020.

Data Collection

Water Quality

Stream grab samples were collected at nine (9) locations within the Pithole Creek watershed as part of the Three Rivers Quest[1] (3RQ) water quality assessment initiative. Sample locations included five (5) sites on the Pithole Creek mainstem, two (2) on the West Branch of Pithole Creek, and two (2) on tributaries: Tributary 55774 to Pithole Creek and Woodcock Run. Samples were collected between March 2018 and February 2020.

Samples were collected on seven (7) dates. Grab samples were collected mid-stream/mid-column and immediately field filtered with a hand-held vacuum pump through 0.45 UM filters and placed in bottles provided by PACE. Additional raw water samples were collected in PACE provided bottles and placed on ice in a cooler.

Samples were shipped overnight from the FedEx location in Franklin, PA to PACE Water Labs in Greensburg, PA. Sample analysis was conducted on 12 separate parameters as shown in Table 2. Chain of Custody (COC) documentation and sample tracking was completed by RedHorse Environmental and PACE labs.

Lab results and information related to QA/QC was provided to 3RQ in both a PDF format and MS Excel spreadsheets. Data were graphed with Minitab and/or SPSS as box plots for visual characterization of station data and comparisons between sites.

Table 1. Water sample station locations for Pithole Creek watershed water quality assessment/3RQ Targeted Study Project.

Station	River Mile	Site Detail
Pithole Creek	0.3	Upstream from confluence with Allegheny River
Pithole Creek	3.3	Stone Arch Bridge on Eagle Rock Road
Pithole Creek	6.5	Lesher Road Bridge off Pithole Road
Pithole Creek	10.3	Pithole Road/Pleasant Valley Road
Pithole Creek	13.5	Walk-in access off Pike Road
West Pithole Creek	0.1	Pithole Road between Plank Road & Lesher Road
West Pithole Creek	3.7	Coe Road Bridge
Tributary #55774	0.1	Pithole Road/Pleasant Valley Road
Woodcock Run	0.1	Walk-in access off Pike Road

[11] Three Rivers QUEST (3RQ) is a joint project consisting of Research Partners: West Virginia Water Research Institute at West Virginia University, the Center for Environmental Research and Education (CERE) at Duquesne University, Wheeling Jesuit University (2011-2019), West Liberty University, and RedHorse Environmental, LLC, and is currently funded by the Colcom Foundation. The project includes an outreach program titled 3RQ REACH (Research Enhancing Awareness via Community Hydrology). Through online mapping and the 3RQ database, the program serves to display and manage water quality data collected throughout the Ohio River Basin. In addition to routine sampling, 3RQ Targeted Studies provide sound science to serve as the basis for implementing solutions to water quality programs throughout outreach and awareness by engaging community, regulators, and other parties of interest.

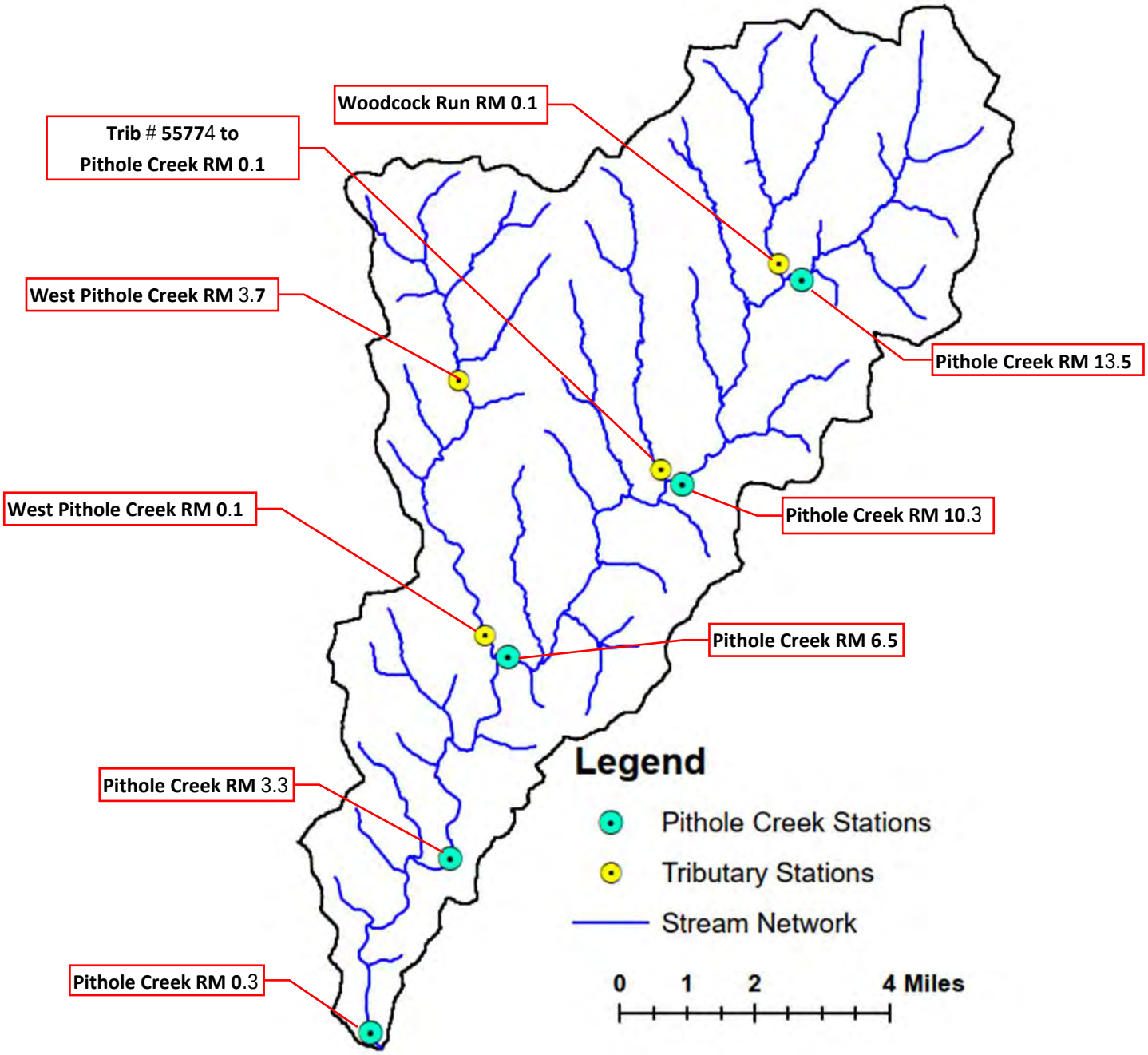

Figure 9. Pithole Creek watershed water sample locations 2018 – 2020.

Table 2. Chemical parameters, analytical method, and associated detection limits for Pithole Creek watershed water quality assessment 3RQ Targeted Study Project.

Parameter	Analytical Method	Detection Limit
Aluminum (dissolved)	EPA 6010B	0.050 mg/l
Calcium (dissolved)	EPA 6010B	1.0 mg/l
Alkalinity (Total/CaCo3 pH 4.5)	SM2320B-97	10.0 mg/l
Sodium (dissolved)	EPA 6010B	1.0 mg/l
Bromide	EPA 300.0	0.020 mg/l
Chloride	EPA 300.0	5.0 mg/l

PACE Pennsylvania/TNI Certification #: 65-00282

Figure 10. Typical filtering apparatus for 3RQ sample field filtration. Filters were 0.45 UM Cole-Parmer cellulose membrane.

Conductivity Loggers

Data loggers were placed in Pithole Creek at three (3) main-stem locations and two (2) tributary locations (West Pithole Creek and Woodcock Run) to monitor specific conductivity during 2018. Hobo data loggers were deployed in protective housings secured to the stream substrate with cables and stakes. Measurements were recorded every 15 minutes (96 observations/day) from March 26 to July 27, 2018.

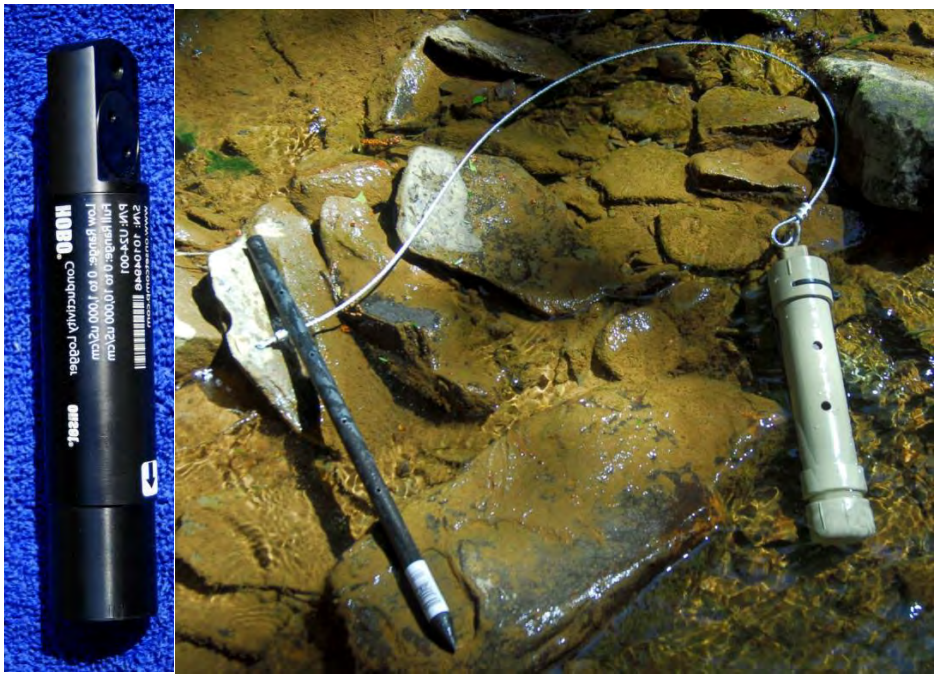

Figure 11. Hobo data logger (left) and housing w/cable and stake (right) used to deploy loggers.

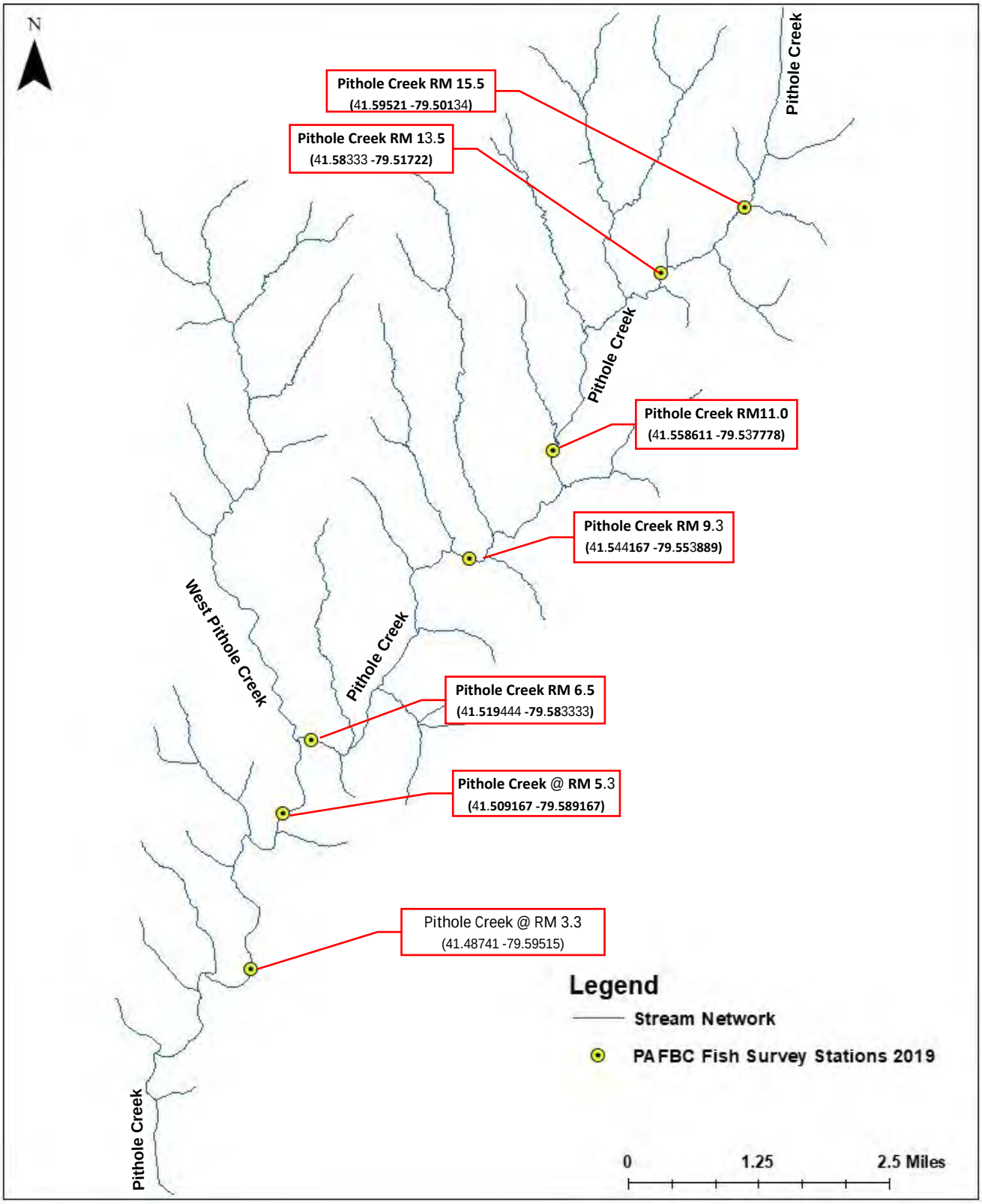

Figure 13. PAFBC fish survey stations on Pithole Creek mainstem 2019. Station length approximately 300m. Surveys conducted by PAFBC personnel with a DC backpack electro-fisher during summer low flow conditions.

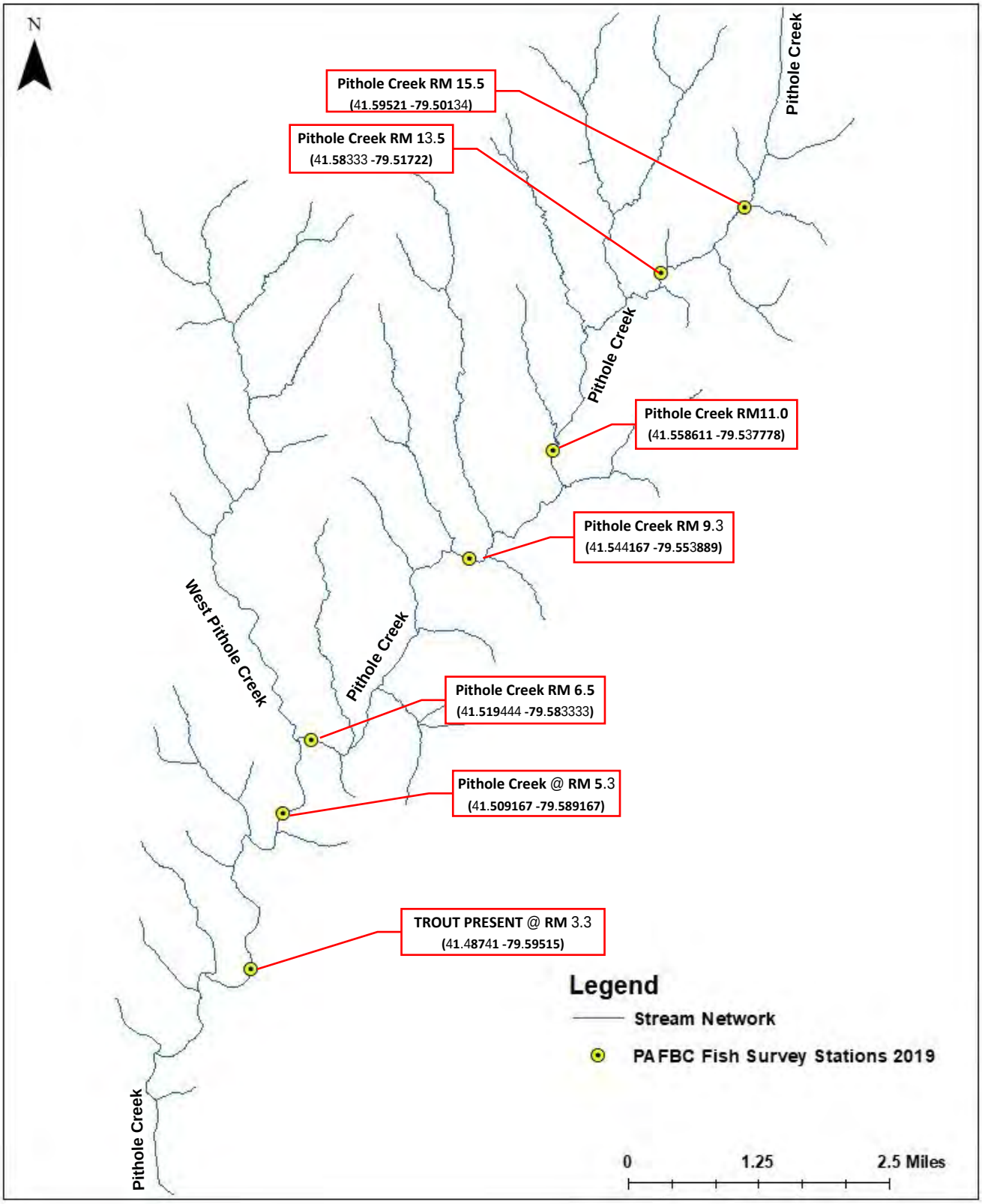

Figure 13. PAFBC fish survey stations on Pithole Creek mainstem 2019. Station length approximately 300m. Surveys conducted by PAFBC personnel with a DC backpack electro-fisher during summer low flow conditions.

Results

Water Quality

Lab summary results (median, minimum, maximum, and number of samples) are presented in Table 3 for five primary water quality parameters of interest for all stations combined collected across the watershed from 2018 – 2020.

Table 3. Water quality summary for alkalinity, calcium, chloride, sodium, and bromide for all stations combined in the Pithole Creek watershed 2018 – 2020. Represents nine (9) stations for seven (7) sampling events.

Parameter	Median	Minimum	Maximum	N
Alkalinity (Total)	26.0	10.0	50.0	60
Calcium	9.4	4.3	27.7	63
Chloride	17.8	7.5	146	63
Sodium	10.6	5.2	40.0	63
Bromide	0.110	0.042	0.800	63

Across the watershed dissolved calcium and associated total alkalinity (CaCo3) were higher than anticipated considering the ongoing problem of acidic precipitation in western Pennsylvania and the geology of the watershed being dominated by acid bearing sandstones. Alkalinity showed levels providing some buffering capacity within the watershed, but sample concentrations fell below 20 mg/l (desired concentration by the PA Fish and Boat Commission) in 20 of the 60 samples from 2018-2020.

Dissolved aluminum was not detectable in any of the water samples collected across the watershed at the level of testing conducted by PACE labs (< 0.05 mg/l). The presence of calcium and the amount of buffering capacity (alkalinity) currently occurring in the watershed ensures that aluminum is not in solution and thereby not detrimental to sensitive fish species like Brook Trout.

Chloride, sodium, and bromide showed somewhat elevated concentrations and variability throughout the watershed. It is reasonable to expect this result in that produced water (brine) from conventional oil wells escapes to local streams from currently producing wells, numerous abandoned and inactive wells, and from previous road applications throughout the watershed. It should be noted that there are no unconventional wells located in the Pithole Creek watershed as of August 2020.

Water quality for each of the parameters of interest (alkalinity, calcium, chloride, sodium, and bromide) is presented as box plots. Box plots were used as a graphic/statistical information display technique for groups or subpopulations of water quality data and provide a nonparametric graphical method to compare locations and examine trend or spatial data. In this report box plots are used to produce a graphical display of the spatial arrangement of water quality values of interest in locations where multiple stations exist within the Pithole Creek watershed-monitoring network. The plots show the median value and the range of values for each parameter and are arranged base on relational characteristics (total alkalinity and calcium; chloride, sodium, and bromide).

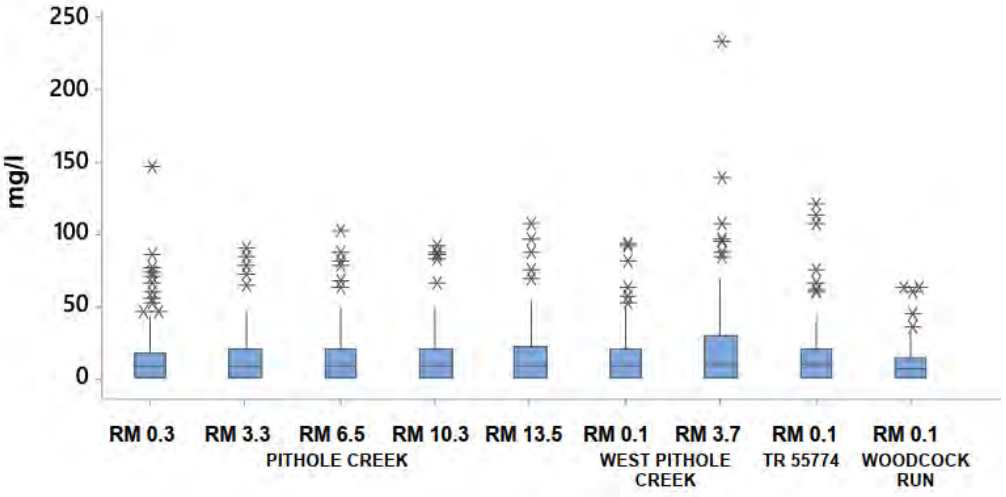

Figure 14. Box plot of Total Alkalinity (as $CaCO_3$ @ PH 4.5) at Pithole Creek, West Pithole Creek, Trib 55774, and Woodcock Run stations collected from 2018 -2020. N= 7.

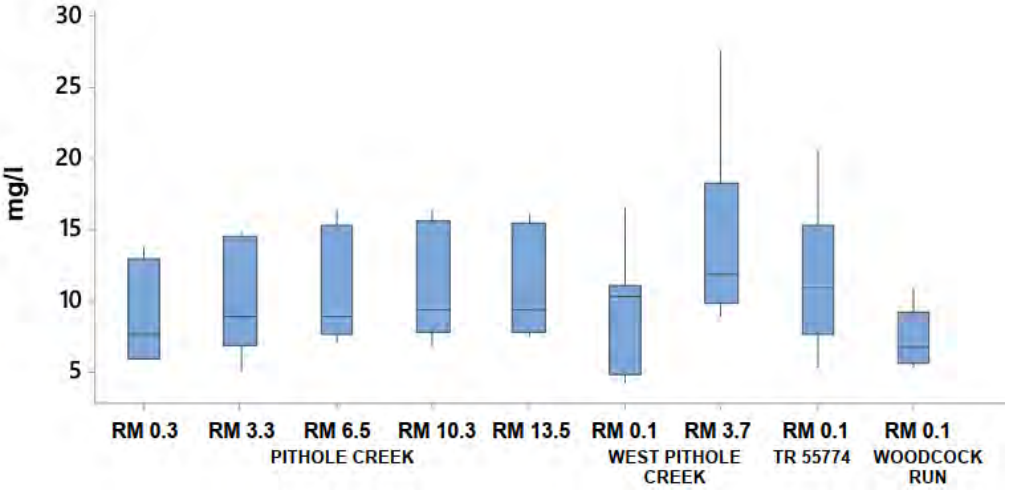

Figure 15. Box plot of calcium at Pithole Creek, West Pithole Creek, Trib 55774, and Woodcock Run stations collected from 2018 -2020. N= 7.

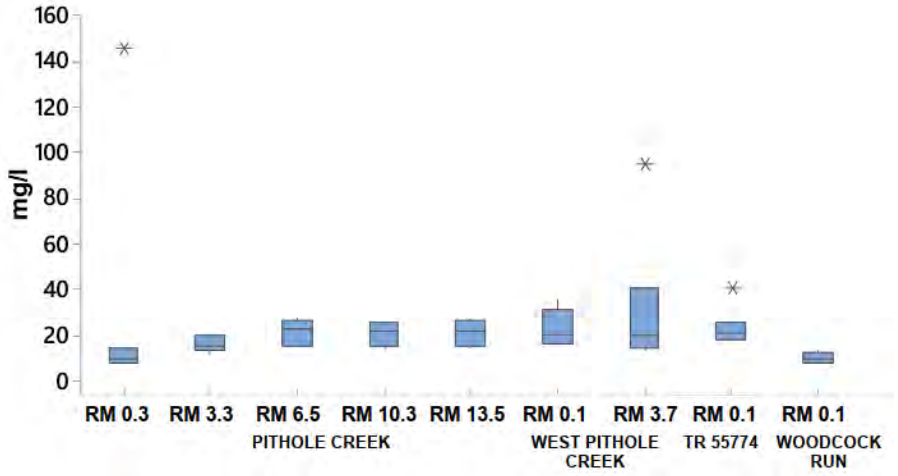

Figure 16. Box plot of chloride at Pithole Creek, West Pithole Creek, Trib 55774, and Woodcock Run stations collected from 2018 -2020. N= 7.

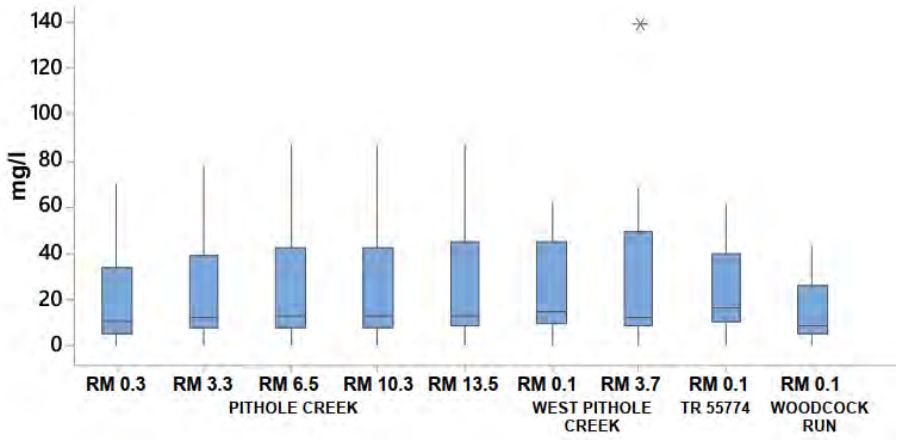

Figure 17. Box plot of sodium at Pithole Creek, West Pithole Creek, Trib 55774, and Woodcock Run stations collected from 2018 -2020. N= 7.

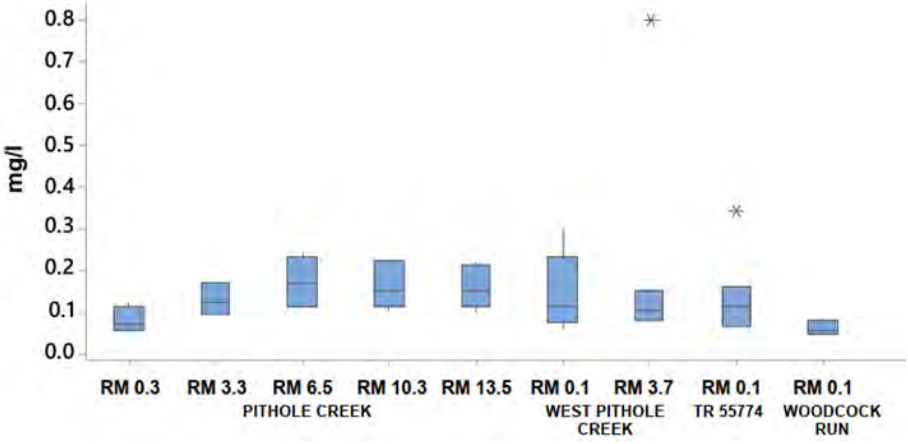

Figure 18. Box plot of bromide at Pithole Creek, West Pithole Creek, Trib 55774, and Woodcock Run stations collected from 2018 -2020. N= 7.

Water Quality: Specific Conductivity

Specific conductivity was measured with Hobo data loggers and the data were plotted as shown in the following graphs. Specific conductivity varied during the deployment of the loggers. This was anticipated as stream discharge is often correlated with specific conductivity.

Specific conductivity at the five locations was generally higher than would be expected in similar unpolluted waters regionally. Assessments in the Upper Allegheny watershed between 2011 -2015 showed that waters unaffected by pollutants have a specific conductivity range of 20 to 40 µS/cm. These higher concentrations can be related to the presence of calcium, bromide, chloride, and sodium (and other chemicals like iron, manganese, magnesium, sulfate) in water samples collected across the watershed between 2018 to 2020.

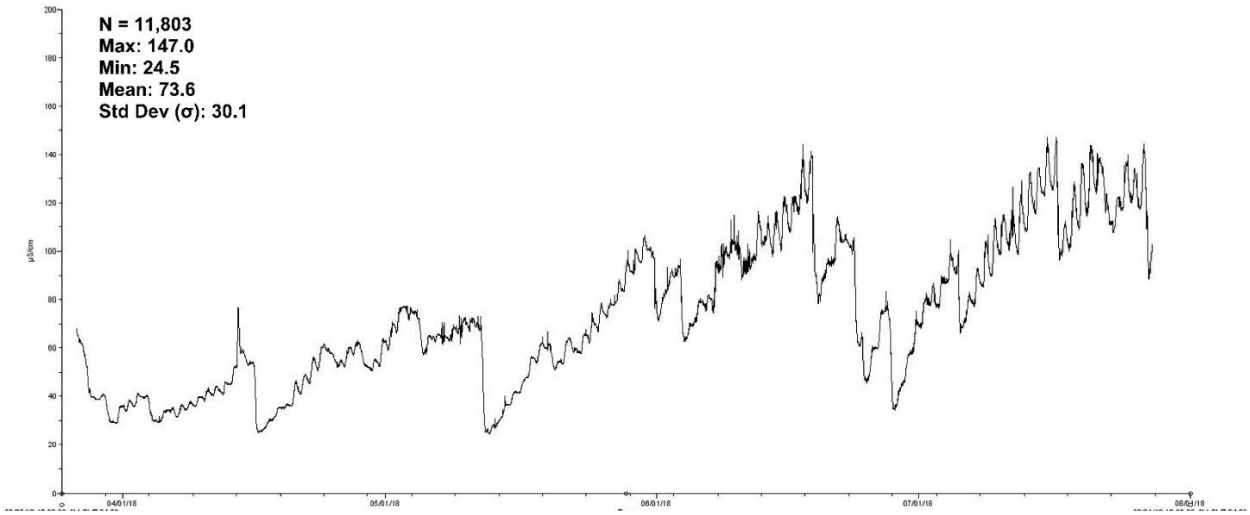

Figure 19. Specific conductivity (µS/cm) at Pithole Creek RM 13.5 March 26 – July 27, 2018.

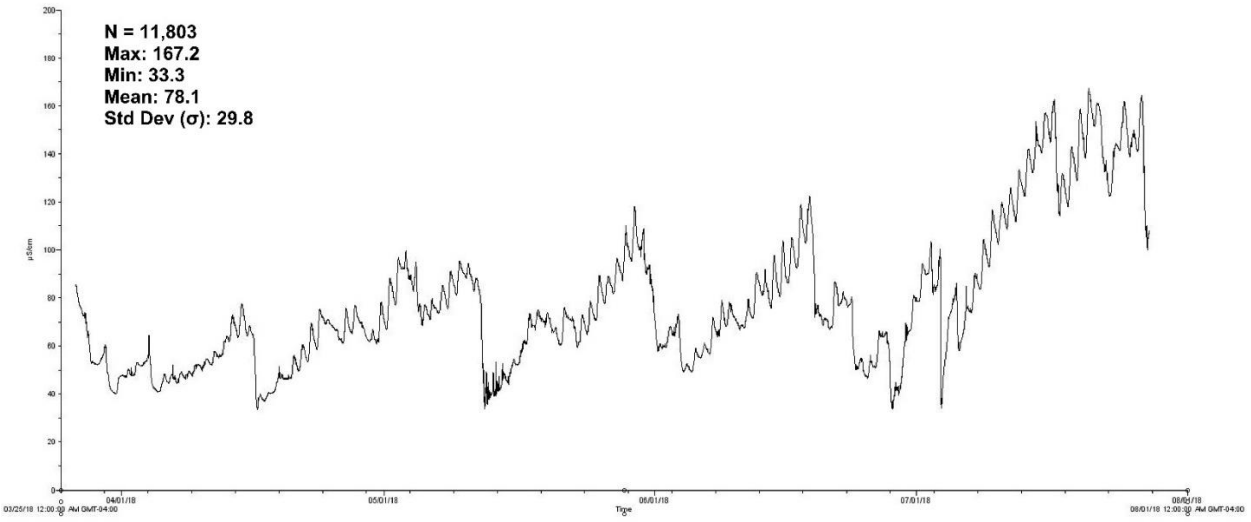

Figure 20. Specific conductivity (µS/cm) at Pithole Creek RM 6.5 March 26 – July 27, 2018.

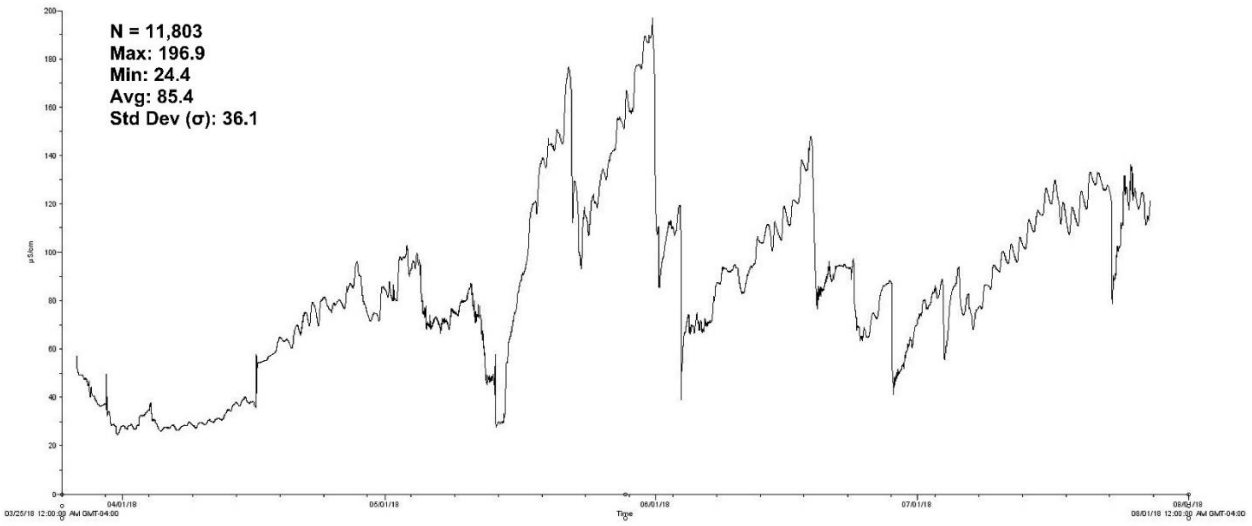

Figure 21. Specific conductivity (µS/cm) at Pithole Creek RM 0.3 March 26 – July 27, 2018.

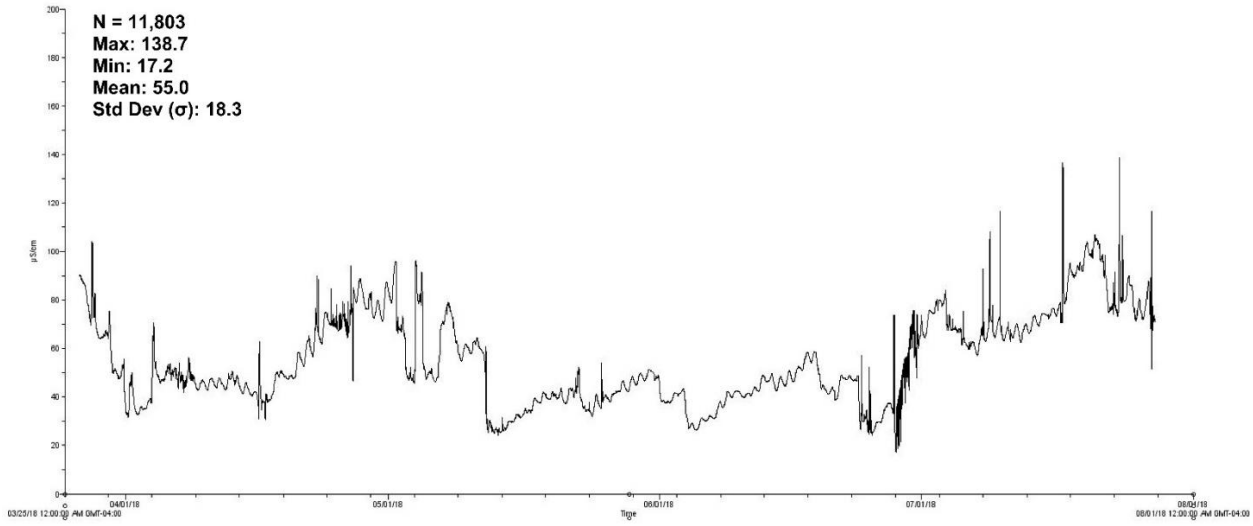

Figure 22. Specific conductivity (µS/cm) at West Pithole Creek RM 0.1 March 26 – July 27, 2018.

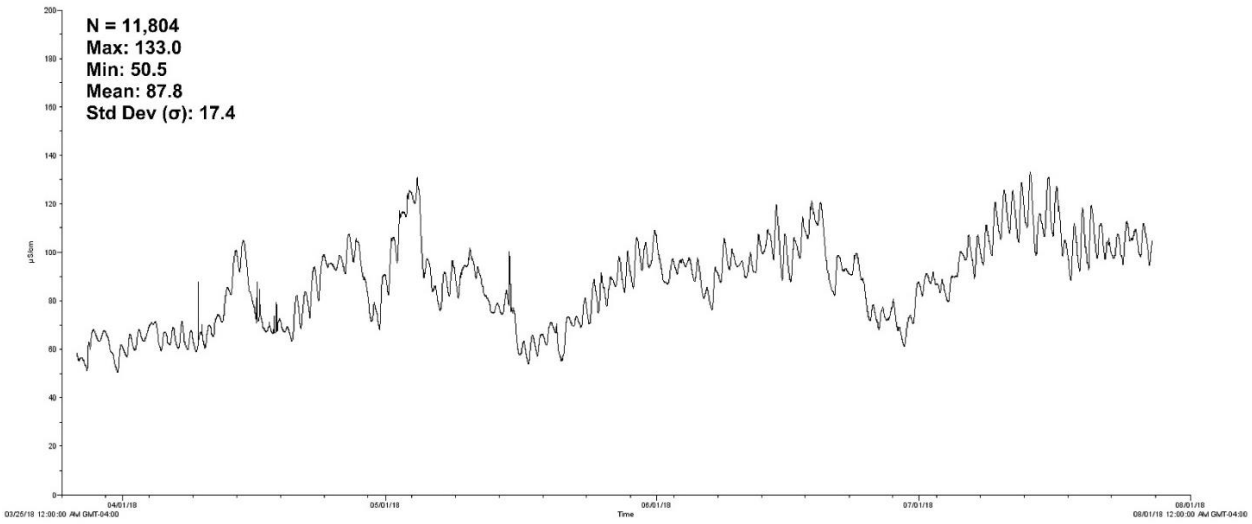

Figure 23. Specific conductivity (µS/cm) at Woodcock Run at RM 0.1 March 26 – July 27, 2018.

Fishery Surveys

Recent fish surveys of Pithole Creek and tributaries completed in 2018 and 2019 shows that natural reproduction of trout occurs throughout the watershed. An Unassessed Waters Survey conducted by Dr. Andy Turner (Clarion University) in 2018 in the Pithole Creek watershed surveyed 8 tributaries for the presence of naturally reproducing trout. Included were tributaries 54770, 54771, 54744, 54765 (2 sites), 54749, 54776, and Neilltown Run. Of these, 3 locations contained natural reproducing trout: 54771, 54765 (lower site), and 74776 (see figure below).

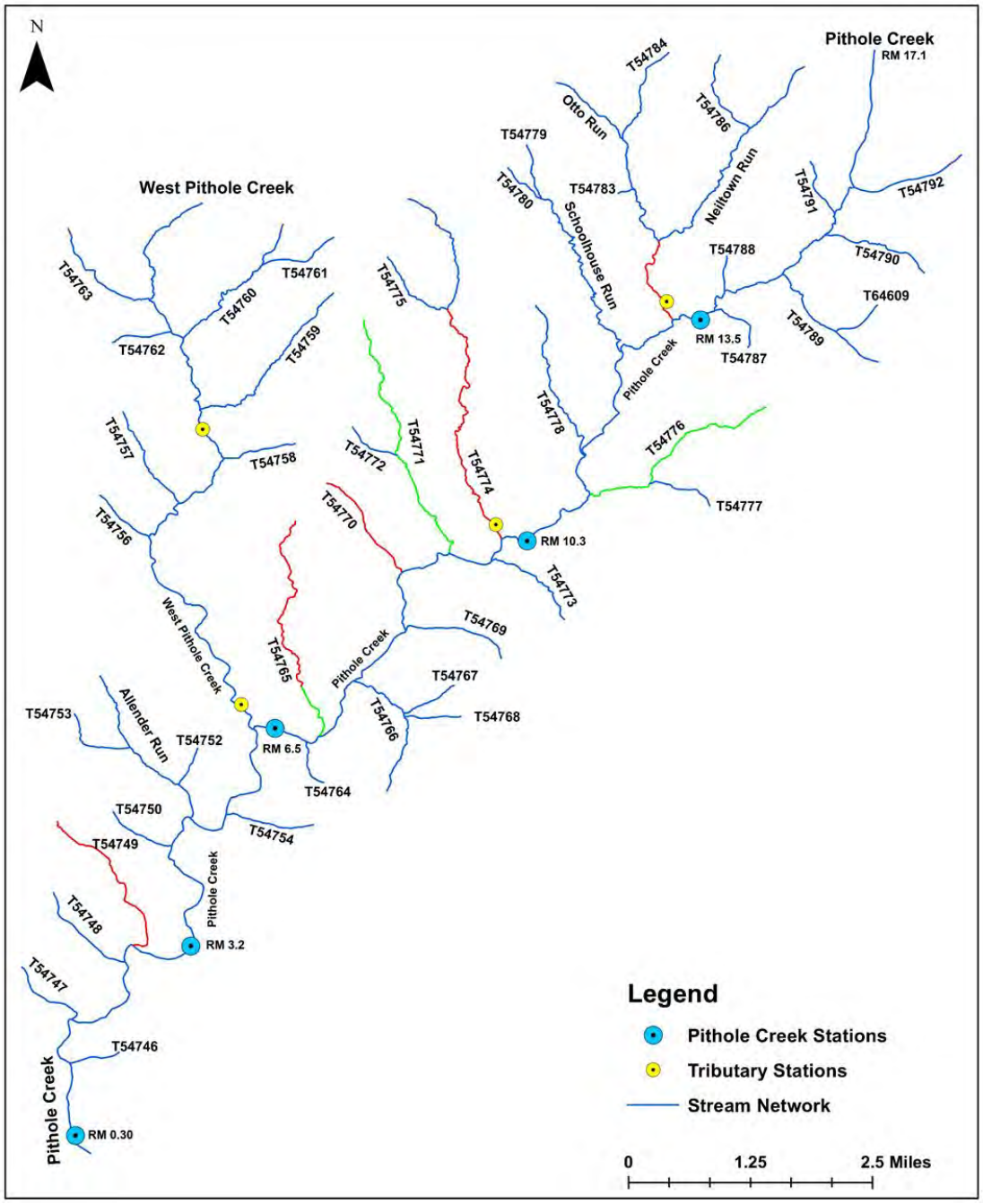

Figure 24. Unassessed Waters Survey showing tributaries with natural reproducing trout (green lines) and absence of reproducing trout (red lines) from surveys conducted in 2018 by Dr. Andy Turner, Clarion University. Blue and yellow station markers represent 3RQ water quality collection sample sites.

The PA Fish and Boat Commission Tionesta Field Office conducted electrofishing surveys at sampling sites on the Pithole Creek mainstem in 2019. These sites were at locations periodically sampled since the 1970s. Data from all surveys is included in the Appendix.

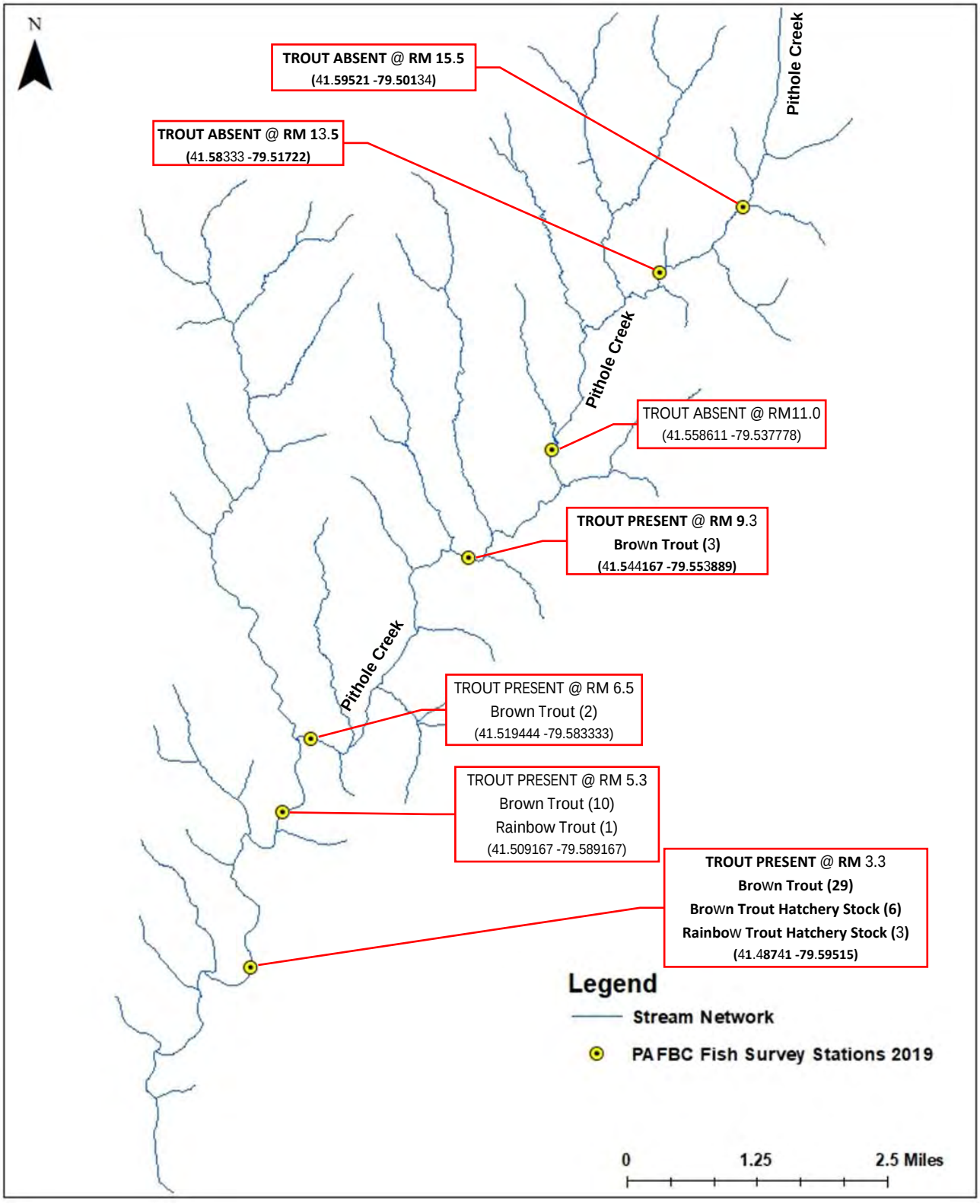

Figure 24. Locations showing results of fishery surveys for trout from electrofishing surveys conducted by the PA Fish and Boat Commission in 2019.

Discussion

Pithole Creek remains a popular fishing destination in northern Venango County and is stocked annually with trout by the PA Fish and Boat Commission. Many of these releases are at the bridge on Pithole Road south of Pleasant Valley Road and at the Stone Arch Bridge on Eagle Rock Road. Both locations are easily accessible to fishermen and therefore experience heavy fishing pressure during the early portion of the trout season, especially in April and May.

It is noteworthy that these stocking locations are within those portions of Pithole Creek that have been designated by the PA Fish and Boat Commission as "natural reproduction trout waters". Natural trout waters are defined by the PA Fish and Boat Commission as "stream sections supporting naturally reproducing populations of trout. A wild trout stream section is a biological designation". The practice of stocking hatchery reared trout over existing populations of naturally producing trout has historically been, and remains, a controversial management practice by the PA Fish and Boat Commission.

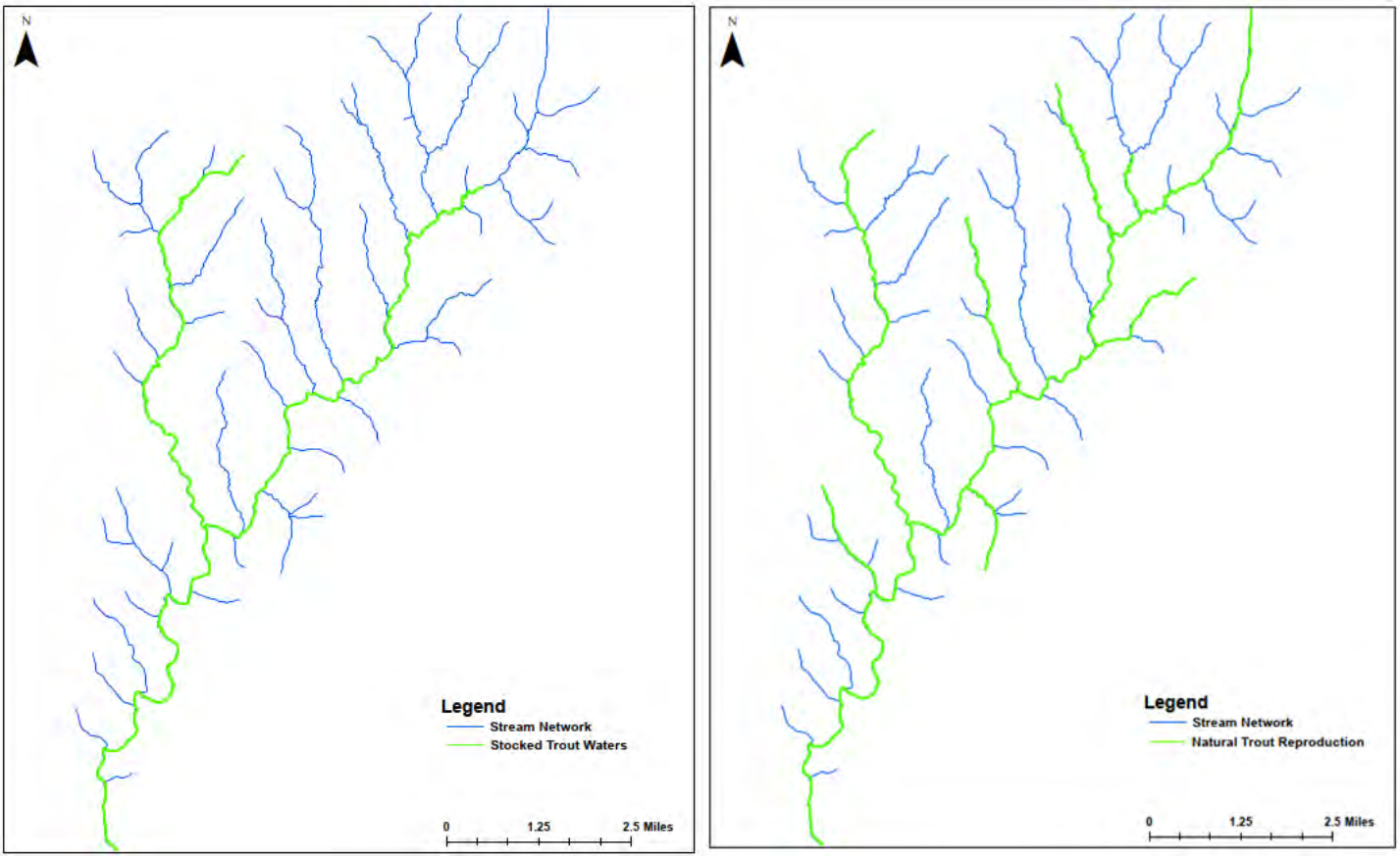

Figure 26. PA Fish and Boat Commission stocked trout waters (left) and natural reproducing trout waters (right) in the Pithole Creek watershed.

Figure 27. Large brown trout (*Salmo trutta*) captured during PAFBC electrofishing sampling in the middle portion to the Pithole Creek watershed July 3, 2019.

The Pithole Creek watershed has challenges related to water quality and habitat degradation. This is most evident in the diminished fish diversity found at many of the locations where surveys have been recently conducted. Elevated levels of bromide, chloride, and sodium were detected in the water samples taken throughout the watershed between 2018 and 2020. While these parameters do not reach levels that cause fish-kills they can have negative impacts related to chronic toxicity and impaired growth and reproduction in fish and other stream biota.

In a fishery any metabolic obligation associated with adapting to chronic, sub-acute toxicity, steals energy that is normally directed toward growth and reproduction. Sodium, chloride, and bromide concentrations are of concern in waters samples taken throughout. These chemicals are associated with historic and current oil production as they are found in produced water (brine). Undiluted brine samples collected from producing wells in Venango County from 2015 – 2017 showed very high concentrations of chloride, sodium, and bromide (and others). Further analysis of constituent concentration of the Venango County brine data and other sample data provided a means to identify the source of contaminants associated with mine drainage, unconventional well production, and conventional well production. (Cantlay et. al., 2020; Cantlay et. al., 2020).

The pathways these chemicals follow to reach surface waters in the watershed is linked to groundwater and surface runoff. Subsurface connectivity of oil producing formations and freshwater aquifers from drilling activity beginning 155 years ago is well known throughout the watershed. Many of the producing formations are “flooded” with freshwater as wells have been abandoned over the years and well casings have subsequently failed. This allows formations that were previously isolated from one another geologically to interact with this mixed groundwater subsequently reaching streams. Numerous abandoned and inactive wells are spread across the watershed potentially contributing to groundwater contamination with brine.

Figure 28. Inactive well site with pump jack (photo left) and old separator with overflow pit (photo right) in the Pithole Creek watershed.

Brine leaks and spills at active well sites, separators, or along transfer lines, illegal dumping, and the use of brine water for dust control on dirt and gravel roads are the primary pathways associated with surface water contamination. Accidental spills or leaks are relatively common with conventional well production activities. Illegal dumping is done by producers to avoid having to pay the costs associated with legal disposal (trucking and fees at disposal facilities) or to permitted disposal wells. The incidence of illegal dumping typically increases when the price per barrel of oil drops as producer profitability slips.

Brine spreading for dust control on dirt and gravel roads has historically been a common practice in Pennsylvania that was loosely overseen by PADEP. Brine spreading was terminated in late 2017 following a court case in Warren County that contended that produced water from conventional wells was hazardous waste and should be regulated just like produced/flowback water emanating from unconventional wells that cannot be spread on roads. Locally produced brine is typically spread by private contractors on dirt roads maintained by townships predominantly in northwest Pennsylvania.

Figure 29. Typical application of brine on dirt and gravel roads as practiced prior to 2018 (photo left) and ditch turnout on Dean Road aiding brine and sediment runoff into Otto Run (photo right).

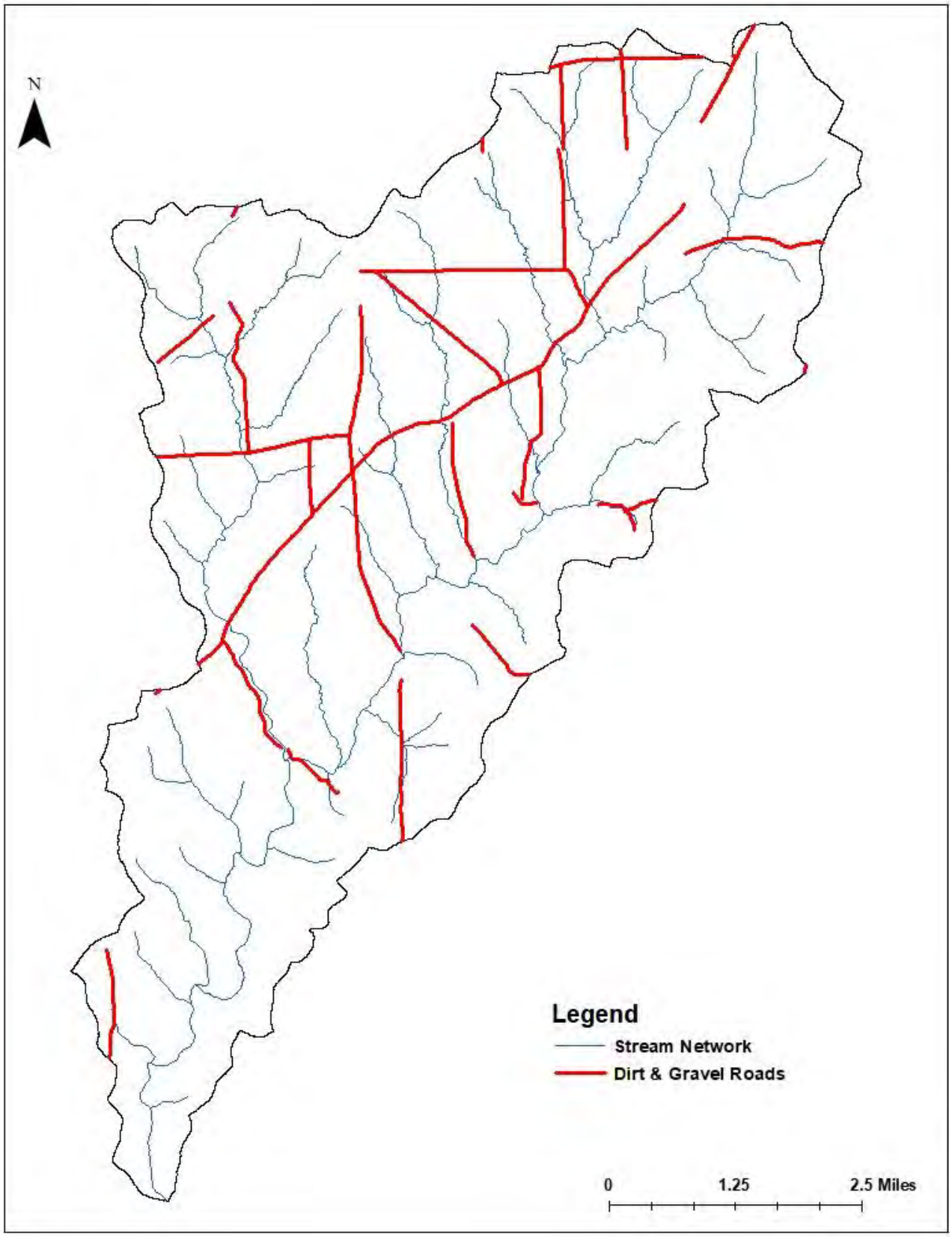

Figure 30. Location of dirt and gravel roads in the Pithole Creek watershed totaling 36.25 miles

Additionally, habitat degradation is a major concern especially in lower gradient reaches of the mainstem of Pithole Creek. Excessive substrate embeddedness negatively impacts macroinvertebrate production and fish reproduction. Visual inspections of locations in the upper and middle portion of the watershed show substrate that is moderately or severely embedded.

Sediment loading related to channel widening and dirt and gravel roads is driving increasing embeddedness primarily in the upper portion of the watershed. Sedimentation in lower gradient reaches nearer to the mouth of Pithole Creek is also associated with heavy ATV use in riparian areas adjacent to the stream channel.

Figure 31. Ditch turnout into Woodcock Run on Pike Road (photo left) and ATV crossing on Pithole Creek mainstem near mouth at Oleopolis (photo right).

Channel widening has been documented in the reaches historically sampled by the PAFBC. The result of channel widening in the stream channel is a modification in channel units (creation of glides), reduction in water depth and hydraulic cover, reductions of in-stream cover (overhanging vegetation) and loss of large woody debris (log jams and log deflectors). Lateral widening is also contributing sediment as bank full discharge events increase in frequency.

Figure 32. Channel widening in PAFBC sampling section in the middle portion of Pithole Creek. Note lack of instream habitat, overhanging vegetation, hydraulic cover, and woody debris (photo left) compared to in-stream log with downstream scour pools (photo right).

Significantly better habitat exists in the lower reaches of Pithole Creek where the stream channel gradient increases. This is primarily found in that portion of the main channel beginning upstream of the Stone Arch

Bridge on Eagle Rock road and extends to about 3/4 mile above the confluence of Pithole Creek with the Allegheny River. This section contains gradient breaks, boulder fields, chutes, flow deflectors, and large pools that are favored by trout and other fish species.

Figure 33. Quality fish habitat found in higher gradient portions of Pithole Creek. Upper photo shows a boulder field and lower photo an elongated pool below a high gradient riffle.

Summary

Pithole Creek is a relatively healthy stream and remains a popular trout fishery. Trout can be found throughout the mainstem and in many tributaries but were rarely encountered in the upper portion of the watershed. Local fishermen generally note that over the last 30 years the trout fishery has declined in Pithole Creek. The PA Fish and Boat Commission has indicated that it will continue stocking Pithole Creek to meet angler needs.

There is room for improving water quality and in-stream habitat conditions throughout the watershed. Water quality improvements can focus on finding and eliminating brine from reaching Pithole Creek and its tributaries. This has the potential to reduce the concentration of chloride, sodium, and bromide in stream water. Targeting abandoned and inactive wells for plugging and proper brine management could achieve this goal.

Habitat improvement in the upper portion of the watershed will require improving dirt and gravel road management. This has the potential to reduce road generated sediment from reaching the stream and causing the widespread embeddedness encountered in many stream reaches. Reducing the degree of embeddedness in riffles may help restore trout reproduction in those areas where 2019 surveys failed to find native populations.

Habitat in the center section of the mainstem of Pithole Creek above the Stone Arch Bridge often lacks channel structure and habitat diversity. Sections of the channel have failing banks from long term widening and lack large woody debris. Reintroducing large wood into the channel and stabilizing bank and riparian areas would create locations that would support a more diverse and robust fishery.

The lower section of the Pithole Creek mainstem has high quality habitat especially in high gradient reaches that have a diversity of connected channel units including deep pools and abundant riffles prior to reaching the Allegheny River. In the transitional reach at the mouth of Pithole Creek significant erosion and sedimentation is occurring from heavy ATV use in the riparian zone. The formation of ruts that lead directly into the channel and stream crossings (fords) are accelerating sedimentation throughout this section.

Recommendations

Dirt and Gravel Roads

- Conduct an in-depth assessment of dirt and gravel roads within the watershed to identify locations with direct contributions of sediment and other runoff contaminants to local streams. Survey results can be used to secure funding from the PA Dirt and Gravel Roads Program by the Venango County and Forest County Conservation Districts to address problematic locations and thereby reduce sediment contributions from dirt and gravel roads.
- The use of brine water from local conventional producing oil wells should not be utilized by townships in the future for dust control on dirt and gravel roads to eliminate contaminant transfer to local streams.
- Conduct a study to convert existing dirt and gravel roads to paved or sealed low volume roads and identify where conversion would be feasible throughout the watershed.

In-Stream Habitat Improvement

- Conduct a habitat assessment of the middle and upper sections of Pithole Creek where channel widening has been observed and channel units are dominated by glides. Survey results can identify locations where improvement projects could be implemented by local interests that could stabilize failing banks where appropriate, add large woody debris and boulders, and diversify in-channel habitat.

Oil Well Management

- Work with landowners to conduct a survey to identify inactive and abandoned wells throughout the watershed and secure funding to plug wells.
- Promote responsible brine disposal for actively producing wells within the watershed.

Fishery Management

- Conduct a survey of stream culverts within the watershed to identify locations where fish passage is restricted. The culvert survey can be used to secure funding from the PA Dirt and Gravel Roads Program and other conservation funding sources to install oversized culverts that enable fish passage into smaller tributaries and thereby facilitate more coldwater migratory species (i.e., trout) spawning opportunities throughout the watershed.
- Much of the mainstem of Pithole Creek, West Pithole Creek and many tributaries support reproducing trout populations. Some of these locations are also stocked by the Pennsylvanaia Fish and Boat Commission with hatchery produced trout. While the PAFBC is currently not planning to alter stocking policy in the watershed local interests may consider regulatory action that could modify existing policies and management practices.

Watershed Association Development

- Explore local/regional interest in developing a watershed group to advocate for conservation initiatives, surveys, and potential projects in the Pithole Creek watershed.

Appendices

- **PA Streams Stats Report: Pithole Creek**
- **Pennsylvania Fish and Boat Commission 2019 Reinventory Summary for Pithole Creek**
- **Unassessed Waters of the Upper Clarion and Middle Allegheny: Clarion University, 2018**
- **Pennsylvania Fish and Boat Commission Fisheries Reports (1996, 1985, 1981, 1970)**
- **Pennsylvania Department of Environmental Protection Pithole Creek Survey 2018 (Macro-invertebrate Study)**

Pithole Creek Stream Stats Report

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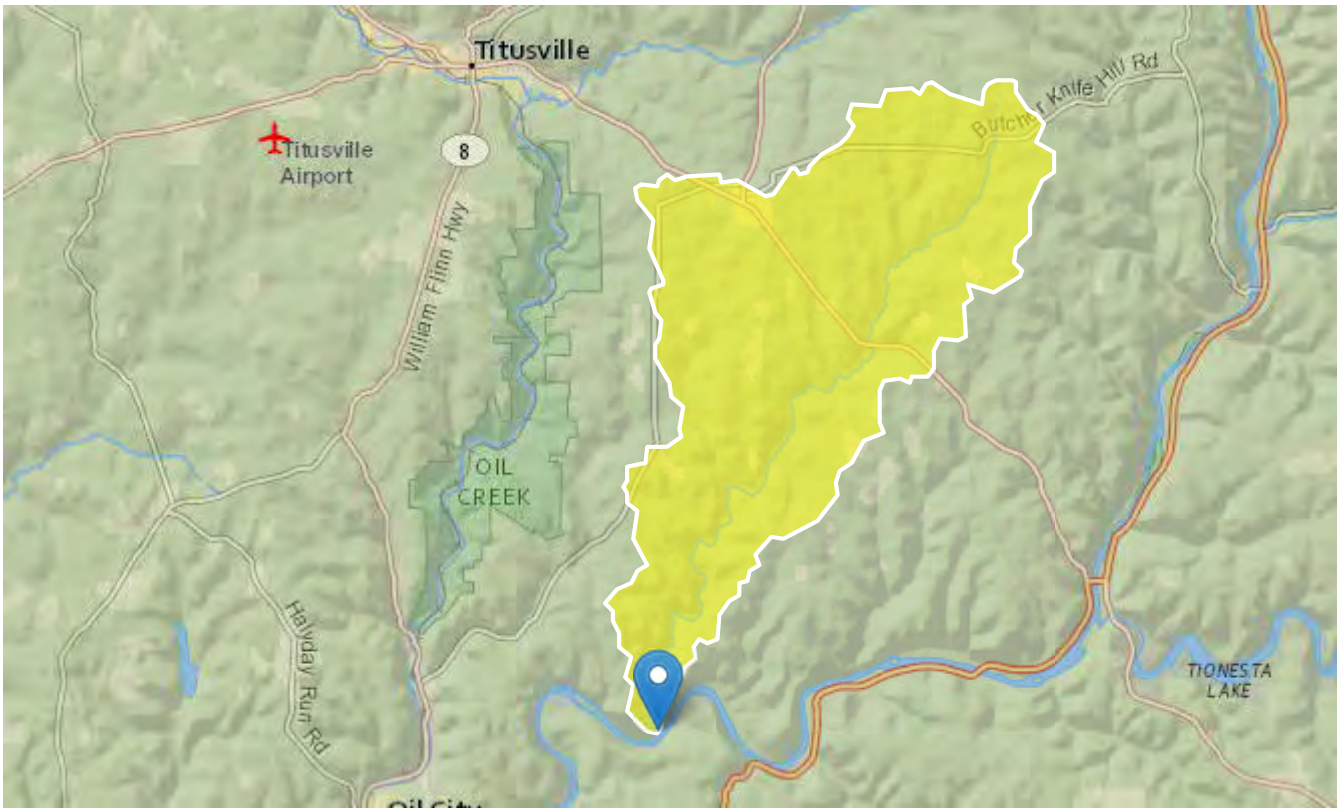
Workspace ID: PA20180419105050514000
Clicked Point (Latitude, Longitude): 41.45645, -79.61028
Time: 2018-04-19 06:51:07 -0400



Basin Characteristics

Parameter Code	Parameter Description	Value	Unit
BSLOPD	Mean basin slope measured in degrees	4.6	degrees
BSLOPDRAW	Unadjusted basin slope, in degrees	4.84	
CARBON	Percentage of area of carbonate rock	0	percent
CENTROXA83	X coordinate of the centroid, in NAD_1983_Albers, meters	-130097.8	
CENTROYA83	Basin centroid horizontal (y) location in NAD 1983 Albers	285114.7	
DRN	Drainage quality index from STATSGO	3.7	
DRNAREA	Area that drains to a point on a stream	41.8	square miles

Parameter Code	Parameter Description	Value	Unit
ELEV	Mean Basin Elevation	1551.3	feet
FOREST	Percentage of area covered by forest	93	percent
GLACIATED	Percentage of basin area that was historically covered by glaciers	0	percent
IMPNLCD01	Percentage of impervious area determined from NLCD 2001 impervious dataset	0	percent
LC01DEV	Percentage of land-use from NLCD 2001 classes 21-24	3	percent
LC11DEV	Percentage of developed (urban) land from NLCD 2011 classes 21-24	2.73	percent
LC11IMP	Average percentage of impervious area determined from NLCD 2011 impervious dataset	0.27	percent
LONG_OUT	Longitude of Basin Outlet	-79.61024	degrees
MAXTEMP	Mean annual maximum air temperature over basin area from PRISM 1971-2000 800-m grid	55	degrees F
OUTLETXA83	X coordinate of the outlet, in NAD_1983_Albers,meters	-134515	
OUTLETYA83	Y coordinate of the outlet, in NAD_1983_Albers, meters	273995	
PRECIP	Mean Annual Precipitation	43	inches
ROCKDEP	Depth to rock	5.3	feet
STORAGE	Percentage of area of storage (lakes ponds reservoirs wetlands)	0	percent
STRDEN	Stream Density -- total length of streams divided by drainage area	1.84	miles per square mile
STRMTOT	total length of all mapped streams (1:24,000-scale) in the basin	77.05	miles
URBAN	Percentage of basin with urban development	3	percent

COMMONWEALTH OF PENNSYLVANIA
Fish and Boat Commission
Division of Fisheries Management
172 Fish Hatchery Lane
Tionesta, PA 16353

DATE: October 2nd, 2020

SUBJECT: 2019 reinventory summary for Pithole Creek (216E) located in Forest and Venango Counties.

TO: Bruce Dickson, Redhorse Environmental

FROM: Brian Ensign, Fisheries Biologist, Fisheries Management Area 2 - Tionesta Office

Introduction

Pithole Creek is a 29.0 km (18.0 mi) medium sized long tributary to the Allegheny River located in Forest and Venango Counties near the town of Tionesta, PA. The stream has a drainage area of 109.04 km^2 (41.3 mi^2) and flows southwest to its confluence with the Allegheny River. The stream is currently subdivided into four sections for management purposes. Pithole Creek contains moderately to low density wild Brown Trout population. The current 25 PA Code Chapter 93 Water Quality Standards designation for Pithole Creek is Cold Water Fishes (CWF). Pithole Creek is included on the PFBC's list of stream sections that support natural reproduction of trout from the headwaters to the mouth. It is also classified as an Approved Trout Water (ATW) and thus Sections 02 & 03 are stocked annually with catchable size Brown and Rainbow Trout during the preseason and inseason stocking periods. Historically, the stream and its entire watershed has suffered from significant impacts since the turn of the century due to oil and gas production. Although these impacts have greatly improved the stream still suffers from lingering effects of water quality conditions and particularly within the past 20 years or so increased degradation of quality wild trout habitat. Recent concerns fueled by the boom in gas extraction resulting new road construction to well pads and brine pumping, discharging and spraying of dirt roads within the Pithole Creek watershed that could potentially have negative impacts on the present wild trout populations.

A re-inventory survey of Pithole Creek was conducted in Sections 01 – 03 to assess the naturally occurring fish populations, to assess the stocked trout population, to assess in-stream habitat and water quality, and to update management plans for the stream. These sections were last surveyed by Fisheries Management Area 2 staff in 1996. An assessment of Section 04 was tentatively scheduled for 2020 but due to the COVID 19 pandemic, along staffing issues and scheduling conflicts the survey was postponed until the summer of 2021. A final report will then be distributed once Section 04 is surveyed, which is expected in the winter of 2021.

Methods

Biologists from the Area 2 Fisheries Management office conducted surveys in Pithole Creek on July 02 and September 11, 2019 in Section 01, on July 03, 2019 in Section 02 and on September 26, 2019 in Section 03. Additionally, three representative sampling stations totaling 2.9 percent of the section length were sampled in Section 01, two representative sampling stations totaling 7.3 percent of the section length was sampled in Section 02 and two representative sampling stations totaling 9.5 percent of the section length was sampled in Section 03.

All procedures were carried out according to those outlined by Detar et al. (2011) and Weber et al. (2011). Physical characteristics, physical-chemical values, and fish communities were examined. The fish communities were sampled using a backpack electrofisher. Wild trout were measured and recorded in 25 mm (l.0 inch) length groups. Statewide average weights calculated for each length group were used to generate biomass estimates. Wild trout densities were determined by using the number of trout captured in a single electrofishing pass. Hatchery trout, identified by excessive fin wear and coloration, were excluded from abundance and biomass estimates. Scientific and common fish names reference the Integrated Taxonomic Information System (http://www.itis.gov).

Results and Discussion

Results of the survey saw an overall decline in wild trout populations, specifically Brown Trout, both in abundance and biomass estimates in Sections 01 & 02. Section 03 continues to provide decent numbers of wild Brown Trout and good fishing opportunities for stocked trout. Significant changes to habitat complexity with degradation of quality wild trout habitat conditions, primarily in Sections 01 & 02 were noteworthy. Staff also documented many of the pool habitat types within these two sections historically had relatively good depths but are now much shallower due to excessive sedimentation, embeddedness and stream bedload from road development in the headwaters. These increases in sedimentation are continually changing the morphology of the stream which is often accelerated by flood events causing the widening of the channel and reducing the overall width/depth ratios. This also can be especially problematic for the natural reproduction of young fish and staging of adult fish. It is of the opinion by Area 2 staff that in order to maintain and rebuild the wild trout population in Sections 01 & 02 of Pithole Creek, that instream habitat is further needed to prevent the decline of the current wild trout population. Although RBP habitat scores generally indicate that habitat is suboptimal, there are limiting factors at each site that reduce the wild Brown Trout population. Specifically, beaver activity in Section 01 has caused a reduction in stream velocities and an increase in siltation throughout downstream historical sites. Cover for trout has also been reduced resulting in thermal increases in water temperatures during the summer as even more concerning are many of riffle habitats in these open canopy areas preferred by young-of-the-year (YOY) trout are being degraded and for the most part disappearing. The addition of instream habitat to constrict flows or the addition of spawning substrate may be of benefit to the wild Brown Trout in these Sections. In Section 02, the wild trout population is described as moderate, with somewhat improved habitat conditions compared to Section 01. Historically this section maintains a Class C wild Trout population but results from our 2019 saw an overall decrease in the wild trout population since the previous surveys. Reasons for this decline can be attributed to lack of holding water for staging of adult size trout and increases in sedimentation resulting in excessive widening of the channel that continues to suppress recruitment and spawning success of wild trout. Section 03 contains a moderately dense Class C wild Brown Trout population, which is also stocked, and continues to provide good fishing opportunities for

catchable trout. Section 03 contains much improved and preferred habitat complexity compared to the upper sections that consists of larger and deeper pools, increased flow due to increased gradient, shallow water riffles for improved spawning and recruitment and most importantly reduced sedimentation, all critical factors for both stocked and wild trout that reside in this section. RFP habitat scores were reflective of these quality habitat conditions and scored in the optimal range between 157 to 162. Water quality has remained consistent over the years with pH's in the mid 7's and alkalinity values slightly improving with each successive survey that's providing adequate buffering compacity for the stream. All other water quality values collected in 2019 were similar to previous surveys with slight to moderate decreases in specific conductance at various sites. A summary of each section and respective site is detailed below.

Section 01

Section 01 begins at the headwaters and continues downstream to the State Route 66 bridge (Table 1). The upper portion is mainly low gradient and shows evidence of impact from beavers (*Castor canadensis*) damming up the stream. Beaver activity immediately up-stream of the survey reach may have negatively influenced seasonal thermal regimes and trout catch at this location. This was further documented when comparing historical stream widths from 2019 data for Section 01 saw increase by an average 1.3 meters. Previous surveys have documented a low-density Class D Brown Trout (*Salmo trutta*) population but in 2019 no wild trout were captured at all three sites surveyed, two of which were conducted at historical locations. Water quality in Section 01 was similar at all sites in 2019 with slightly higher levels of alkalinity and hardness at RM 13.50 (Table 4). In comparison to previous years, Specific Conductance levels were much higher, nearly two-fold, in 1977 at RM's 11.00 and 13.50. The RBP habitat scores were similar in at all sites ranging from 122 -134, in the suboptimal range, and slight improvements in scoring values as you progress further downstream, as evident at RM 11.00 (134) (Table 5).

Sample site RM 15.35 was a newly established site located 100 meters downstream of McCarthy Run Road (Table 2). The 100 meter long station averaged 3.0 meters in width and comprised 1.1 percent of the total section length (Table 1). This site was conducted further upstream into the headwaters in order to verify the presence of wild trout. This portion of the stream flowed through a low gradient meandering meadow that contained very few pools, mostly shallow riffle habitat with some instream large woody debris (LWD). Bank erosion was heavy, and the stream substrate was comprised of sand, silt, gravel and rubble. Water was also tannic, i.e. tea colored. Stream banks were composed of clay and are prone to erosion during peak events. The stream experiences high seasonal flows from excessive runoff/snowmelt. Stream shading is rated as open, composed mostly of grasses, shrub small diameter tree saplings. Habitat for fish consists of shallow riffles and runs with heavily embedded substrate and light amounts of aquatic vegetation. The RBP analysis yielded a final score of 130, placing it in the sub-optimal category (Table 3). Physical-chemical parameters and their associated values measured under normal flow conditions were as follows: air temperature 25.0^{o}C, water temperature 16.9°C, specific conductance 91 umhos, pH 6.8 standard units, and total alkalinity 20 mg/l (Table 4). A total of nine fish species were captured at the site but did not include wild trout. These species included Redside Dace, White Sucker, Blacknose Dace, Mottled Sculpin, Johnny Darter, Creek Chub, River Chub Bluntnose Minnow and Tonguetied Minnow (Table 5.). Species composition included fish common to a coldwater environment to fish common in a warmwater environment.

Sample site RM 13.50 was an historical site located 500 meters downstream of LR 511 Bridge (Table 2). The 75 meter long station averaged 6.3 meters in width and comprised 0.08 percent of the total section length. This portion of the stream flowed through a low gradient meandering meadow with signs of heavy beaver activity. Site had had very little flow, mostly backwater areas that contained deeper pools with muddy bottoms. Bank erosion was heavy, and the stream substrate was comprised of sand, silt, gravel and rubble with heavy sediment deposition and embeddedness. Very little substrate was exposed in the main channel. Stream banks were composed of clay with noticeable AMD seeps and is prone to erosion during peak events. Stream shading is rated as partial and composed of grasses, shrubs and trees. Habitat for fish consists of riffles and runs with moderate to shallow pools containing LWD. The RBP analysis yielded a final score of 122, placing it in the sub-optimal category (Table 3). Physical-chemical parameters and their associated values measured under normal flow conditions were as follows: air temperature 19.0ºC, water temperature 16.3°C, specific conductance 97 umhos, pH 6.8 standard units, and total alkalinity 27 mg/l (Table 4). Nine fish species were captured at the site; but did not include wild trout. Historically, wild Brown Trout were captured in 1977 and 1985 (Table 7). In 1977 a total of five Brown Trout ranging size from 50 to 299 mm for a biomass estimate of 8.20 kg/ha and in 1985 only one Brown Trout at 250 mm at 6.02 kg/ha respectively. Nine species, excluding trout, were captured in 2019 (Table 5) compared to six species in 1985 and five in 1977. Additional new species included Central Stoneroller, Common Shiner, Johnny Darter and Northern Hog Sucker.

Sampling site RM 11.00 was an historical site located 300 meters upstream of SR 36 Bridge (Table 2). The 156 meter long station averaged 7.6 meters in width and comprised 1.7 percent of the total section length. This portion of the stream flowed through low gradient meandering meadow with signs of beaver activity. Bank erosion was heavy, and the stream substrate was comprised of rubble, boulder, gravel and sand. The stream channel was heavily scoured and altered as the result of periodic flood events. Stream shading is rated as open and was composed of grasses, shrubs and tree saplings. Habitat for fish consists of mostly of shallow riffles with very some deeper pools as staging water for trout. The RBP analysis yielded a final score of 134, placing it in the sub-optimal category (Table 3). Physical-chemical parameters and their associated values measured under normal flow conditions were as follows: air temperature 26.0ºC, water temperature 18.4°C, specific conductance 120 umhos, pH 7.6 standard units, and total alkalinity 17 mg/l (Table 4). Thirteen fish species were captured at the site; but did not include wild trout. Wild Brown Trout were last captured back in 1997. A total of seven trout ranging in size from 200 to 324 mm for an estimated biomass of 16.22 kg/ha (Table 6) were captured in 2019. Nine species, excluding trout, were captured in 2019 (Table 5) compared to seven species in 1985 and four in 1977. Additional new species included Common Shiner, Fantail Darter and Tonguetied Minnow. Interestingly, the Tonguetied Minnow is associated with clean rock river bottoms, requires a forested riverbank and needs somewhat cool water temperatures to survive.

Section 02

Section 02 begins at the State Route 66 bridge and continues downstream for 7.33 km to the Lesher Road (T612) bridge (Table 1). This 7.33 km section is primarily forested with a mixture of moderate to low gradient stretches and is currently managed with stocked trout under Commonwealth Inland Regulations with annual preseason and inseason stockings of adult Brown and Rainbow Trout (*Oncorhynchus mykiss*). In Section 02, the wild trout population is described as moderate, with slightly improved habitat conditions than compared to Section 01. Previous

surveys have documented a mixed low-density Class D wild Brook (*Salvelinus fontinalis*) and Brown Trout (*Salmo trutta*) population. In 2019, wild Brown Trout were captured at both historical sites and the estimated biomass of 3.29 kg/ha at RM 9.30 and RM 6.30 at 2.22 kg/ha were the lowest on record when compared to historical surveys (Table 7). Reasons for this decline can be attributed to lack of holding water for staging of adult size trout and increase in sedimentation deposition and embeddedness resulting in decreased pool depths and widening of the channel that continues to suppress recruitment of young of the year (YOY) and spawning/reproductive success of wild trout. Again, the widening of the stream section was further documented as we saw an increase in overall mean width by approximately 1.5 meters. Water quality in Section 02 was similar at both sites in 2019 with the exception of Specific Conductance. Specific Conductance levels were significantly lower than all previous surveys by a nearly three-fold difference in some years. The RBP habitat scores were similar in at all sites ranging from 120 -128, in the suboptimal range (Table 3).

Sample site RM 9.30 was an historical site located 300 meters downstream of SR 1066 (Table 2). The 256 meter long station averaged 12.7 meters in width and comprised 3.5 percent of the total section length. This portion of the stream primarily flowed through a forested reach, which provided partial to open shading. Bank erosion was minimal, and the stream substrate consisted primarily of rubble, gravel, boulder, bedrock, and sand. Stream vegetation was set back from the channel due to high flow disturbance, resulting from the swift flowing water due to the high gradient of the stream. Stream shading is rated as open and composed of grasses, shrubs and tree saplings. Habitat for fish consists of mostly of shallow riffles with very some deeper pools as staging water for trout. The RBP analysis yielded a final score of 128, which place this stream reach in the sub-optimal category (Table 3). Physical-chemical parameters and their associated values measured under normal flow conditions were as follows: air temperature 26.0ºC, water temperature 18.4°C, specific conductance 120 umhos, pH 7.6 standard units, and total alkalinity 17 mg/l (Table 4). Two wild Brown Trout ranging from at 350 to 399 mm in total length (TL) were captured during the survey (Table 8). All trout were greater than or equal to the legal harvestable length (175 mm: 7 in). Total Brown Trout biomass was estimated to be 3.29 kg/ha. Brown Trout abundance was estimated at 8 trout/km (13 trout/mi) being of legal length or longer (Table 5). One hatchery adult Rainbow Trout at 250 mm was also captured. Interestingly, wild Brook Trout were captured only once at this site during the 1996 survey. No Brook Trout were captured in 2019. Thirteen fish species besides trout were captured in 2019 (Table 5) compared to six species in 1977, four in 1985 and 5 in 1996 respectively. Additional new species included Common Shiner, Fantail Darter Johnny Darter, Longnose Dace, River Chub and Tonguetied Minnow.

Sample site RM 6.50 occurred at an historical site located 500 meters upstream of confluence of West Pithole Creek (Table 2). The 280 meter long station averaged 10.6 m in width and comprised 3.8 percent of the total section length. This portion of the stream primarily flowed through a partially forested reach, with mostly open shading. Bank erosion was minimal, and the stream substrate consisted of rubble, boulder, gravel, sand and silt. Stream shading was rated as open and was composed of grasses, shrubs and smaller tree saplings. Habitat for fish consist of mostly of shallow riffles and lacked deeper pools for staging of trout. Site contained heavy amounts of sedimentation deposition and embeddedness. Stream vegetation was set back somewhat from the channel due to high flooding events, resulting from the swift flowing water due to the high gradient of the stream. Also documented were several Acid Mine Discharge (AMD) seeps throughout the

site located on both right and left descending banks. The RBP analysis yielded a final score of 120, which place this stream reach in the sub-optimal category (Table 3). Physical-chemical parameters and their associated values measured under normal flow conditions were as follows: air temperature 26.0ºC, water temperature 18.0°C, specific conductance 138 umhos, pH 7.7 standard units, and total alkalinity 20 mg/l (Table 4). Two wild Brown Trout ranging in size from 250 to 399 mm in total length (TL) were captured during the survey (Table 7). All fish were greater than or equal to the legal harvestable length (175 mm: 7 in). Total Brown Trout biomass was estimated to be 2.22 kg/ha. Brown Trout abundance was estimated at 6 trout/km (8 trout/mi). One hatchery adult Brown Trout at 250 mm was also captured. The estimated biomass of wild Brown Trout in 2019 at 2.22 kg/ha was again the lowest on record compared to previous biomass estimates of 3.25 kg/ha in 1977, 31.00 kg/ha in 1985 and 3.10 kg/ha in 1996. A total of 11 species were captured in 2019 (Table 5) compared to four species in 1977, three in 1985 and five in 1996 respectively. Additional new species included Bluntnose Minnow, Creek Chub, Green Sunfish, Johnny Darter, Longnose Dace, Northern Hog Sucker, Redside Dace, and River Chub.

Section 03

Section 03 of Pithole Creek extends from Lesher Road (T612) bridge to 300 meters downstream of the Stone Arch bridge on State Route 1004 (Table 1). This 5.22 km long section is primarily forested with a moderately to steep gradient in the upper portions, consists of a mixture of habitats, including some slow and deep low gradient pools created by large boulders in the upper portion and then to wide and shallow riffles with rubble, gravel substrates in the lower portion. Section 03 contains a moderate wild Brown Trout population and has some of the best trout habitat conditions, other than Section 04. Drastic differences in trout populations and habitat conditions occur between Section 03 and Sections 01 & 02. The section is also stocked and receives preseason and inseason of Brown and Rainbow Trout (*Oncorhynchus mykiss*). Section 03 receives high angler use during the stocking season and throughout the summer for catching wild trout as most of the section has good access points for anglers to target many of the deeper holes. Water quality at both sites was similar with pH values ranging from 7.3 to 7.4 and alkalinities levels just slightly below 40 mg/l, providing good buffering capacity for throughout the section.

Sampling site RM 5.30 was located 1.5 km downstream of West Pithole Creek (Table 2). The 168 meter long station averaged 13.6 meters in width and comprised 3.2 percent of the total section length (Table 2). This portion of the stream is very popular with anglers who frequent area and contains some of the best habitat for reproduction of wild trout. The site primarily flows through an open forested setting with minimal shading. The stream banks were primarily lined with shrubs, ferns, and grasses. Bank erosion was light to moderate. The water was clear and swift, and the stream substrate was comprised of rubble, gravel, boulder and silt. The stream configuration consisted of long riffles and runs with many deep pools that were difficult to effectively sample. As a result, several Brown Trout were observed but not netted due to the shear depths. Channel widening and scouring was due to high discharge from routine flood events. Fish habitat was provided by water depths in pools and runs and with current breaks created by large boulders. The RBP analysis yielded a final score of 161, which place this stream reach in the optimal category (Table 3). Physical-chemical parameters and their associated values measured under normal flow conditions were as follows: air temperature 18.0ºC, water temperature 17.9°C, specific conductance 211 umhos, pH 7.3 standard units, and total alkalinity 38 mg/l (Table 4). Ten wild Brown Trout ranging from 50 mm to 374 mm in total length (TL) were captured during the survey

(Table 11). Six of the ten Brown Trout (60 percent) were greater than or equal to the legal harvestable length (175 mm: 7 in). Total Brown Trout biomass was estimated to be 5.53 kg/ha. Brown Trout abundance was estimated at 60 trout/km (96 trout/mi) with 30 trout/km (48 trout/mi) being of legal length or longer. One Brown Trout captured (6 trout/km or 10 trout/mi) was greater than or equal to 350 mm, or 14 inches in length (Table 9). Additionally, one hatchery adult Brown Trout at 275 mm was also captured. The estimated biomass of wild Brown Trout in 2019 at 5.53 kg/ha was slightly above the 1977 biomass estimate of 5.45 kg/ha but well below the 1985 biomass estimate of 13.47 kg/ha. Species diversity was low with only six species besides wild trout were captured in 2019 (Table 5). Overall species composition was similar to those of previous surveys.

Sampling site RM 3.34, a newly established site, was located 60 meters upstream of SR 1004 (Stone Arch Bridge) (Table 2). The 329 meter long station averaged 10.7 meters in width and comprised 6.3 percent of the total section length. This portion of the stream primarily flows through an open forested setting with minimal shading. The stream banks were primarily lined with trees, shrubs, ferns, and grasses. Bank erosion was light to moderate. The water was clear and swift, and the stream substrate was comprised of rubble, boulder and gravel. The stream configuration again consisted of long riffles and runs with some deeper pools. Extensive channel widening and scouring in this portion of the stream was due to roads, bridge crossings, and residences (camps) that parallel much of the site. Fish habitat was provided by water depths in pools and runs created by large boulders and large woody debris (LWD). Several undercut banks providing fish cover were also present throughout this site. The RBP analysis yielded a final score of 157, which place this stream reach in the optimal category (Table 3). Physical-chemical parameters and their associated values measured under normal flow conditions were as follows: air temperature 20.0ºC, water temperature 16.7°C, specific conductance 207 umhos, pH 7.4 standard units, and total alkalinity 38 mg/l (Table 4). Twenty-nine wild Brown Trout ranging from 75 mm to 399 mm in total length (TL) were captured during the survey (Table 10). Ten of the 29 Brown Trout (34 percent) were greater than or equal to the legal harvestable length (175 mm: 7 in). Total Brown Trout biomass was estimated to be 7.35 kg/ha. Brown Trout abundance was estimated at 87 trout/km (140 trout/mi) with 30 trout/km (48 trout/mi) being of legal length or longer. Two of the Brown Trout captured (6 trout/km or 10 trout/mi) were greater than or equal to 350 mm, or 14 inches in length. Additionally, three hatchery stocked adult Brown Trout and three Rainbow Trout were captured. Hatchery Brown Trout ranged from 225 mm to 399 mm and Rainbow Trout at 275 mm to 374 mm, respectively. Six fish species were captured in 2019 (Table 5), excluding wild and hatchery stocked trout, included Mottled Sculpin, Northern Hog Sucker, River Chub, Creek Chub and Longnose Dace. Species composition collected are considered transitional in nature and are common to coolwater and warmwater types of environments.

Recommendations

1. Section 01 should continue to be managed as a Class D wild Brown Trout fishery under the Commonwealth Inland Waters regulations with no stocking by the PFBC.

2. Section 01 & 02 of Pithole Creek should be considered a priority water for habitat improvement projects. Water quality in both sections is suitable for year round survival of wild and stocked trout. Factors limiting the expansion of the wild trout population these sections include excessive sedimentation, beaver dams that could potentially impede fish passage, overall lack of large woody debris limiting the amount of holding

water for larger adult trout due to excessive stream widths. Section 02 is currently stocked, continues to provide good fishing opportunities for catchable trout and contains good access points for anglers to target deeper pools

3. Stocking with catchable size trout continues to be the best management program for Sections 02 & 03, which should continue to be managed as an Approved Trout Water under current classification, frequency and allocation.

4. Section 04 should be resurveyed to verify its current stream classification for management purposes and to update biomass estimates regarding the wild trout population. Section 04 is currently not stocked by PFBC due to its remoteness and inaccessibility.

Literature Cited

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Table 1. Sectioning strategy and management for Pithole Creek (Forest and Venango Counties, 16E).

	Upper Limit Description (RM)	Lower Limit Description (RM)	Length (km)	Management Program
Section 01	Headwaters (16.49)	State Route 36 Bridge (10.80)	9.16	Natural Yield
Section 02	State Route 36 Bridge (10.80)	Lesher Road (T612) Bridge (6.25)	7.33	Stocked Trout Water
Section 03	Lesher Road (T612) Bridge (6.25)	300 meters downstream of Stone Arch Bridge on State Route 1004 (3.01)	5.22	Stocked Trout Water
Section 04	300 meters downstream of Stone Arch Bridge on State Route 1004 (3.01)	Mouth (0.00)	17.98	Natural Yield

Table 2. Pithole Creek (216E), Forest and Venango Counties. Sections 01, 02 and 03 site sampling locations, length surveyed, average site width and site area.

Site Date	River-mile	Downstream limit description	Length (m)	Ave. Width (m)	Site Area (ha)
Section 01					
09/11/2020	15.35	100 m downstream of McCarthy Run Road	100	3.0	0.03
09/11/2020	13.50	500 m downstream of LR 511 Bridge	75	6.3	0.05
07/02/2020	11.00	300 m upstream of State Route 36	156	7.6	0.12
Section 02					
07/03/2020	9.30	300 m downstream of State Route 1066	256	12.7	0.32
07/03/2020	6.50	500 m upstream of confluence of West Pithole Creek	280	10.6	0.30
Section 03					
09/26/2020	5.30	1.5 km downstream of West Pithole Creek	168	13.6	0.23
09/26/2020	3.34	60 m upstream of State Route 1004 (Stone Arch Bridge)	329	10.7	0.35

Table 3. Low and High Gradient Rapid Bioassessment Protocol ratings for Pithole Creek (216E), Forest and Venango Counties, conducted within Sections 01, 02 and 03 at RM's 3.34, 5.30, 6.50, 9.30, 11.00, 13.50 and 15.35 in 2019 sample year.

Habitat Parameter Reported	River Mile						
	11.00	**13.50**	**15.35**	**6.50**	**9.30**	**3.34**	**5.30**
	Section 01			Section 02		Section 03	
1. Epifaunal Substrate / Available Cover:	10	5	5	9	7	18	18
2. Embeddedness:	8	15	19	8	8	14	13
3. Velocity / Depth Regime:	11	15	14	14	13	15	16
4. Sediment Deposition:	13	3	5	12	13	13	11
5. Channel Flow Status:	16	14	17	16	16	15	15
6. Channel Alteration:	17	18	14	16	16	18	18
7. Frequency of Riffles (or bends):	8	14	14	7	5	16	16
8. (LB) Left Bank Stability (RB):	8	3	5	6	7	9	9
8. (RB) Right Bank Stability (RB):	7	3	5	6	7	9	9
9. (LB) Left Bank Vegetative Protection:	8	8	8	7	8	8	9
9. (RB) Right Bank Vegetative Protection:	8	8	8	8	8	7	9
10. (LB) Left Bank Riparian Vegetative Width:	10	8	8	7	10	8	9
10. (RB) Right Bank Riparian Vegetative Width:	10	8	8	4	10	7	9
Total Score	**134**	**122**	**130**	**120**	**128**	**161**	**157**

RBP Habitat Ratings with Total Score:
Optimal = 151-200 Suboptimal = 101-150 Marginal = 51-100 Poor = 0-50

Table 4. Chemistries collected in Pithole Creek (216E), Venango County within Sections 01, 02 and 03 at RM's 3.34, 5.30, 6.50, 9.30, 11.00, 13.50 and 15.35 in 2019 sample year.

Parameter	River Mile						
	11.00	**13.50**	**15.35**	**6.50**	**9.30**	**3.34**	**5.30**
	Section 01			Section 02		Section 03	
Sample Date	07/02	09/11	09/11	07/03	07/03	09/26	09/26
Time (24 hour)	1355	945	1105	920	1155	1420	1050
Air Temperature	29.0	19.0	25.0	26.0	26.0	20.0	18.0
pH Field Colorimetric/Electronic	7.6	6.8	6.8	7.7	7.6	7.4	7.3
Specific Conductance	103	97	91	138	120	207	211
Total Alkalinity Field Mixed Indicator	25	27	20	20	17	38	38
Total Hardness Field Mixed Indicator	29	30	25	36	34	52	56
Water Temperature	19.9	16.3	16.9	18.0	18.4	16.7	17.9

Table 5. Fish species occurrence in Pithole Creek (216E) within Sections 01, 02 and 03 at RM's 3.34, 5.30, 6.50, 9.30, 11.00, 13.50 and 15.35 in 2019 sample year.

		River Mile						
		11.00	**13.50**	**15.35**	**6.50**	**9.30**	**3.34**	**5.30**
Common Name	*Scientific Name*	Section 01			Section 02		Section 03	
Blacknose Dace	*Rhinichthys atratulus*	X		X	X	X	X	X
Bluntnose Minnow	*Pimephales notatus*			X	X			
Brown Trout	*Salmo trutta*				X	X		
Central Stoneroller	*Campostoma anomalum*		X					
Common Shiner	*Luxilus cornutus*	X	X			X		
Creek Chub	*Semotilus atromaculatus*	X	X	X	X	X	X	X
Fantail Darter	*Etheostoma flabellare*	X				X		
Green Sunfish	*Lepomis cyanellus*				X			
Hatchery Rainbow Trout	*Oncorhynchus mykiss*					X		
Johnny Darter	*Etheostoma nigrum*	X	X	X	X	X	X	
Longnose dace	*Rhinichthys cataractae*				X	X		X
Mottled Sculpin	*Cottus bairdii*	X	X	X	X	X	X	X
Northern Hog Sucker	*Hypentelium nigricans*		X		X	X	X	X
Rainbow Darter						X		
Redside Dace	*Clinostomus elongatus*	X	X	X	X	X		
River Chub	*Nocomis micropogon*			X	X	X	X	X
Stonecat	*Noturus flavus*						X	
Tonguetied Minnow	*Exoglossum laurae*	X		X		X		
White Sucker	*Catostomus commersonii*	X	X	X	X	X	X	
Species Total		9	8	9	12	14	8	6

Note: No wild trout captured in Section 01.

Table 6. Time series abundance data for Brown Trout from Pithole Creek (216E), Section 01 at RM 11.00 for 1985.

Size Group	Population Estimate	6/26/1985 Kg/Ha	6/26/1985 N/Km
200	1	1.19	8
225	2	3.30	15
250	1	2.23	8
275	2	5.79	15
300	1	3.71	8
Totals:	7	16.22	84

Table 7. Time series abundance data for Brown Trout from Pithole Creek (216E), Section 01 at RM 13.50 for the years of 1977 and 1985.

Size Group	Population Estimate	7/11/1977 Kg/Ha	7/11/1977 N/Km	Population Estimate	6/26/1985 Kg/Ha	6/26/1985 N/Km
50	1	0.02	3			
125	1	0.15	3			
150	1	0.25	3			
175	1	0.38	3			
250				1	6.02	14
275	1	1.38	3			
Totals:	5	8.20	29	1	6.02	14

Table 8. Time series abundance data for wild Brown Trout from Pithole Creek (216E), Section 02 at RM 6.50 for the years of 1977, 1985, 1996 and 2019.

Size Group (mm)	Catch	7/15/1977 Kg/Ha	7/15/1977 N/Km	Catch	6/26/1985 Kg/Ha	6/26/1985 N/Km	Catch	6/26/1996 Kg/Ha	6/26/1996 N/Km	Catch	7/3/2019 Kg/Ha	7/3/2019 N/Km
50				1	0.03	8						
75	1	0.04	6									
100	1	0.11	6				1	0.04	4			
125							4	0.32	16			
200				1	0.99	8						
225	1	0.94	6	6	8.31	50						
250				9	16.81	76	1	0.56	4	1	0.62	4
275				2	4.86	17	1	0.73	4			
300	1	2.16	6									
350							1	1.45	4	1	1.6	4
Totals:	4	3.25	24	19	31.00	159	8	3.10	32	2	2.22	8

Table 9. Time series abundance data for wild Brown Trout from Pithole Creek (216E), Section 02 at RM 9.30 for the years of 1977, 1985, 1996 and 2019.

Size Group (mm)	Catch	7/11/1977 Kg/Ha	7/11/1977 N/Km	Catch	6/26/1985 Kg/Ha	6/26/1985 N/Km	Catch	6/25/1996 Kg/Ha	6/25/1996 N/Km	Catch	7/3/2019 Kg/Ha	7/3/2019 N/Km
125							1	0.13	4			
150							1	0.22	4			
175				1	1.23	14						
200				2	3.55	28						
225				4	9.88	56						
250				7	23.32	97						
275				6	25.99	83						
300	1	4.58	13		10.56	14						
350							1	2.35	4	1	1.48	4
375				1						1	1.81	4
475							1	5.97	4			
Totals:	1	4.58	13	21	74.53	292	4	8.67	16	2		8

Table 10. Time series abundance data for wild Brook Trout from Pithole Creek (216E), Section 02 at RM 9.30 for 1996.

Size Group (mm)	Catch	6/25/1996 Kg/Ha	6/25/1996 N/Km
75	1	0.03	4
100	2	0.14	8
125	4	0.49	16
150	1	0.20	4
Totals:	8	0.86	32

Table 11. Time series abundance data for wild Brown Trout from Pithole Creek (216E), Section 03 at RM 3.34 for 2019 sampling year.

Size Group (mm)	Catch	9/26/2019 Kg/Ha	9/26/2019 N/Km
75	6	0.11	18
100	5	0.20	15
125	2	0.15	6
175	6	0.75	18
200	4	0.76	12
225	1	0.38	3
250	2	1.04	6
275	1	0.67	3
375	1	3.29	6
Totals:	29	7.35	87

Table 12. Time series abundance data for wild Brown Trout from Pithole Creek (216E), Section 03 at RM 5.30 for the years of 1977, 1985 and 2019.

Size Group (mm)	Catch	7/15/1977 Kg/Ha	7/15/1977 N/Km	Catch	6/26/1985 Kg/Ha	6/26/1985 N/Km	Catch	6/26/1996 Kg/Ha	6/26/1996 N/Km
50							1	0.01	6
75							3	0.08	13
150	1	0.08	3	1	0.27	7			
175	6	0.67	16				2	0.59	12
200	1	0.17	3				1	0.42	6
225									
250	7	2.25	19						
275	1	0.41	3	1	1.44	7	1	1.03	6
300				2	3.69	14	1	1.33	6
325				1	2.32	7			
350				2	5.75	14	1	2.07	6
450	1	1.88	3						
Totals:	17	5.46	47	7	13.47	49	10	5.53	60

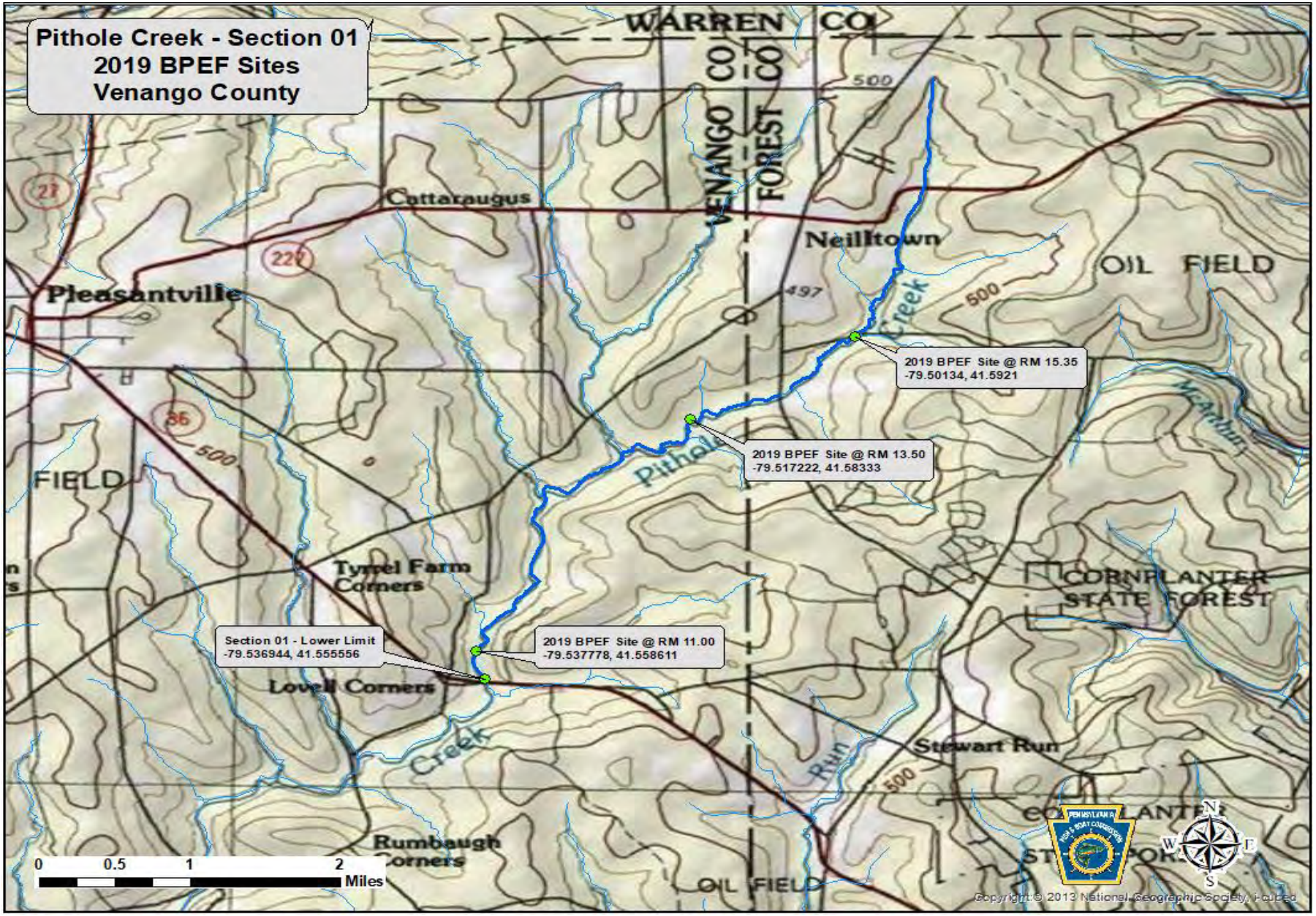


Figure 1. Location map for sample site river mile 11.00, 13.50 and 15.35 in Section 01, on Pithole Creek (16E), Venango County, USGS Topographic 7.5 Minute Quadrangle – Pleasantville, PA.

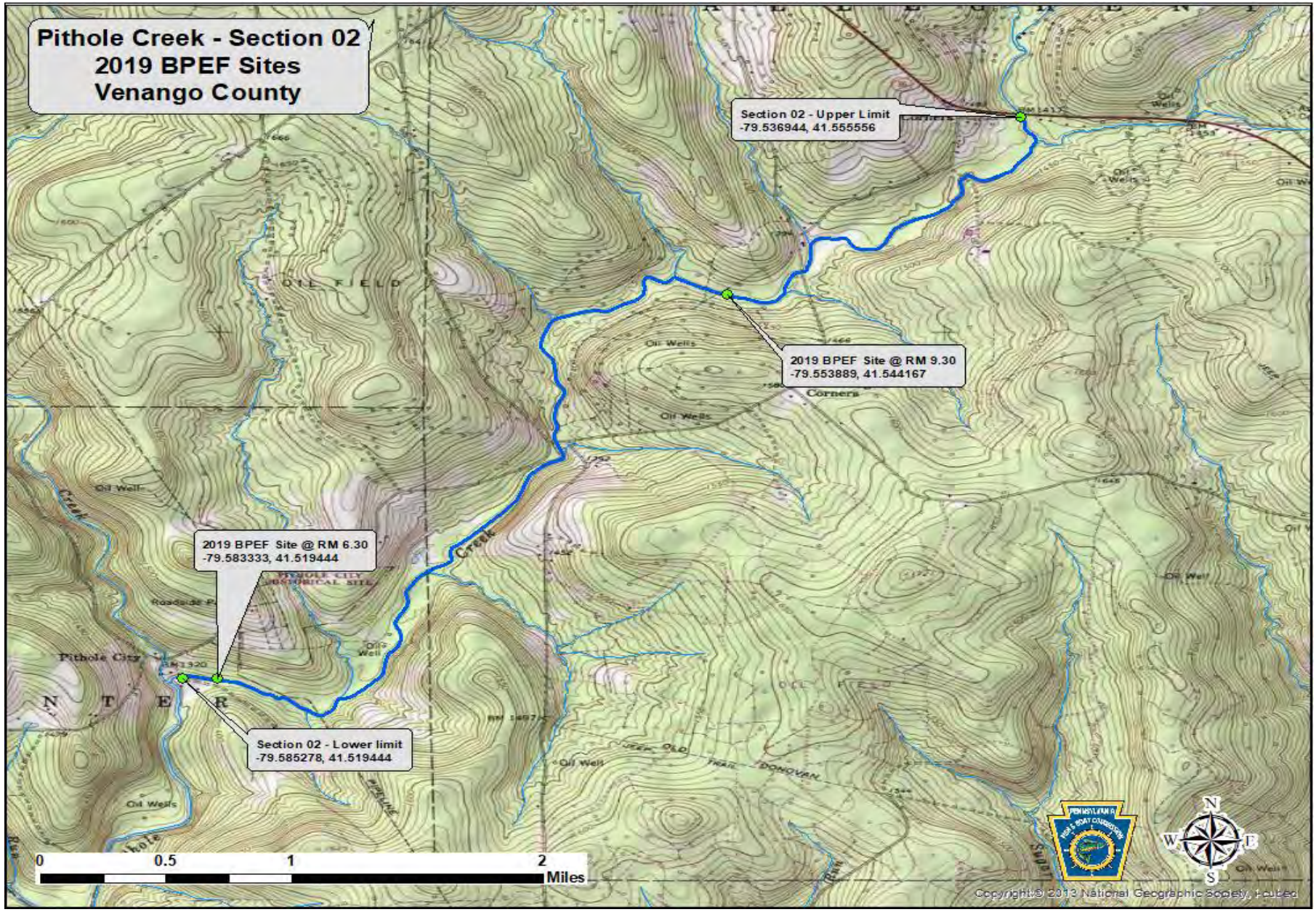


Figure 2. Location map for sample site river mile 6.30 and 9.30 in Section 02, on Pithole Creek (16E), Venango County, USGS Topographic 7.5 Minute Quadrangle – Pleasantville, PA.

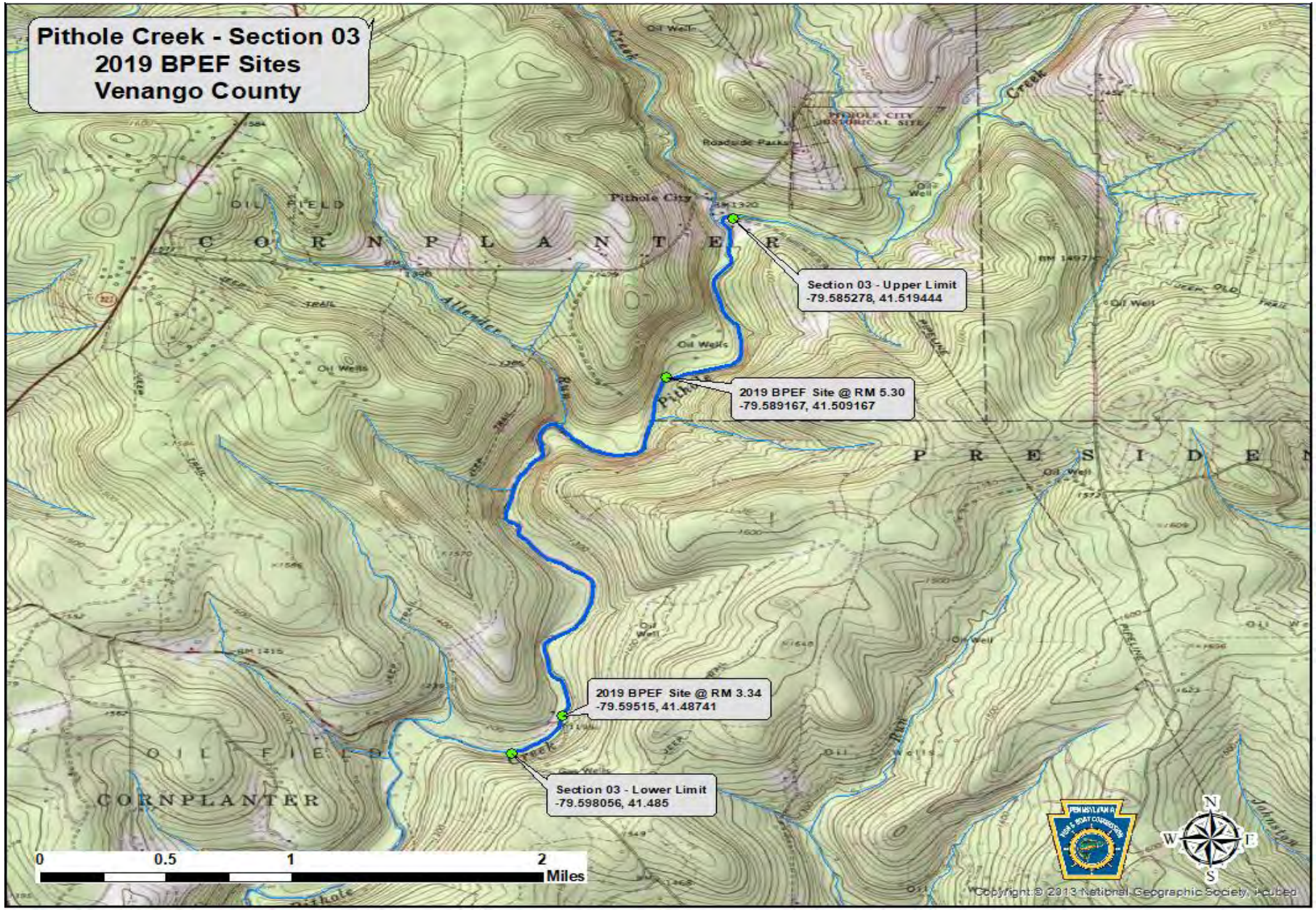


Figure 3. Location map for sample site river mile 3.34 and 5.30 in Section 03, on Pithole Creek (16E), Venango County, USGS Topographic 7.5 Minute.

Unassessed Waters of the Upper Clarion and Middle Allegheny: Clarion University, 2018

Andrew Turner

Overview

Our assigned streams were located in a number of different Northwestern Pennsylvania watersheds, including the East Branch and West Branch of the Clarion River, Millstone Creek, Hemlock Creek, and Pithole Creek. From this list we sampled 41 sites on 39 different streams. All sampling was completed in August or early September and followed standard methods. As of Sept. 13, data for all 41 streams has been entered into the reporting system and copies of our data sheets have been mailed to Robert Weber. Photos with location information and time tags were taken at each site and are posted here: https://photos.app.goo.gl/hdUxvsMdxRMEFdft6 All photos are labeled with stream name.

Of the 41 sites sampled, one was dry, and 40 were electrofished. Of that 40, 24 yielded at least one wild trout. Not all of these 24 will qualify for wild trout status...a couple yielded just one fish.

In terms of broader impacts, the sampling work provided an opportunity for seven different undergraduates and recent graduates to earn professional experience. The data are providing a foundation for two separate research projects. I recently gave a talk for our local TU chapter and solicited input from them. We also work closely with other stakeholders including our local conservation districts.

Below I provide a brief synopsis of the results from each stream. Streams highlighted in green are those that yielded at least one wild trout.

1) UNT West Branch Millstone, RM 1.05 (8/3/18) Most of this stream, including our sample site, is on Forest Service property. This is an acidic stream, with a pH of 5.2. We sampled near the mouth, and caught a just a single fish in the entire transect – a mottled sculpin at the very beginning. Habitat features are excellent, but poor water quality has presumable excluded fish from this stream. The watershed is entirely forested, but is underlain by the Pottsville Sandstone. Streams draining this geological strata are poorly buffered and vulnerable to acid rain.

2) **UNT to West Branch Millstone Creek (RM 4.27)** (8/3/18) Seneca Resources property. Another small trib to West Branch of Millstone Creek. Forested watershed. This is a small stream, but we captured five Brook Trout in a 100m transect. Included were four YOY and one older fish. Dace, sculpin, and chubs were also present. Although the stream is poorly buffered, water quality is good enough for brook trout and other fish to reproduce.

3) **Oil Creek** (8/4/18) This tributary to the West Branch of the Clarion River, north of Johnsonburg, was sampled above the mobile home park on Rt. 219, about 400m from the mouth of the stream. It is bordered by deep hemlock forest and the substrate is very clean. In a 100m transect we captured 13 Brook Trout (photo at right) from several age classes and four brown trout. Eight additional species were present. This is a very high quality stream.

4) **Meffert Creek** (8/4/18) This is another West Branch trib north of Johnsonburg, but is smaller than Oil Creek. We sampled below Rt. 219 and captured three Brown Trout, from multiple size classes, and one YOY Brook Trout. There were seven additional species of fish present. The water was relatively warm and temperature may limit trout use of this stream.

5) **Long Branch Crooked Creek** (8/4/18) Located east of Johnsonburg on State Game Lands 25. This stream requires a mile long hike through the game lands, and thus is not easily accessible. We captured 15 YOY Brook Trout in our transect, along with seven additional species of fish. We noted that a recent logging project had removed trees right up to the edge of the stream (photos available) and that there was fine silt present in the stream. We recommend that the game commission maintain forested riparian buffers along wild trout streams.

6) **UNT East Branch Clarion River (RM 2.75)** (8/4/18) Located near Bendigo State Park, this small stream has wild populations of Brook and Brown Trout. We captured 19 Brook Trout, of several age classes, and four YOY Browns in a 100m transect. Excellent substrate and many undercut banks, great habitat. These small tribs are important reproductive habitat and essential in maintaining the wild trout of the East Branch.

7) **Scott Run** (8/5/18) A tributary to West Branch Millstone Creek, located south of Marienville. We had sampled this stream in summer 2012 and failed to find wild trout, but flows were high and it was recommended that we resample the stream. As before, we found that fish are abundant in this stream, with eight species present, but trout are absent. It is a mystery why trout are not present...flows are strong, even in dry periods, and water quality is good, though we noted that conductivity is elevated over other streams in the region. The Marienville Prison is located in the headwaters of this watershed.

8) **McCray Run** (8/5/18) A tributary to West Branch of Millstone, located southeast of Marienville and east of Scott Run. This stream has an extensive network of beaver ponds at the mouth, but we hiked above the ponds and sampled flowing water with a forested riparian zone. We captured 113 Creek Chubs and a single Pumpkinseed, but no trout. The water was cold, but flows were low. The beaver ponds may block trout movements in and out of this stream.

9) **UNT to Sandy Creek (RM 14.56)** (8/5/18) Located State Game Lands 130. Dry, despite recent rainfall.

10) **UNT Sandy Creek (RM 8.58)** (8/6/18) Sample site located behind a private residence on SR 965, about 400m from mouth. This is a very high quality stream with good water quality, cold water, and a good trout population. We caputured 11 YOY Brook Trout (photo at left) in a 100m transect. The property owner was initially very reluctant to allow us to sample, but as we discussed the issues he eventually warmed up to the idea and granted us permission.

11) **UNT to Sandy Creek (RM 9.12)** (8/6/18) Sample site located immediately upstream of railroad culvert. Despite this being a small stream, we captured 18 Brook Trout in a 100m transect, including one 260mm individual. The large trout did not show any signs of having been a hatchery fish. Good habitat, undeveloped watershed.

12) **Sulphur Run** (8/6/18) Sample site located above cabins, about 600 meters from mouth. As the stream name suggests, this stream is degraded by acidic minerals. pH = 5.7 and conductivity = 590 µs/cm. The substrate was stained orange from iron hydroxide deposition. We captured just a single fish, a large Brook Trout, in the entire transect. This trout did not appear to be stocked, but the lack of YOY fish obviously leads us to believe that no reproduction is occurring in this stream. Acidic streams like this one often provide good habitat for adults, but inhibit reproduction.

13) **UNT to Sulphur Run** (8/6/18) Because we found a Brook Trout in Sulphur Run, apparently wild, but no YOY fish, we sampled one additional site in a nearby tributary in an effort to locate the source population. Sulphur Run has a fork near its mouth, and we sampled the unnamed trib that forms this fork. Unfortunately, the effort was not fruitful....we found dace and sculpin, but no trout. The trib did have good water quality, but may have been too warm for trout.

14) **Winlack Run** (8/7/18) Tributary to Millstone Creek. Like other small streams in the immediate area, acidic due to acid rain and poor buffering, pH = 4.8. Also has a perched culvert where Millstone Road crosses the stream. This stream was sampled in summer 2017 and a single trout was captured below the culvert. We sampled above the culvert and found no fish present.

15) **Sugarcamp Run – downstream location** (8/7/18) Another Millstone tributary with poorly buffered and acidic water. This site was surveyed in 2011 and a single trout was found. We found eleven species fish, some in great abundance, but no trout were present. Our site included 50 below the bridge and 50m above.

16) **Sugarcamp Run – upstream location** (8/7/18) We were told by an angler that trout lived in Sugarcamp Run upstream from our first sample site. So, following up on the tip, we conducted a second survey about 1 km upstream of the first site. This site also failed to yield any trout.

17) **Log Run** (8/7/18) Yet another poorly buffered, acidic tributary to the East Branch of Millstone Creek. It was surveyed in 2012 and a single trout was found. We did not find any trout in our 100m transect. Blacknose Dace and Creek Chub were abundant.

18) **West Branch Clarion River** (8/9/18) We were assigned to sample Section 1, which is the section above SR 219, near Lantz Corners. This was the most exciting stream we sampled in 2018. The catch included 11 Brown Trout, with the largest being 440mm. Eight of the Brown Trout were YOY fish, and the larger individuals did not show any signs of having been stocked. We also captured a single YOY Brook Trout, along with dace, sculpin, and suckers. We also captured a 280mm Rainbow Trout, but it was clearly a stocked fish. Most of the trout came from two deep pools, but most of the reach sampled lacked pool development.

19) **Little Sicily Run** (8/9/18) This was one of the highest quality streams sampled in 2018. Clean, coarse substrate, cold water, and a high density of Brook Trout. We captured 20 Brook Trout in 100m, with sizes ranging from YOY to 220mm (Photo below).

20) **Sicily Run** (8/9/18) This is a larger, warmer stream, and it contained both wild Brook Trout (four individuals captured) and wild Brown Trout (10 individuals captured, photo below). All size classes present for both species. Six additional species of fish present. There was some silt in the stream, and we noted that a pipeline is being constructed near the stream.

21) **UNT to Hoffman Run RM 0.53** (8/9/18) The coordinates for this site are for an UNT to Hoffman Run, RM 0.53, but were mistakenly labeled on our list as UNT to Wilson Run. This small stream is on the Allegheny National Forest. We captured 43 Brook Trout in a 100m transect! 31 of those were YOY fish, so this little stream is clearly an important habitat for reproduction.

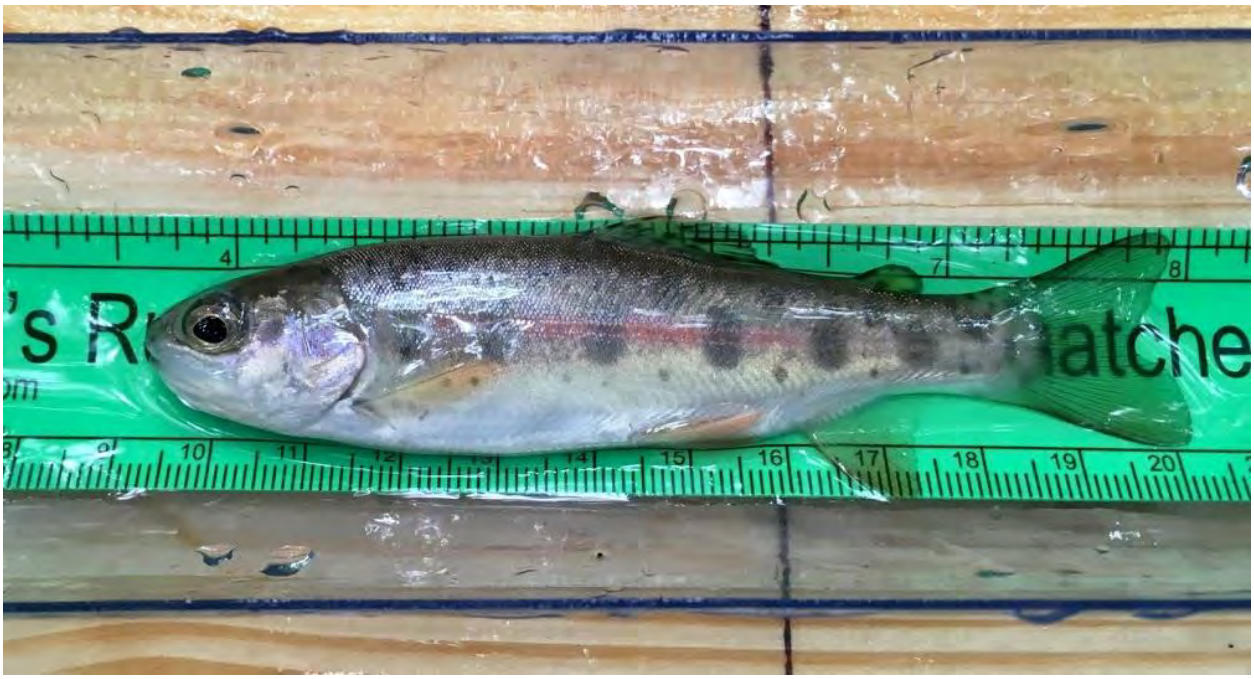
22) **Castle Brook** (8/9/18) There is a beaver marsh at the lower end of this stream, and access difficulties above Rt. 321, so our transect consisted of 60m below Rt. 321 and 40m above Rt. 321. The culvert offers free passage to fish. We captured eight wild Brook Trout and 22 Wild Brown Trout, with all size classes present.

23) **UNT to West Branch Millstone, RM 9.62** (8/11/18) Low alkalinity and warm water. No trout present.

24) **UNT to Clarion River RM 69.51** (8/11/18) A high gradient tributary to the Clarion near Callen Run and Clear Creek. Twenty four wild Brook Trout captured. A beautiful, high quality stream.

25) **Trib 54809 to Porcupine Creek** (8/19/18) A very small stream with a 15' waterfall at its mouth where it enters Porcupine Creek. There are good pools present. We found a single YOY largemouth bass in the stream, obviously washed downstream from a farm pond.

26) **Trib 54807 to Porcupine Creek** (8/19/18) This is a small trib near the mouth of Porcupine Run. Despite its small size, it stunned us as we captured all three species trout, all with YOY present and multiple size classes (13 Brook Trout, 4 Rainbow Trout, and 4 Brown Trout, rainbow photo below). Three coexisting species of wild trout is a rare thing in Pennsylvania.



27) **Trib 54819 to Hemlock Creek** (8/19/18) Lower portion of Hemlock Creek watershed. Small stream with little flow, but it yielded three Brook Trout (YOY) and seven Brown Trout. On our hike in we noted that large areas of the lower Hemlock Creek riparian zone have been damaged by extensive ATV traffic.

28) **Trib 54770 to Pithole Creek** (8/20/18) A small brook with little flow and amazingly cold water – 11.2 C on a hot summer day. Good population of chubs and dace, but no trout, despite the presence of well developed pools.

29) **Trib 54771 to Pithole Creek** (8/20/18) – This is a productive little stream with YOY Brown Trout. It also held high numbers of dace, chub, and sculpin.

30) **Trib 54774 to Pithole Creek** (8/20/18) – A larger stream with cold water and many dace, chub, and sculpin. Surprisingly, no trout were present. Water quality is good, and the absence of trout is surprising.

31) **Trib 54138 to Cherry Run** (8/22/18) – A trib to Cherry Run in the town of Plumer. We captured a half-dozen YOY Brown Trout in this stream, and water quality is good.

32) **Trib 54765 to Pithole Creek Lower Site** (8/22/18) This site is located on the Pithole City historical site. We sampled at the site of historic "1st avenue". Despite good water quality and high densities of chub and dace, we captured just a single YOY Brown Trout.

33) **Trib 54765 to Pithole Creek Upper Site** (8/22/18) Because of the single YOY trout captured at the lower site, we elected to hike upstream one KM in an effort to sample additional trout. Unfortunately, the upstream site did not yield any trout.

34) **Trib 54749 to Pithole Creek** (8/23/18) Sampled above large culvert, which is impassable. No fish found. A visual inspection below the culvert also failed to detect fish. This is a small, high gradient stream with little flow and it may dry up in drought periods.

35) **Trib 54776 to Pithole Creek** (8/23/18) Located near Rt. 36, this is a small but productive stream. It yielded four YOY Brown Trout and high densities of dace, chub, and sculpin.

36) **Neilltown Run** (8/23/18) This tributary to Woodcock Run has a large wetland in the lower reaches, probably an abandoned beaver meadow. We sampled where the stream cuts through this meadow, and found an abundance of fish, but no trout. Water temp was 20 C., and probably limits trout use of this stream.

37) **Sugar Run –** (8/24/18) This is a tributary to Stewart Run and is located on the "Crawford Reserve", a large tract of land now owned by Chagrin Timber, but with conservation easements in place that allow public access. Sugar Run had the highest abundance of trout of any stream sampled for this survey, and may be a candidate for Class A status. We captured 44 Brook Trout and 3 Brown Trout (photo below) in a 100m transect. At least ten of the Brook Trout were 1+ or larger fish, so the biomass was large. Although open to the public, this stream is a long hike from the nearest road, and so might be considered for wilderness trout stream status.

38) **Pine Run** (8/24/18) – This stream is also on the Crawford Reserve. It yielded six Brook Trout and nine Brown Trout. We also found a Seal Salamander at this site, *Desmognathus monticola,* which represents a northern extension of its known range.

39) **Trib 54797 to Muskrat Run** (8/24/18) – This small tributary to Muskrat Run is located in the midst of an active oil field, but it yielded 30 Brook Trout in a 100m transect. A very high quality stream.

40) **UNT Redbank Creek RM 46.52** (8/30/18) – This stream was initially assigned to Jon Niles, Susquehanna University. Jon requested permission from the landowner for access, and the permission was granted only after Jon had left the area. So we picked up the stream and added to our list. Unfortunately, there were few fish in this stream and no trout. It has elevated conductivity (420 us/cm) and appears to be suffering from some sort of water pollution.

41) **Auge Run** (9/7/18) This stream is located in the headwaters of the Hemlock Creek watershed. It yielded 12 Brook Trout of multiple size classes.

PA FISH AND BOAT COMMISSION
COMMENTS AND RECOMMENDATIONS
February 11, 1999

WATER: Pithole Creek (216E) Venango County

EXAMINED: June 26, 1996

BY: Allen Woomer and Ron Lee

Bureau Director Action: Approved. Delano P. Hall Date: 2-17-99

Division Chief Action: Richard A. Snyder Date: 2-17-99

WW Unit Leader Action: _____ Date: _____

CW Unit Leader Action: R. Thomas Greene Date: 2/16/99

AREA COMMENTS:

Pithole Creek, Sections 02 and 03, were surveyed to assess the current management classification and strategy and to monitor the wild trout population. Average biomass estimated for all wild brook and brown trout combined in Section 02 was 6.61 kg/ha which matches the current biomass DGR3 classification. Biomass of wild brown trout in Section 03 was estimated 19.83 kg/ha which matches the current biomass classification CGR2.

AREA RECOMMENDATIONS:

1. The current management classification and strategy in Section 02 is appropriate and no changes are necessary.

2. The current management classification and strategy in Section 03 is appropriate and no changes are necessary.

CWU COMMENTS:

Pithole Creek (216E), Sections 02 and 03, were examined during June 1996 as part of a routine reinventory of catchable trout stocked waters in Fisheries Management Area 2.

Section 02

This segment can be characterized as a moderate size, coldwater stream. The 1996 examination (conducted at two sites) recorded the presence of eight fish species, including a modest wild brook and brown trout fishery estimated in excess of 6 kg/ha.

Section 03

Section 03 can be characterized as a moderate size, coldwater stream. The 1996 inventory recorded the presence of seven fish species, including a biomass Class C wild brown trout fishery estimated in excess of 19 kg/ha.

This work made possible by funding from the Sport Fish Restoration Act Project F-57-R Fisheries Management.

PENNSYLVANIA FISH AND BOAT COMMISSION
BUREAU OF FISHERIES
DIVISION OF FISHERIES MANAGEMENT

Pithole Creek (216E)
Sections 02 & 03

Prepared by
Allen Woomer and Ron Lee

Date Sampled: June 25 & 26, 1996 Date Prepared: March 1998

Abstract

Pithole Creek (216E) is a medium size stream located in Venango County and managed as an Approved Trout Water (ATW). It also holds a fair population of wild brown trout. Pithole Creek is divided into four management sections with Sections 02 and 03 catchable trout stocked waters with classifications of DGR3 and CGR2, respectively. Only these two sections were surveyed in 1996. Sections 01 and 04 are managed for wild trout under the Natural Yield option. Sections 02 and 03 of Pithole Creek have been previously surveyed by Lee (1985), Lee (1977). Water chemistry results from 1996 (Table 1) were indicative of optimal conditions for trout. Previous surveys measured unusually high specific conductance values which were not evident in the 1996 survey and may suggest a reduction in brine water discharges from oil and gas extraction activities within the watershed. Two stations were sampled in Section 02 (Fig 1). Station 0201 was located at River Mile (RM) 9.30 and was 248 m in length. Seven fish species were sampled (Table 2). A low density sympatric population of wild brook and brown trout was sampled. Brook trout ranged in size from 75 to 174 mm with a biomass of 0.82 kg/ha estimated based on only the trout handled in a single electrofishing run (Table 3). Brown trout ranged in size from 125 to 499 mm and a biomass 9.31 kg/ha was estimated (Table 4). A total of twelve stocked brown trout were sampled ranging in size from 225 to 299 mm indicating good holdover of stocked trout into the summer on this stream. Station 0202 (RM 6.50) was 247 m in length and had six fish species sampled. Brown trout ranged in size from 100 to 374 mm and biomass was estimated at 3.09 kg/ha (Table 5). Two stocked brown trout in the 225 mm size group were also sampled but no brook trout were collected. Section 02 continues to maintain a low density wild trout population with an average biomass of 6.61 kg/ha which indicates it is correctly classified D biomass. Current classification and strategy are appropriate on Section 02 and no changes in allocation or frequency are necessary. A single station was sampled in Section 03 at RM 3.40 (Fig. 2). Previous surveys also sampled at a site located at RM 5.30 but we were unable to repeat this in 1996. Seven fish species were sampled in the 308 m site. Brown trout ranged in size from 25 to 449 mm and biomass was estimated at 19.83 kg/ha (Table 6). Table 7 shows the biomass estimates for the last three surveys at this site and that 1996 was

CWU RECOMMENDATIONS:

1. Pithole Creek (216E), Section 02, should continue to be managed with the planting of PFBC catchable trout. Stocking rate and frequency should be determined by classification according to program guidelines.

2. Pithole Creek (216E), Section 03, should continue to be managed with the planting of PFBC catchable trout as an Optimum Yield II - Rural Destination Water.

This work made possible by funding from the Sport Fish Restoration Act Project F-57-R Fisheries Management.

PENNSYLVANIA FISH AND BOAT COMMISSION
BUREAU OF FISHERIES
DIVISION OF FISHERIES MANAGEMENT

Pithole Creek (216E)
Sections 02 & 03

Prepared by
Allen Woomer and Ron Lee

Date Sampled: June 25 & 26, 1996 Date Prepared: March 1998

Abstract

Pithole Creek (216E) is a medium size stream located in Venango County and managed as an Approved Trout Water (ATW). It also holds a fair population of wild brown trout. Pithole Creek is divided into four management sections with Sections 02 and 03 catchable trout stocked waters with classifications of DGR3 and CGR2, respectively. Only these two sections were surveyed in 1996. Sections 01 and 04 are managed for wild trout under the Natural Yield option. Sections 02 and 03 of Pithole Creek have been previously surveyed by Lee (1985), Lee (1977). Water chemistry results from 1996 (Table 1) were indicative of optimal conditions for trout. Previous surveys measured unusually high specific conductance values which were not evident in the 1996 survey and may suggest a reduction in brine water discharges from oil and gas extraction activities within the watershed. Two stations were sampled in Section 02 (Fig 1). Station 0201 was located at River Mile (RM) 9.30 and was 248 m in length. Seven fish species were sampled (Table 2). A low density sympatric population of wild brook and brown trout was sampled. Brook trout ranged in size from 75 to 174 mm with a biomass of 0.82 kg/ha estimated based on only the trout handled in a single electrofishing run (Table 3). Brown trout ranged in size from 125 to 499 mm and a biomass 9.31 kg/ha was estimated (Table 4). A total of twelve stocked brown trout were sampled ranging in size from 225 to 299 mm indicating good holdover of stocked trout into the summer on this stream. Station 0202 (RM 6.50) was 247 m in length and had six fish species sampled. Brown trout ranged in size from 100 to 374 mm and biomass was estimated at 3.09 kg/ha (Table 5). Two stocked brown trout in the 225 mm size group were also sampled but no brook trout were collected. Section 02 continues to maintain a low density wild trout population with an average biomass of 6.61 kg/ha which indicates it is correctly classified D biomass. Current classification and strategy are appropriate on Section 02 and no changes in allocation or frequency are necessary. A single station was sampled in Section 03 at RM 3.40 (Fig. 2). Previous surveys also sampled at a site located at RM 5.30 but we were unable to repeat this in 1996. Seven fish species were sampled in the 308 m site. Brown trout ranged in size from 25 to 449 mm and biomass was estimated at 19.83 kg/ha (Table 6). Table 7 shows the biomass estimates for the last three surveys at this site and that 1996 was

down somewhat compared to previous years. Section 03 is currently classified CGR2 and the 1996 estimate falls within this range. The current management classification and strategy is appropriate on Section 03 and no changes in allocation are needed. Pithole Creek is classified Cold Water Fishery (CWF) in PA DEP Chapter 93 Water Quality Standards.

Literature Cited

Lee, R.D. 1985. Pithole Creek (216E) Management Report. PFBC Files, Robinson Lane, Bellefonte, PA.

Lee, R.D. 1977. Pithole Creek (216E) Stream Examination Report. PFBC Files, Robinson Lane, Bellefonte, PA.

Table 1. Water quality results from Pithole Creek (216E) collected on June 25 & 26 1996.

Parameter	02		03
River Mile	9.30	6.50	3.40
Date	06/25	06/25	06/26
Air Temperature (°C)	20	22	23
Water Temperature (°C)	14.0	13.9	14.8
pH (SU)	7.1	7.0	7.0
Specific Conductance (μmhos)	148		131
Total Alkalinity (mg/l)	18	12	12
Total Hardness (mg/l)	27	40	34

Table 2. Fish species occurrence in Pithole Creek (216E) on June 25 & 26, 1996.

Common Name	River Mile / Scientific Name	9.30 02	6.50 02	3.40 03
Brown trout	Salmo trutta	x	x	x
Brook trout	Salvelinus fontinalis	x		x
Redside dace	Clinostomus elongatus	x		
Blacknose dace	Rhinichthys atratulus	x	x	x
Longnose dace	Rhinichthys cataractae			x
Creek chub	Semotilus atromaculatus	x	x	x
White sucker	Catostomus commersoni	x	x	x
Bluegill	Lepomis macrochirus		x	
Mottled sculpin	Cottus bairdi	x	x	x
Species Total		7	6	7

Table 3. Abundance index and biomass of brook trout in Pithole Creek (216E) RM 9.30 on June 25, 1996.

LENGTH GROUP (mm)	POP. EST.	LOW CI	HIGH CI	#/HA	KG/HA	#/KM
75	1	NA	NA	5	0.03	4
100	2	NA	NA	10	0.13	8
125	4	NA	NA	20	0.46	16
150	1	NA	NA	5	0.20	4
TOTALS	8			40	0.82	32

Table 4. Abundance index and biomass of brown trout in Pithole Creek (216E) RM 9.30 on June 25, 1996.

LENGTH GROUP (mm)	POP. EST.	LOW CI	HIGH CI	#/HA	KG/HA	#/KM
125	1	NA	NA	5	0.13	4
150	1	NA	NA	5	0.21	4
350	1	NA	NA	5	2.40	4
475	1	NA	NA	5	6.57	4
TOTALS	4			20	9.31	16

Table 5. Abundance index and biomass of brown trout in Pithole Creek (216E) at RM 6.50 on June 25, 1996.

LENGTH GROUP (mm)	POP. EST.	LOW CI	HIGH CI	#/HA	KG/HA	#/KM
100	1	NA	NA	3	0.05	4
125	4	NA	NA	12	0.32	16
250	1	NA	NA	3	0.55	4
275	1	NA	NA	3	0.71	4
350	1	NA	NA	3	1.46	4
TOTALS	8			24	3.09	32

Table 6 . Estimated abundance and biomass of brown trout in Pithole Creek (216E) RM 3.40 on June 26, 1996.

LENGTH GROUP (mm)	POP. EST.	LOW CI	HIGH CI	#/HA	KG/HA	#/KM
25	1	NA	NA	3	<0.01	3
50	2	NA	NA	6	0.02	6
100	2	NA	NA	6	0.08	6
125	43	22	95	121	3.38	141
150	6	NA	NA	17	0.67	19
200	6	NA	NA	17	1.90	19
225	2	NA	NA	6	0.74	6
250	1	NA	NA	3	0.50	3
275	1	NA	NA	3	0.55	3
300	1	NA	NA	3	0.87	3
350	2	NA	NA	6	2.49	6
375	4	NA	NA	11	6.12	13
425	1	NA	NA	3	2.51	3
TOTALS	72			205	19.83	235

Table 7. Pithole Creek (216E) estimated abundance and biomass of brown trout from 1977, 1985, 1996 for RM 3.40.

Length Grp(mm)	07/15/1977 (N/ha)	(kg/ha)	06/26/1985 (N/ha)	(kg/ha)	06/26/1996 (N/ha)	(kg/ha)
25	....	.....	....	.....	3	
50	28	0.11	33	0.10	6	0.02
75	14	0.07	....	.....	....	.....
100	....	.....	....	.....	6	0.08
125	14	0.32	5	0.19	121	3.38
150	80	3.52	5	0.24	17	0.67
175	70	4.05	10	0.60	....	.....
200	17	1.48	8	0.87	17	1.90
225	19	2.90	26	3.01	6	0.74
250	11	1.96	29	5.86	3	0.50
275	6	1.14	21	3.94	3	0.55
300	6	1.68	18	5.22	3	0.87
325	3	1.10	8	2.55	....	.....
350	8	3.16	8	3.74	6	2.49
375	....	.....	10	5.54	11	6.12
425	3	1.58	3	1.82	3	2.51
550	....	.....	3	5.10	....	.....
TOTALS	279	23.07	187	38.78	205	19.83

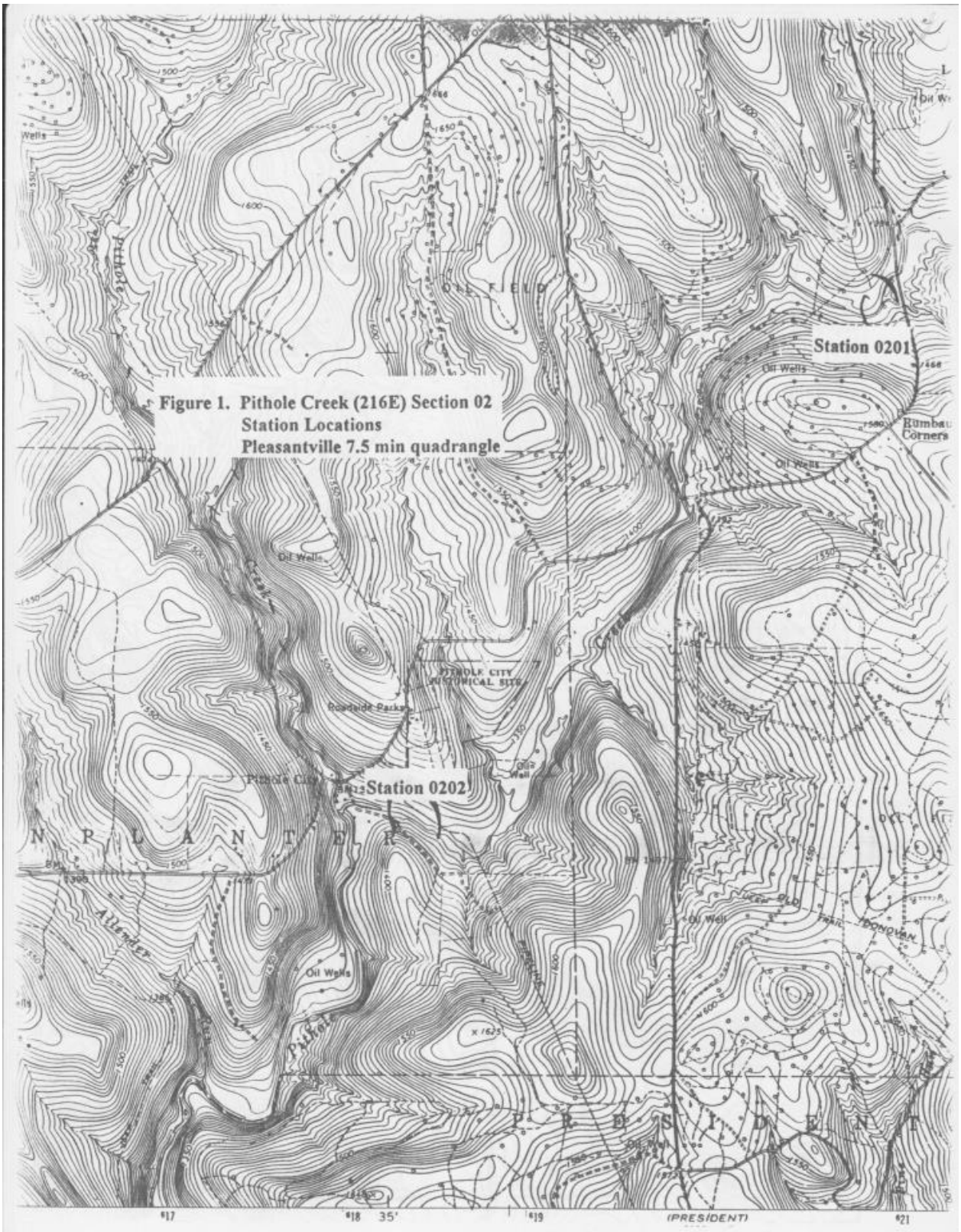


Figure 1. Pithole Creek (216E) Section 02 Station Locations Pleasantville 7.5 min quadrangle

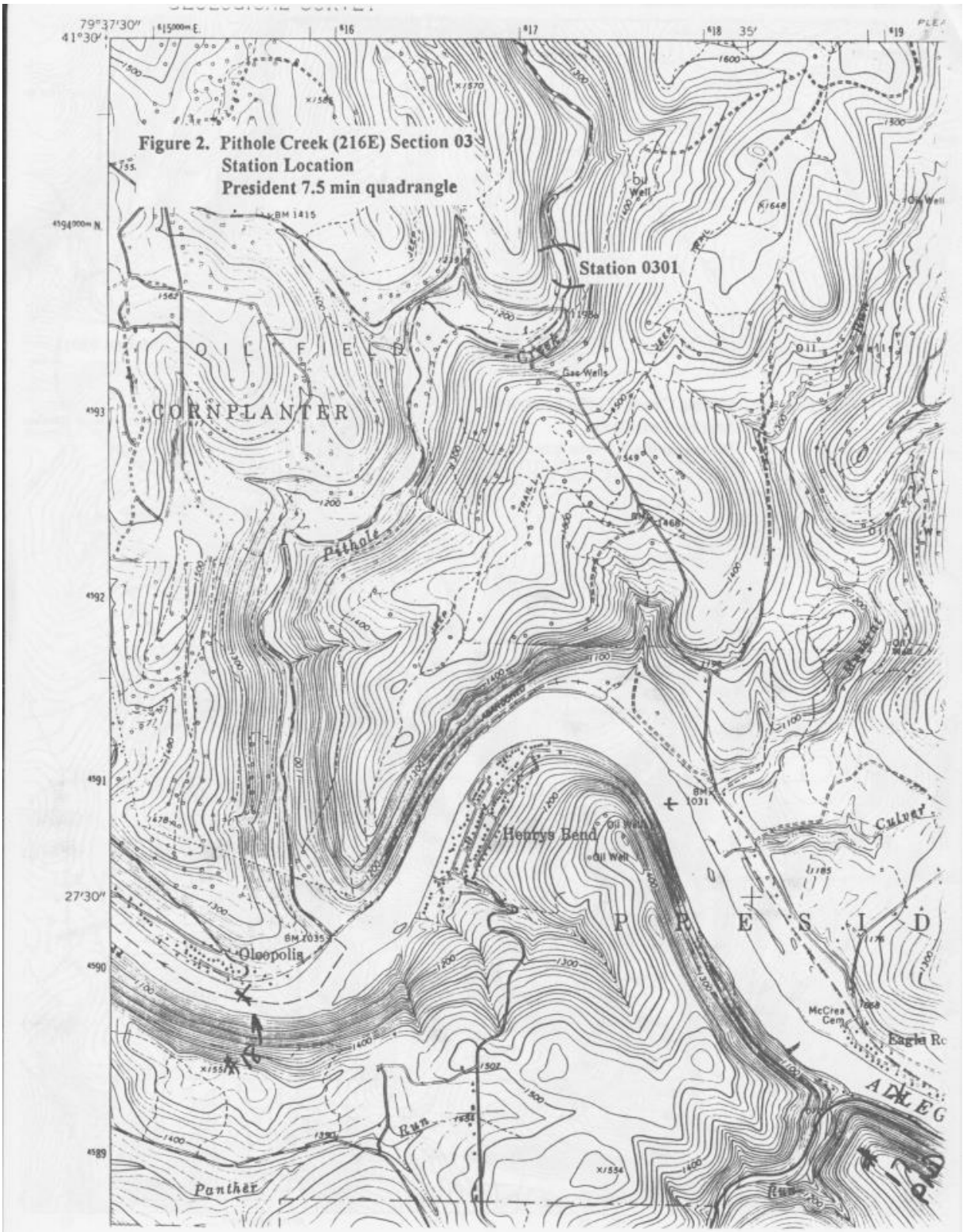
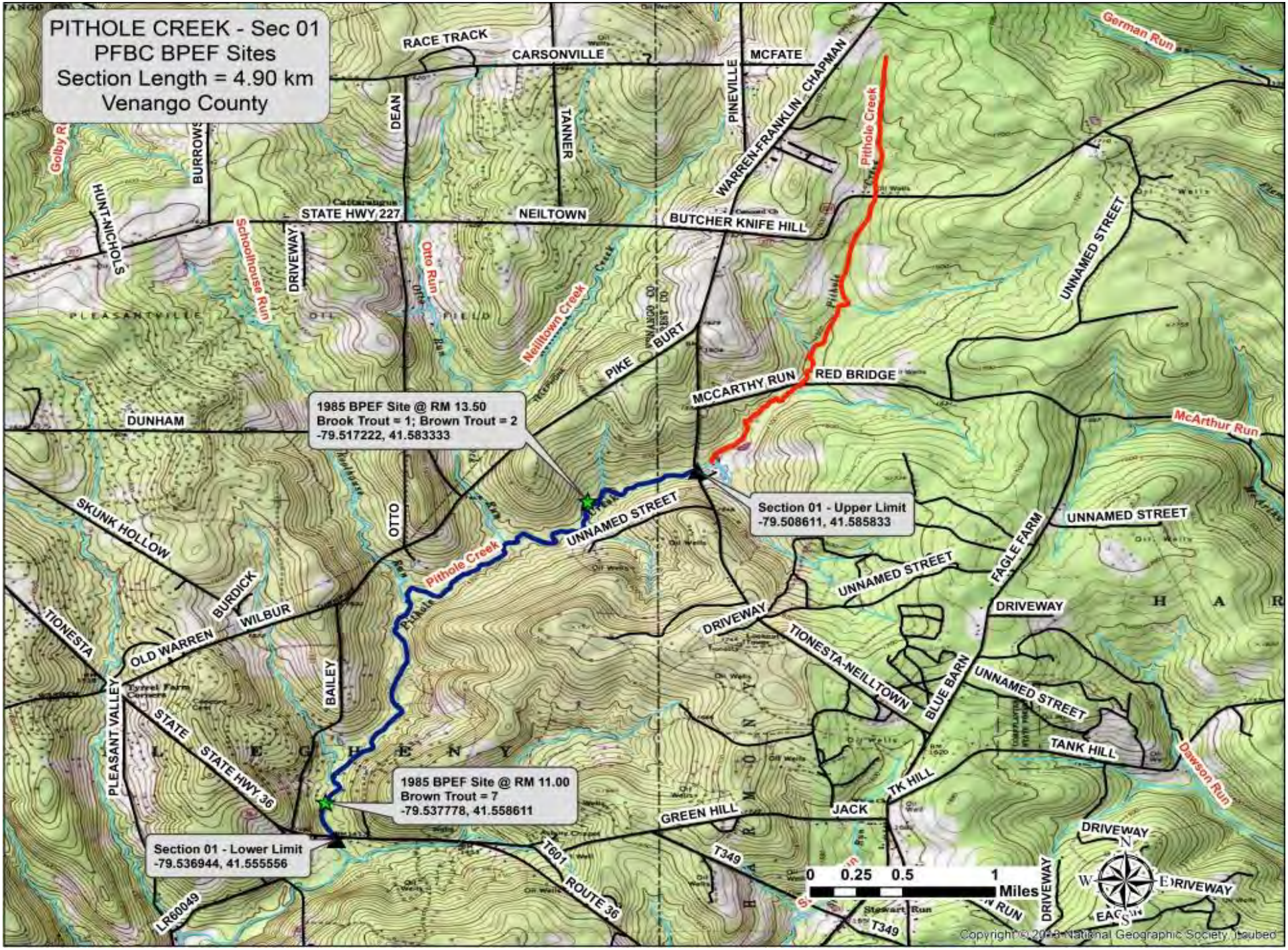


Figure 2. Pithole Creek (216E) Section 03
Station Location
President 7.5 min quadrangle


PITHOLE CREEK - Sec 01
PFBC BPEF Sites
Section Length = 4.90 km
Venango County
1985 BPEF Site @ RM 13.50
Brook Trout = 1; Brown Trout = 2
-79.517222, 41.583333
Section 01 - Upper Limit
-79.508611, 41.585833
1985 BPEF Site @ RM 11.00
Brown Trout = 7
-79.537778, 41.558611
Section 01 - Lower Limit
-79.536944, 41.555556
Pithole Creek
German Run
McArthur Run
Dawson Run
Otto Run
Neilltown Creek
Schoolhouse Run
RACE TRACK
CARSONVILLE
MCFATE
PINEVILLE
DEAN
TANNER
BURROWS
HUNT-NICHOLS
STATE HWY 227
NEILTOWN
BUTCHER KNIFE HILL
WARREN-FRANKLIN - CHAPMAN
DRIVEWAY
UNNAMED STREET
PLEASANTVILLE OIL FIELD
PIKE
BURT
MCCARTHY RUN
RED BRIDGE
DUNHAM
SKUNK HOLLOW
OTTO
BURDICK
WILBUR
TIONESTA
OLD WARREN
BAILEY
PLEASANT VALLEY
STATE
STATE HWY 36
FAGLE FARM
TIONESTA-NEILLTOWN
BLUE BARN
TANK HILL
TK HILL
JACK
GREEN HILL
T601
ROUTE 36
LR60049
T349
Stewart Run
0 0.25 0.5 1 Miles
N
W
E
S
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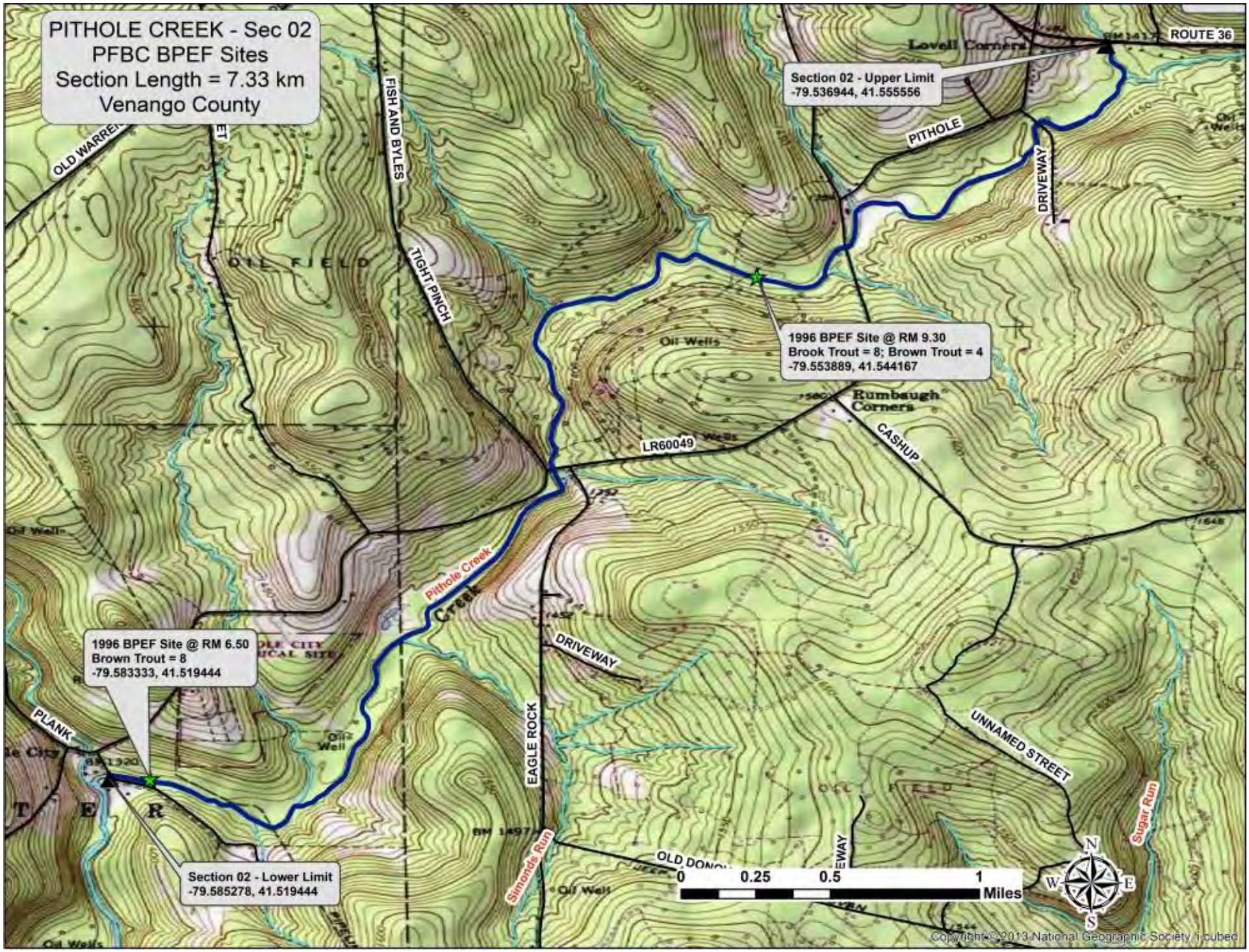
PITHOLE CREEK - Sec 02
PFBC BPEF Sites
Section Length = 7.33 km
Venango County
Section 02 - Upper Limit
-79.536944, 41.555556
1996 BPEF Site @ RM 9.30
Brook Trout = 8; Brown Trout = 4
-79.553889, 41.544167
1996 BPEF Site @ RM 6.50
Brown Trout = 8
-79.583333, 41.519444
Section 02 - Lower Limit
-79.585278, 41.519444
ROUTE 36
Lovell Corners
PITHOLE
DRIVEWAY
FISH AND BYLES
TIGHT PINCH
OIL FIELD
Oil Wells
Rumbaugh Corners
CASHUP
LR60049
Pithole Creek
Creek
DRIVEWAY
EAGLE ROCK
PLANK
UNNAMED STREET
Sugar Run
Simonds Run
RM 1497
0 0.25 0.5 1 Miles
N
W
E
S
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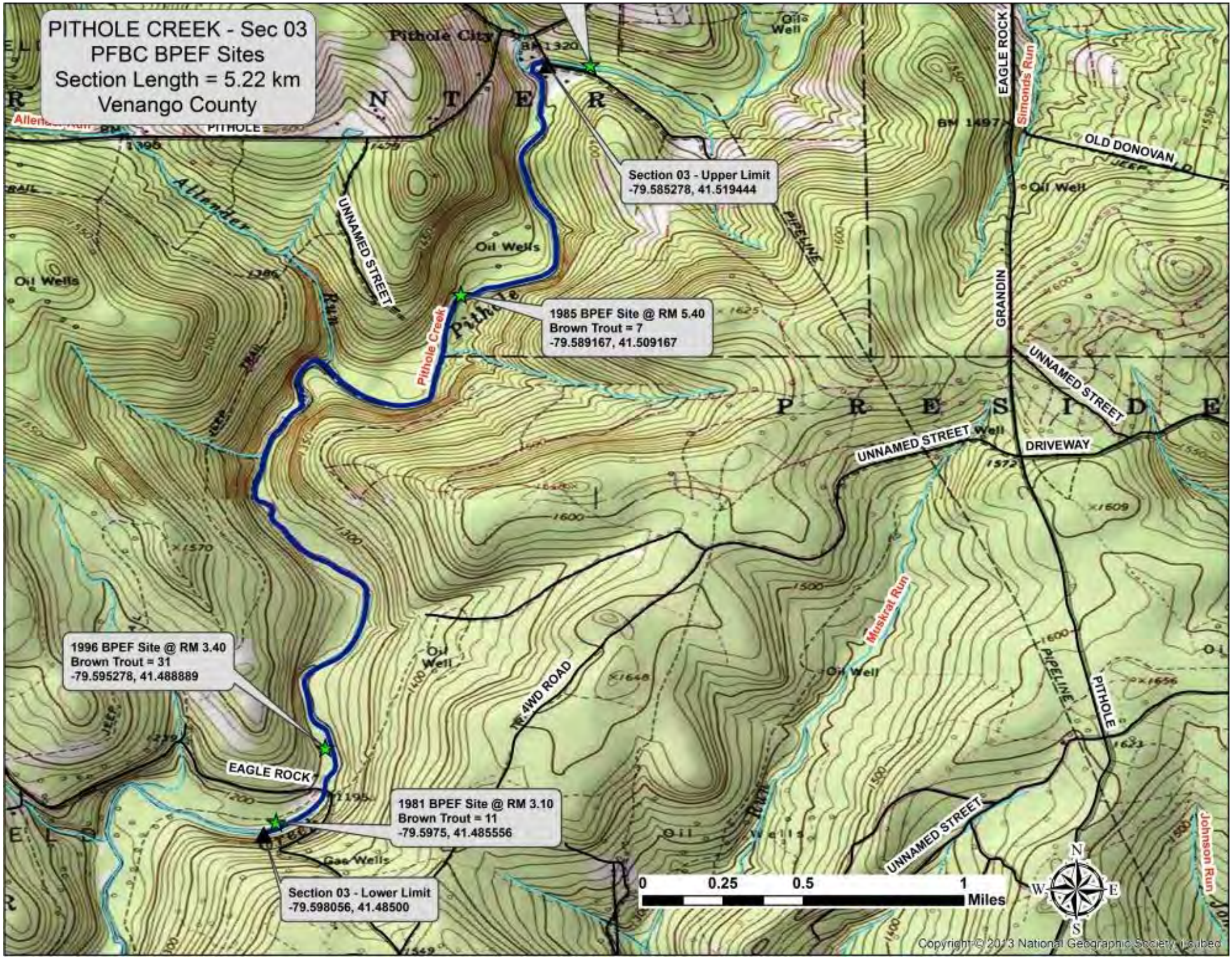
PITHOLE CREEK - Sec 03
PFBC BPEF Sites
Section Length = 5.22 km
Venango County
Section 03 - Upper Limit
-79.585278, 41.519444
1985 BPEF Site @ RM 5.40
Brown Trout = 7
-79.589167, 41.509167
1996 BPEF Site @ RM 3.40
Brown Trout = 31
-79.595278, 41.488889
1981 BPEF Site @ RM 3.10
Brown Trout = 11
-79.5975, 41.485556
Section 03 - Lower Limit
-79.598056, 41.48500
Pithole City
Pithole Creek
Allender Run
UNNAMED STREET
PIPELINE
GRANDIN
EAGLE ROCK
Simonds Run
OLD DONOVAN
UNNAMED STREET
DRIVEWAY
Muskrat Run
4WD ROAD
PITHOLE
Johnson Run
Oil Wells
Gas Wells
0 0.25 0.5 1 Miles
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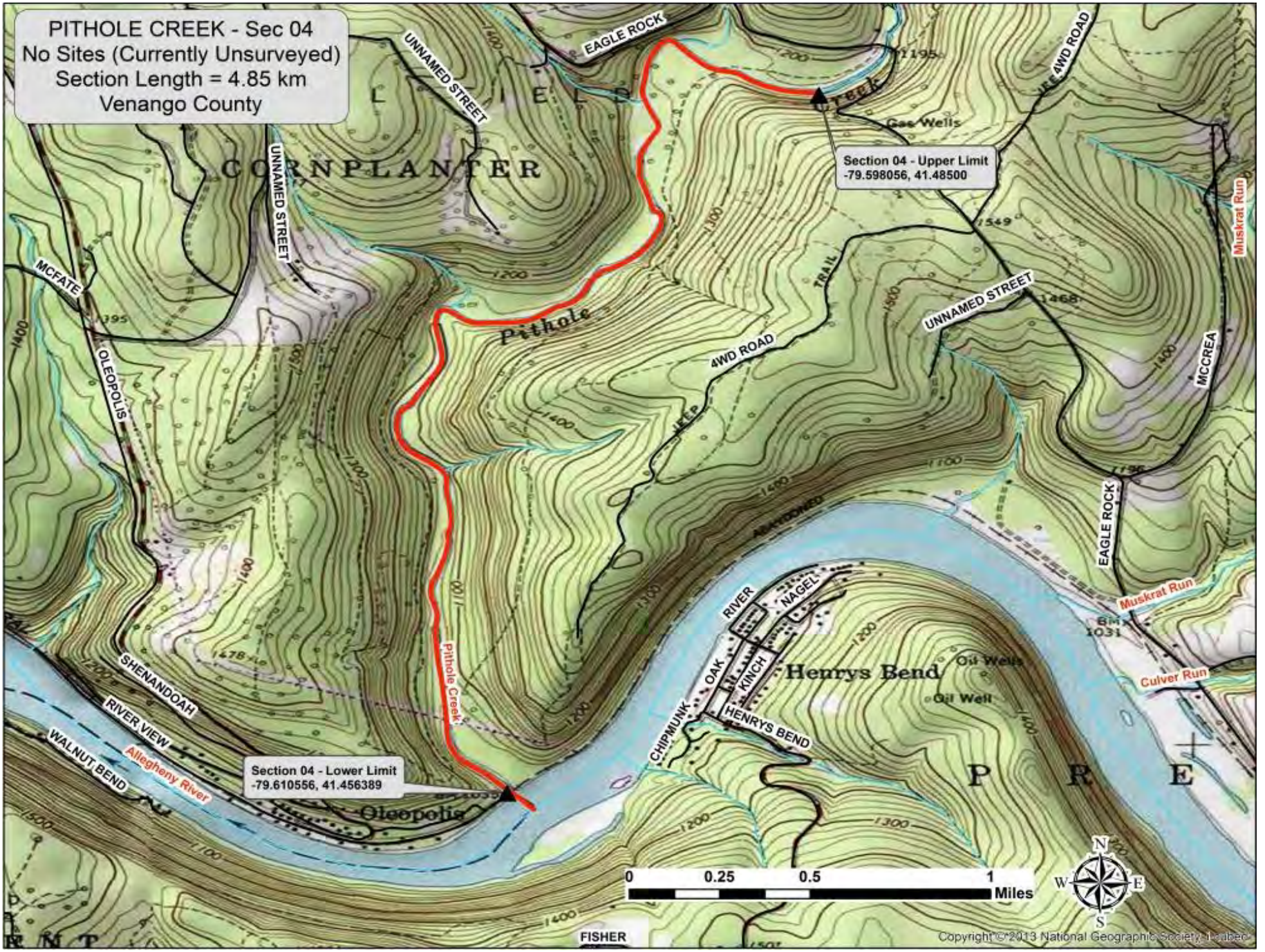
PITHOLE CREEK - Sec 04
No Sites (Currently Unsurveyed)
Section Length = 4.85 km
Venango County
Section 04 - Upper Limit
-79.598056, 41.48500
Section 04 - Lower Limit
-79.610556, 41.456389
Pithole Creek
EAGLE ROCK
UNNAMED STREET
CORNPLANTER
MCFATE
OLEOPOLIS
SHENANDOAH
RIVER VIEW
WALNUT BEND
Allegheny River
Oleopolis
4WD ROAD
JEEP TRAIL
ABANDONED
Gas Wells
Muskrat Run
MCCREA
RIVER
NAGEL
OAK
KINCH
CHIPMUNK
HENRYS BEND
Henrys Bend
Oil Wells
Oil Well
Culver Run
FISHER
0 0.25 0.5 1 Miles
N
S
E
W
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COMMENTS AND RECOMMENDATIONS

WATER: Pithole Creek (216E): Sections 01, 02 and 03 Forest County

EXAMINED: June 1985

BY: Ronald Lee

Bureau Director Action: Approved Delano R. Graff Date: 9-25-87

Division Chief Action: Richard A. Snyder Date: 9-21-87

WW Unit Leader Action: _____ Date: _____

CW Unit Leader Action: M. Manenko Date: 9/17/87

CW UNIT COMMENTS:

Section 01

As a result of this evaluation, Pithole Creek, Section 01, was deleted from the catchable trout program effective for 1986. Its apparent that oil extraction activities have eliminated wild trout reproduction from this section. The classification for Section 01 is closed to fishing. No management action is recommended until posting can be significantly reduced.

The headwaters section of Pithole Creek is unnumbered with the present section assignments. For the purpose of identification, a future revision should reassign Section 01 to that portion from the headwaters downstream to RT 511.

Section 02

Pithole Creek (216E), Section 02, was characterized as having satisfactory trout habitat, however, the fishery is provided entirely by stocking. Evidence of abnormal conditions was apparent from water chemistry values. The cumulative impact of extensive oil and gas development will probably be difficult to correct. This report should be reviewed by FES before any action is initiated with DER.

Catchable trout management is recommended to continue. The stocking strategy will be established by classification. The revised area for 1988 stocking should be 15.4 acres as the grand mean of 1977 and 1985 site widths. No change in allocation will occur.

Section 03

Pithole Creek (216E), Section 03, provided some insight into the habitat potential for natural reproduction provided pristine water quality. The effects of West Pithole Creek flows are not evident from the routine chemical data; however, I suspect that Ron is correct about its effect. A 1981 report for Section 04 documented conditions similar to those observed in Section 02, i.e., few trout.

Catchable trout management is recommended to continue. Stocking rate and frequency should be established by classification. The revised area for 1988 stocking should be 14.3 acres. The current area based on 1977 data only is 15.6 acres, so a slight decrease in allocation will occur.

PENNSYLVANIA FISH COMMISSION
BUREAU OF FISHERIES
FISHERIES MANAGEMENT DIVISION

Pithole Creek (216E)
Sections 01, 02 & 03

Ronald D. Lee

Date Sampled: June 1985 Date Prepared: Jan. 1986

Introduction

Pithole Creek (216E) originates in extreme northwestern Forest County. It almost immediately leaves Forest County and enters Venango County where it flows in a southwesterly direction to its confluence with the Allegheny River. The headwaters area is a gently rolling plateau which change to steeper gradient ridge and valley topography as the stream approaches its mouth.

Pithole Creek is transected by Rt. 36 in its upstream area, paralleled by L.R. 60049 in its mid-stream area, and crossed by L.R. 60046 between Sections 03 and 04. The entire watershed is dotted with active oil wells and pipelines attesting to active oil extraction activities.

Previous surveys are basically formatted data reports with little or no narrative pertaining to the survey. Historical surveys from most recent to oldest in area two files include:

1) 8-12-81 Lee, Obert, Dinger--Section 04 (data and narrative)
2) 7-11-77 Lee, Obert, Dinger--Section 01, 02, & 03
3) 6-10-70 Hoopes, Lee, Reed--Section 04

Pithole Creek is so named because of its historical significance in the oil industry. Initially oil was recovered from "pits" dug along the creek. There is a state park located on Pithole Creek which has an oil museum. The museum depicts the oil boom at the historical pithole which went to a city of 20,000 from zero population, to a ghost town in a period of three years in the 1860s.

The oil legacy of Pithole Creek continues today and is unfortunately attested to by fifty-six (56) pollution reports from 1982 through the fall of 1985. Enforcement of Pennsylvania Fish Commission (PFC) pollution laws, recently enacted well drilling permit fees, and bonding regulations

have resulted in posting of land owned by oil companies as a protest to these new regulations. As a direct result of those actions, Section 01 of Pithole Creek is no longer eligible for management as a stocked trout stream.

The area two file on Pithole Creek indicates a very strong interest in the fishery by Messrs. Clark and Nelson. There was a fairly consistent stream of correspondence from these two Trout Unlimited (T.U.) people from 1972 through 1982.

Section 01

Methods

Section 01 was sampled by Lee, Obert, and Anderson during the week of June 26, 1985. Section 01 is a 4.9 km section bounded by Rt. 36 and L.R. 511. Two stations were sampled. Station 0101 was located 500 m downstream from L.R. 511 and was 74 m long. Station 0201 was located 300 m upstream from Rt. 36 and was 130 m in length. A Coffelt backpack unit was used to sample fish life. Invertebrate and chemical parameters were not checked.

Results

Section 01 yielded nine brown trout and one brook trout at two sample stations. All ten trout appeared to be of hatchery origin. Table 1 shows the physical and social characteristics of Section 01. No chemical parameters are reported. The important factor to note for Section 01 is that it is 100% private and was posted by oil companies to protest law enforcement, permit fee requirements and bonding requirements.

Discussion

Section 01 is dependent upon stocking to support a trout fishery. As a result of posting, stocking is not a management alternative. Unfortunately this section has not demonstrated the ability to support natural reproduction cycles by trout. It appears a trout fishery will not exist in Section 01.

Recommendation

Due to posting, stocking will be discontinued. Management will be limited to conventional state regulations for non-stocked streams.

Section 02

Methods

Section 02 is that portion of stream from the confluence of West Pithole Creek upstream to Rt. 36. The 7.5 km section was sampled at two stations. Station 0201 was located 300 m downstream from the bridge on L.R. 60049, which is between the junction of T-362 and 60049 and Rumbaugh Corners. The station was seventy two (72) m long. Station 0202 was located 500 m upstream from the confluence of West Pithole Creek and was

119 m long. No invertebrate samples were taken. Fish sampling was done utilizing a Coffelt backpack with TAS generator, yielding a C.U.E. estimate.

Results

Section 02 did not and has not shown an ability to support natural reproduction of either brook or brown trout. A total of forty brown trout were sampled at Stations 01 and 02. One brown trout at Station 02, 50 mm in length, was the only trout that appeared to be a wild trout. It is suspected it was recruited from W. Pithole Creek. Thirty-seven of the 39 remaining brown trout ranged from 175 to 299 mm and were all hatchery trout. A brown in the 375 mm size group was sampled, however it was not noted if this was a hatchery or holdover trout. In addition to brown trout, blacknose dace, mottled sculpin, creek chubs, and white suckers were sampled.

Chemical characteristics indicate most parameters are well within ranges suitable for trout populations. Conductivity was somewhat high at 479 umhos and 0201 and 439 umhos at 0202.

Discussion

Section 02 of Pithole Creek has the physical habitat to support a viable brown trout population. The absence of Y.O.Y., or even holdover hatchery trout beyond one season, indicates a major failure in water quality is occurring in the watershed. The presence of hatchery trout through June 26 indicates it is not a problem that immediately affects stocked trout.

The presence of numerous oil operations and a track record of 56 pollution incidences in less than four years indicate oil activities are having a direct effect on this fishery. It also indicates after-the-fact fines are not a deterrent to pollution and are not protecting the fishery. It is obvious that past operators in the oil fields have been "sloppy" and the attitude has been one of finding it cheaper to pay a fine than to provide adequate safeguards to protect Pithole Creek.

Recommendations

It is recommended the oil and gas division of DER conduct a long term investigation of this watershed. This investigation should result in immediate action by operators to bring their operations into both state and federal compliance. Water quality should be monitored with a major goal of determining what water quality parameters are substandard and therefore limiting factors for a viable brown trout fishery.

Section 02 is still capable of providing a seasonal trout fishery through stocking efforts by the PFC. It is recommended stocking efforts continue as in the past under statewide allocation system

Section 03

Methods

Section 03 is 4.7 km in length and located between the confluence of the West Branch of Pithole Creek and the "Stone Arch bridge" on L.R. 60046. Station 0301 was 147 m in length and located 1.5 km downstream from the confluence of the West Branch. The station was reached via oil lease road. Station 0302, located 100 m upstream from L.R. 60046 (Stone Arch bridge), was 348 m in length. Station 0301 yielded a C.U.E. estimate and Station 0302 yielded a Petersen estimate. Invertebrates were not sampled. All other sampling was done as specified in the stream examination manual.

Results

Section 03 was sampled at two stations. The upstream station supported a limited fishery that was highly dependent on hatchery trout. A total of seven brown trout were sampled along with two rainbow. Using a C.U.E. estimator based on 21 min of sampling a yield of 18 brown trout and rainbow trout/hr was obtained. Station 0302 provided sufficient numbers of trout to make a Petersen estimate.

A biomass estimate for Station 0301 yielded 12.6 kg/ha brown trout, based on catch/limit effort data. The estimate for Station 0302 was 38.5 kg/ha based on a modified Petersen estimate. These two station estimates were kept separate due to significant sampling differences, with results shown on Table 3 in the appendix of this report. Brown trout reproduction did not occur at 0301, and was significant at 0302.

Chemical characteristics were very similar at both Stations 01 and 02 with pH of 72, total alkalinity at 18 and 19 ppm, total hardness of 78 and 80, and specific conductance of 375 and 415 m umhos respectively. Invertebrates were not sampled. Fish diversity was very similar at both stations and included brown trout, rainbow trout, blacknose dace, longnose dace, creek chub, white sucker and mottled sculpin in the section. Brown trout are stocked and reproducing. Rainbow trout are not stocked by the PFC in Pithole Creek.

Discussion

Pithole Creek continues to have a quality brown trout fishery in the lower portion of Section 03 as indicated by sampling results from Station 0302. Brown trout ranged from the 50 mm size group through the 550 mm size group. An estimate of 38.5 kg/ha was determined for Station 0302, and the sample was primarily wild trout. Station 0301 yielded C.U.E. data only with 18 brown trout/hr and five rainbow trout/hr.

Drastic differences in trout populations occur between Section 03 and Sections 01 and 02. Habitat differences include increased gradient in Section 03 with more boulder, rubble, gravel substrate than in Sections 01 and 02. Nonetheless, I have observed numerous streams with habitat similar to Sections 01 and 02 which have supported good wild brown trout problems. The other possibility for poor upstream fish populations is

water quality related. It appears subtle or unreported water quality deterioration may be occurring as a result of oil and gas extraction activities. Trout population at Station 0302 indicate West Pithole Creek may be "buffering" Section 03 by diluting marginal water making it suitable to support a high quality trout population.

Recommendation

No management changes are recommended for Section 03. However, it is worth reiterating that this stream deserves increased monitoring of water quality by DER to ensure it is being protected as a CWF classified stream.

Table 1a. Social, Physical, and Chemical Characteristics for Section 01, Pithole Creek, June 1985.

Characteristics	Description
USGS Quadrangle	Pleasantville - 02052
Social	
Ownership	
% Public	
% Private	100% - closed
Road Accessibility	
% within 100 m	02
% within 300 m	70
Parking Spaces/km	38
Physical	
Length (km)	4.9
Mean width (m)	5.2
Area (ha)	2.55
Substrate	Rubble/Gravel/Sand
Gradient	2.6-5.4
	Station Number
Chemical	Chemical data not available
pH	
Specific conductance (umhos)	
Total alkalinity (mg/l)	
Total hardness (mg/l)	
Water temperature (C)	

Table 1b. Social, Physical, and Chemical Characteristics for Section 02, Pithole Creek, June 1985.

Characteristics	Description	
USGS Quadrangle	Pleasantville	
Social		
Ownership		
% Public		
% Private	100%	
Road Accessibility		
% within 100 m	2	
% within 300 m	53	
Parking Spaces/km	16	
Physical		
Length (km)	7.5	
Mean width (m)	8.2	
Area (ha)	6.15	
Substrate	Rubble/Gravel	
Gradient	2.6-4.5	
	Station Number	
	0201	0202
Chemical		
pH	7.1	7.1
Specific conductance (umhos)	479	439
Total alkalinity (mg/l)	19	19
Total hardness (mg/l)	94	68
Water temperature (C)	14	14.8

Table 1c. Social, Physical, and Chemical Characteristics for Section 03, Pithole Creek, June 1985.

Characteristics	Description	
USGS Quadrangle	President, Pleasantville	
Social		
Ownership		
% Public		
% Private	100	
Road Accessibility		
% within 100 m	1	
% within 300 m	19	
Parking Spaces/km	5	
Physical		
Length (km)	4.7	
Mean width (m)	11.2	
Area (ha)	5.26	
Substrate	Bedrock/Boulder/Rubble	
Gradient	3.8-9.8	
	Station Number	
	0301	0302
Chemical		
pH	7.2	7.2
Specific conductance (umhos)	375	415
Total alkalinity (mg/l)	18	19
Total hardness (mg/l)	78	80
Water temperature (C)	13.8	13.8

Table 2. Modified Petersen Estimate Station 0302 and C.U.E. for 0301, Pithole Creek, June 1985.

Species	Size groups (mm)	Population density estimated by Number/km	Number/ha	Kilograms/ha
Brown trout	50-174	49	43	0.53
	175-249	49	44	4.38
	250-349	84	75	17.35
	350+	26	24	16.20
				38.46

Station 0301		Catch	Catch/hour	
Brook trout	150-174	1	3	
	250-349	4	10	
	350+	2	5	18/h
Rainbow trout	225-324	2	5	5/h

Pennsylvania Fish Commission
Division of Fisheries
Fisheries Management Section

PITHOLE CREEK (216E) MANAGEMENT REPORT

Section 04

Lee, Obert, Dinger

Sampling Period: 8/12/81

Date Prepared: 8/26/81

Water: Pithole Creek (216E), Sec. 04
Examiners: Lee, Obert, Dinger
Date: 8/12/81 and 8/26/81

Fisheries Management Section
Area 2
Division of Fisheries
Pennsylvania Fish Commission

Introduction

Pithole Creek is located in eastern Venango County near the Forest County Line and is a tributary to the Allegheny River. The creek is 25 kilometers long and has a drainage area of 109.04 square kilometers. Section 04 is located in Cornplanter Township near Oleopolis and is accessible by LR 60046 and LR 60070.

The topography of the drainage is mature forest lands and the area is underlain with deposits of oil and gas. The famous oil boom town of Pithole is located upstream in Section 02. The stream obtained its name from this town which went from zero population to the third largest city in Pennsylvania and back to zero in only a few years after the oil ran out in the 1860s.

The geology of the drainage is the Mississippian Pocono Group. This formation is composed of predominantly gray, hard, massive, crossbedded conglomerate, and sandstone with some shale. Out of this formation and mature forest lands flows a fairly productive stream. At Section 04 the stream is quite wide but very picturesque with many large pools and fast riffle areas.

Section 04 is quite inaccessible and is limited to a walk-in fishery. A jeep trail near the stone arch bridge parallels the stream but is gated to deny access.

Methods

Pithole Creek, Section 04, was sampled at a point 300 meters downstream from the stone arch bridge on LR 60046. The section limits for Section 04 are the mouth upstream to the stone arch bridge on LR 60046. Section 04 is 5.1 km long with an average width of 14.6 meters and an area of 7.45 hectares.

Electrofishing was done using a TAS generator with a Coffelt backpack. A.C. current was utilized for an electrofishing period of .2 hours. All other sampling was done in accordance to methods described in the PA Fish Commission's Stream Survey Manual (1976).

Results

Ownership was 99% private and one percent publicly owned. Fishing is limited to walking-in-only in Section 04. Accessibility was three percent within 100 meters and 24% within 300 meters.

Section 04 was 5.1 km in total length with an average width of 14.6 meters and an area of 7.45 hectares.

Chemical parameters showed a pH of 7.0, specific conductance of 520, total alkalinity 14 mg/l, total hardness 80 mg/l and a water temperature of 15.6 C.

Fish species collected were brown trout, blacknose dace, longnose dace, creek chub, and mottled sculpin. Brown trout collected resulted in an estimate of 33 per hectare, as an absolute minimum based on .2 hours electrofishing time.

Nine invertebrate families were found in Section 04. Diversity was fair and density was excellent. Mayflies comprised the majority of the sample.

The results are tabulated on Tables 1 through 4 at the end of this report.

Discussion

Pithole Creek, Section 04, contained a moderate brown trout population. Eleven fish were collected in 212 meters of electrofishing. Compared to Section 03, the numbers of fish collected was less than what was expected. The low density is probably attributable to the fact that the efficiencey of the electrofishing effort was quite low. Deep, wide pools and fast riffles hampered efficiency, making it impossible to collect enough fish for a population estimate. The habitat present and the number of fish collected just

upstream from this section would suggest that this station did not represent a true picture of the fishery actually present. A resurvey using a P.C. tow boat or two crews with Coffelt backpacks working in unison would be needed to evaluate the fishery correctly.

A survey was made by Reed, Hoopes and Lee in 1970 to see if this section would qualify for the Wilderness Trout Stream Program. Several legal-sized brown trout were collected in this survey, but no natural reproduction was reported. The station location for this survey was approximately 500 feet upstream from the mouth. The stream was not approved for the project because a natural reproducing population was not present. DER presently designates Pithole Creek as a Cold Water Fishery. This classification seems appropriate at this time.

Oil and gas production has been ongoing in this drainage since the turn of the century. This stream has had a history of oil pollutions and nocturnal seeps. These pollutions have been greatly minimized in recent years, and no serious kills have occurred.

djs

Management Recommendations

I. OBJECTIVE:

To provide a wild trout fishery through natural reproduction and recruitment.

II. MANAGEMENT OPTION:

The management needed to maintain Pithole Creek, Section 04, as a wild trout stream is inherent in the Clean Streams Law and DER's Chapter 93 of Rules and Regulations.

A. It is recommended that Pithole Creek continue to be managed as a wild trout stream. Lack of access precludes it from being managed as stockable waters.

No other options available at this time.

III. RECOMMENDED MANAGEMENT OPTIONS:

Management Option A is the recommended option. Pithole Creek, Section 04, will continue to be managed as a wild trout stream.

IV: EVALUATION OF MANAGEMENT:

The objective and management strategies for Section 04 will be evaluated through analysis and classification of the characteristics of this watershed in relation to other waters in the Commonwealth. This evaluation may dictate a change in the recommended management.

REFERENCES

Reed, J., R. Hoopes, R. Lee. 1970. PA Fish Commission Survey. PA Fish Commission files, Pleasant Gap, PA.

Table 1. Key Chemical, Physical and Social Characteristics of Pithole Creek (216D), Section 04, examined on 8/12/81.

Characteristics	Description
USGS Quadrangle	President, PA
Social	
Ownership	
%Public	1%
%Private	99%
Road Accessibility	
%within 100m	3%
%within 300m	24%
Parking Spaces/km	3
Physical	
Length(km)	5.1
Mean Width(m)	14.6
Area(ha)	7.45
Substrate	Boulder, Rubble
Gradient	8.9 (error on report-2.0 should be 8.
	Station Number
Chemical	01
pH	7.0
Specific Conductance (umhos)	520
Total Alkalinity (mg/l)	14
Total Hardness (mg/l)	80
Water Temperature (C)	15.6

REFERENCES

Reed, J., R. Hoopes, R. Lee. 1970. PA Fish Commission Survey. PA Fish Commission files, Pleasant Gap, PA.

Table 2. Fish Species Collected in Pithole Creek (216D), Section 04 on 8/12/81.

Scientific Name	Common Name
Salmo trutta	Brown trout
Rhinichthys atratulus	Blacknose dace
Rhinichthys cataractae	Longnose dace
Semotilus atromaculatus	Creek chub
Cottus bairdi	Mottled sculpin

Table 3. Size Groups and Population Density of Gamefish in Pithole Creek (216D), Section 04, on 8/12/81.

Species	Size Groups (mm)	Population Density Estimated by Number/km	Number/ha	Kilograms/ha
Brown trout	150-224	24	15	
	225-324	24	15	
	425-449	5	3	

Table 4. Invertebrate Families Sampled in Pithole Creek (216D), Section 04, on 8/12/81.

	04
Ephemeroptera	
Baetidae	x
Heptageniidae	x
Siphlonuridae	x
Odonata	
Gomphidae	x
Diptera	
Chironomidae	x
Rhagionidae	x
Hemiptera	
Gerridae	x
Decapoda	
Astacidae	x
Oligochaeta	x

Art

PFC-441
Page 1

PENNSYLVANIA FISH COMMISSION
Division of Fisheries

STREAM SURVEY REPORT
Physical Data

Name of Stream Pithole Creek Tributary to Allegheny River

County Venango, Forest Township(s) Cornplanter, President, Allegheny, Oil Creek

U.S.G.S. Quad. Oil City, Pa., N4115/W7930/15' Total length 15 miles

Station Locations (by route numbers from Pennsylvania Department of Highways Map): SEE ATTACHED MAP

No. 1 500 feet upstream from the confluence with the Allegheny River
No. 2
No. 3
No. 4
No. 5
No. 6

Topography (%): Mountainous _____ Hilly 70 Rolling _____ Flat 30

Land Type (%): Wooded 80 Brushy 20 Pasture _____ Crops _____ Marsh _____

Habitation (%): Rural 100 Suburban _____ Urban _____

Flow Characteristics (%): Rapid 40 Moderate 40 Sluggish 20 Ponded _____

Stream Bottom (%): Bedrock 10 Boulders 20 Rubble 40 Gravel 10
Sand and silt 10 Mud and clay 10

Pool-riffle Ratio: 50 to 50

Shade: Good _____ Fair X Poor _____

Shelter: Good X Fair _____ Poor _____

Bank Erosion: Severe _____ Moderate X Light _____

Accessibility: Good _____ Fair X Poor _____

Degree Posted: Heavy _____ Medium _____ Sparse X

Average Width (feet): Station 1 40 Station 2 _____ Station 3 _____
Station 4 _____ Station 5 _____ Station 6 _____

Overall Average Width of Section: 40 feet. Length of Section(s): 250 feet ~~xxxmiles~~

Area of Section: _____ acres. Does flow meet minimum stocking standards? Yes

Are two continuous miles or one mile and four acres of water open to public? Yes

Comments: Pithole Creek is stocked by the Commission upstream from Station No. 1

Survey by Jim Reed, Rick Hoopes, Ron Lee Date June 10, 1970

PENNSYLVANIA FISH COMMISSION
Division of Fisheries

STREAM SURVEY REPORT
Biological Data

Name of Stream Pithole Creek Tributary to Allegheny River

County Venango, Forest Township(s) Cornplanter, President, Oil Creek, Allegheny

Invertebrates: (1 sq. ft. Surber)

Common Name	Order	Stations Where Found	Relative Abundance
Mayfly	Ephemeroptera	1	
Stonefly	Plecoptera		Most abundant.
Caddisfly	Trichoptera		
Roundworm	Nematoda		
True fly	Diptera		

Fish: (Electro-fishing)

Common Name	Species	Stations Where Found	Relative Abundance
Brown trout	S. trutta	1	
Rock bass	A. rupestris		
Yellow perch	P. flavescens		
Stoneroller	C. anomalum		Several legal-sized
Hog sucker	H. nigricans		brown trout.
Common white sucker	C. commersoni		
Sculpin	C. bairdi		
Blacknose dace	R. atratulus		
Rainbow darter	E. tippecanoe		
Silver shiner	N. photogenis		
Common shiner	N. cornutus		
River chub	H. micropogon		

Aquatic Vegetation:

Common Name	Genus	Stations Where Found	Relative Abundance

Comments:

Survey by Jim Reed, Fish [illegible]

PENNSYLVANIA FISH COMMISSION
Division of Fisheries

STREAM SURVEY REPORT
Chemical and Pollution Data

Name of Stream Pithole Creek Tributary to Allegheny River

County Venango, Forest Township(s) Cornplanter, President, Oil Creek, Allegheny

Chemical Data:

Station No.	Air Temp. °F.	Water Temp. °F	Spec. Cond.	pH	M. O. (ppm)	T. H. (ppm)	D. O. (ppm)	Iron (ppm)	Sulfates (ppm)	Hot Acid. (ppm)
1.Field	78	70	235	7.6*	30	54				
Lab				7.8	27	43				
2.Field										
Lab										
3.Field										
Lab										
4.Field										
Lab										
5.Field										
Lab										
6.Field										
Lab										

Comments or additional analyses:

*No match on Cresole-Red B

Pollution: Serious ____ Moderate ____ Minimal X

Types of Pollution: Acid mine drainage ____ Industrial wastes (inc. heated) ____
Oil seepage
Treated sewage ___ Untreated sewage ___ Radiological ___ Agricultural ___ Other X

Has stream quality changed since the last survey? ____ How? ____

Comments:

Possible oil pollution.

Survey by Jim Reed, Rick Hoopes, Ron Lee Date June 10, 1970

PENNSYLVANIA FISH COMMISSION
Division of Fisheries

STREAM SURVEY REPORT
Status and Recommendations

Name of Stream Pithole Creek Tributary to Allegheny River

County Venango, Forest Township(s) Cornplanter, President, Oil Creek, Allegheny

Status:

Was this stream previously approved for stocking? Yes Date approved 6/29/32

If YES, which species? Brook trout

Date last stocked 4/16/69 What species? Brown and rainbow trout

If not approved, why? (Be specific) N/A

If not previously approved, does this survey now indicate the stream meets the minimum standards for stocking? N/A

Recommendations and General Statement:

No native trout were collected during the survey. Pithole Creek does not qualify as a wilderness trout stream.

If stocking is recommended, state the following: N/A

1. Species to be stocked

2. Length of stockable section ____ miles. 3. Area of stockable section ____ acres

4. Stocking points: From

downstream to

5. Are Change Sheets (PFC-400) from waterways patrolman necessary? Yes ___ No X

Reason for survey Proposed Wild Trout Stream Date May 6, 1969

Survey requested by C.W. Shearer Date May 8, 1969

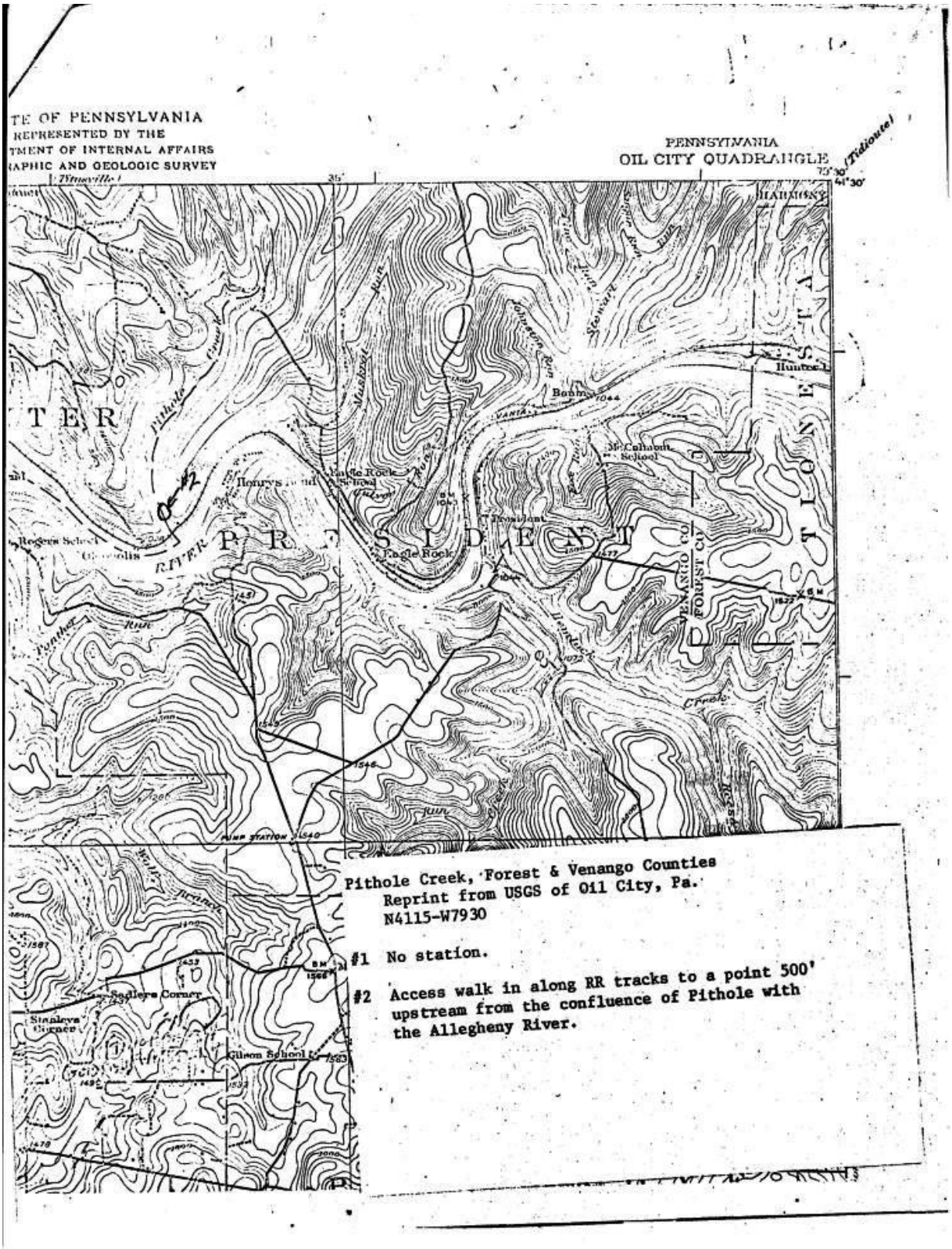
Reference(s) Memorandum Date May 8, 1969

Date

Survey by Jim Reed, Rick Hoopes, Ron Lee Date June 10, 1970

Division Chief Action RECOMMENDATIONS APPROVED Date 7/9/70

Division Chief Arthur D. Bradford Date



Pithole Creek, Forest & Venango Counties
Reprint from USGS of Oil City, Pa.
N4115-W7930

#1 No station.

#2 Access walk in along RR tracks to a point 500' upstream from the confluence of Pithole with the Allegheny River.

pennsylvania
DEPARTMENT OF ENVIRONMENTAL PROTECTION

MEMO

TO	Eric Kicher Environmental Group Manager Clean Water Program
FROM	Jay Gerber Water Pollution Biologist 2 Clean Water Program
THROUGH	Joe Brancato Water Pollution Biologist 3 Clean Water Program
DATE	January 3, 2017
RE	Aquatic Biological Investigation Titusville Oil and Gas Associates Inc. (NPDES #PA0272663) Pithole Creek (Stream Code 54755) Allegheny, Cornplanter, and President Townships, Venango County

INTRODUCTION

At the request of the Clean Water Program, an aquatic biological investigation was completed on Pithole Creek in Allegheny, Cornplanter, and President Townships, Venango County. The survey was completed in response to a Titusville Oil and Gas Associates permit application to construct a water treatment facility on Pithole Creek in Allegheny Township, Venango County. The study documented macroinvertebrate populations and water quality at six sites on Pithole Creek prior to the possible construction of the wastewater treatment plant, named Seaton Products Wastewater Treatment Plant (SPWWTP) in its permit application. This study suggests Pithole Creek has good water quality, sustaining a healthy and diverse aquatic assemblage, from above the proposed SPWWTP downstream through Pithole Creek's confluence with the Allegheny River.

Pithole Creek originates just east of the village of Neilltown in northwestern Forest County. The Pithole Creek basin can be found on the Pleasantville and President USGS quads. The stream flows southwest, approximately 17.1 miles, prior to its confluence with the Allegheny River. The Pithole Creek basin drains approximately 41.8 square miles, primarily in northeastern Venango County though, as mentioned previously, the headwaters originate in northwestern Forest County. The watershed is considered to be 93% forested, with only 2.7% considered urban (USGS StreamStats 2012). Other land uses within the basin include small agricultural plots. Near its mouth, the stream runs adjacent to State Game Lands No. 253. The watershed is in the Oil Creek State Water Plan (SWP 16E) and the Middle Allegheny River – Tionesta Creek Hydrologic Unit (Hydrologic Unit Code 05010003). With exception of the upper reaches of West Pithole Creek, the entire Pithole Creek basin is currently attaining its designated aquatic life use of Cold Water Fishes (CWF), under 25 PA Code §93.9q. The upper two

miles of West Pithole Creek are currently considered to be impaired due to nutrients from a municipal point source. West Pithole Creek flows into Pithole Creek several miles downstream of the proposed SPWWTP. Currently, the Pennsylvania Fish and Boat Commission (PFBC) has classified the mainstem of Pithole Creek, from its headwaters to its confluence with the Allegheny River, as a naturally reproducing trout stream.

Titusville Oil and Gas Associates Inc. manages and operates shallow oil and gas wells primarily within northwestern Pennsylvania. On September 1, 2014, they were permitted to operate a wastewater treatment plant discharging treated shallow brine effluent from nearby stripper wells (wells nearing the end of production) into Pithole Creek, approximately 10.6 miles upstream of its confluence with the Allegheny River, under National Pollutant Discharge Elimination System (NPDES) Permit No. PA0272663. The permit expires on August 31, 2019. Since the issuance of the permit, three Notices of Violation (NOVs) have been sent to Titusville Oil and Gas Associates concerning the SPWWTP, which include a failure to submit a radiation protection plan, failure to complete eDMR registration, and failure to pay annual NPDES permit fees. Prior to this study, and currently, the treatment plant is not operational. No previous studies have been conducted on the Pithole Creek mainstem, though aquatic life use assessment surveys have been completed at the mouth.

METHODS AND MATERIALS

Site Locations

On May 18, 2016, macroinvertebrates, water chemistry, and habitat were examined at six locations on the mainstem of Pithole Creek (Figure 1). One station was sampled at the riffle immediately upstream of the proposed SPWWTP, 1PC (~300 meters upstream of proposed discharge), while five stations (2PC – 6PC) were examined downstream of the proposed discharge, from immediately below the discharge location (~100 meters) to the confluence of Pithole Creek with the Allegheny River (~10.6 miles below SPWWTP).

Macroinvertebrates

Macroinvertebrates were collected, processed, and identified following Instream Comprehensive Evaluation protocols (PA DEP 2013). Sampling was standardized to riffles utilizing the best available habitat for each site. Six D-frame (500 µm mesh netting) kicks were completed at each site. The six kicks were combined into a single jar and filled with 95% ethyl alcohol for preservation. Upon arrival at the Department's lab, organisms were subsampled and identified using a dissecting microscope. Peckarsky *et al.* (1990), Stewart and Stark (2002), and Merritt *et al.* (2008) were used as taxonomic references. An Index of Biotic Integrity (IBI) score was computed for each site.

Water Chemistry

Basic water quality parameters and water chemistry were collected at each site. Water quality parameters, such as temperature, pH, and specific conductivity were measured *in situ* at the six stations prior to macroinvertebrate collection. All parameters were determined using a field meter. Water

chemistry, with a suite of parameters including heavy metals, several species of nitrogen and phosphorus, carbonaceous biochemical oxygen demand, alkalinity, chlorides, and bromides, among others, was collected at each site. These samples were collected with HPDE bottles and shipped on ice to the Department's Bureau of Laboratories following EPA standards.

Habitat

Physical habitat assessments were completed at each site. These assessments consist of twelve criteria, encompassing instream and riparian zone parameters, scored from 0 – 20. Total scores resulted in habitat characterizations of poor (0 - 60), marginal (72 - 120), suboptimal (132 - 180), and optimal (192 - 240). The primary investigator determined the characterization if habitat scored between categories at a given site.

RESULTS

Macroinvertebrates

Macroinvertebrate communities were analyzed through an IBI score. This method aids in determining stream health and aquatic life attainment status of a waterbody (Karr 1981).The Department's IBI scores range from 0 – 100, with a higher score indicating more pristine conditions. IBIs are computed using a suite of metrics measuring characteristics of a macroinvertebrate assemblage. Metrics used for the Department's Freestone IBI include taxa richness, Hilsenhoff Biotic Index, EPT (Ephemeroptera, Plecoptera, Trichoptera) richness, Beck's Index, percentage of sensitive individuals, and the Shannon Diversity Index (Table 1, 2). Generally, if a stream designated as CWF scores greater than 50.0, it is considered to be attaining its aquatic life uses.

Taxa richness is the overall number of taxa, typically genera, found within a subsample. Generally, taxa richness will decrease with increasing anthropogenic stress as pollution tolerant taxa dominate the macroinvertebrate assemblage. Taxa richness varied from 24 at 1PC, 2PC, and 5PC to 34 at 4PC.

The Hilsenhoff Biotic Index (HBI) is the mean pollution tolerance value (PTV) of macroinvertebrates collected in a sample. Hilsenhoff values reflect the tolerance of organisms to organic pollution. Scores range from zero to ten, with lower values representing increased sensitivity (Hilsenhoff 1987, 1988). Typically, HBIs increase as anthropogenic stress increases due to an abundance of pollution tolerant macroinvertebrates. HBI scores ranged from 2.80 at 6PC to 3.82 at 4PC.

EPT taxa richness is the number of mayfly, stonefly, and caddisfly taxa collected at each site. Collectively, these orders are regarded as the most sensitive aquatic macroinvertebrates. Additionally, this metric only includes EPT taxa with PTVs of four or less. EPT taxa richness typically decreases as anthropogenic stress increases due to the loss of sensitive taxa from the benthic community. EPT taxa richness ranged from eleven at 1PC to seventeen at 5PC.

Beck's Index is a weighted count of taxa with a PTV of zero, one, or two, based on water quality studies conducted by William Beck (1955). This metric tends to decrease with increasing anthropogenic stress

due to a loss of sensitive taxa and dominance of a few pollution tolerant taxa. Beck's Index scores ranged from 16 at 4PC to 29 at 6PC.

The percentage of sensitive individuals is the percentage of macroinvertebrate individual organisms in a subsample with PTVs of three or less. Generally, this value declines as anthropogenic stress increases. The percentage of sensitive individuals ranged from 31.2% at 5PC to 50.0% at 6PC.

The Shannon Diversity Index is a measure of the taxonomic richness and taxonomic evenness of macroinvertebrates at each station. This metric tends to decrease as anthropogenic stress increases due to the dominance of pollution tolerant taxa. The Shannon Diversity Index varied from 2.20 at 5PC to 2.71 at 4PC.

IBI scores were calculated for each sampling location (Table 2). IBI scores were relatively similar among stations, ranging from 64.4 at the most upstream station, 1PC, to 78.2 at the furthest downstream station, 6PC. The five most upstream stations did not have statistically significant differences among IBI scores. The furthest downstream station, which was higher gradient and had a greater concentration of cobble and boulder substrate, had a moderately higher IBI score than the other stations. Generally, a stream designated and protected as CWF must score greater than 50 to be considered as attaining its designated aquatic life use. All six sites, encompassing the entire Pithole Creek mainstem, scored above the attainment threshold.

Water Chemistry

Basic water quality varied modestly among the six sampling locations (Table 3). Alkalinity and pH did not vary significantly among sites. Stream temperature gradually dropped while traveling downstream due to increased immediate canopy cover. Conductivity exhibited increases between 2PC to 3PC and 3PC to 4PC. No known discharge is present at these locations, though numerous seeps from historical petroleum extraction activities can be found along the stream bank and within the floodplain.

Water chemistry results from grab samples taken at each location showed slight differences among stations (Table 4). Nutrients, including total phosphorus, nitrites/nitrates, and ammonia, were relatively low at all stations. Many of these concentrations were below detection limits. Concentrations of metals were also relatively low, exhibiting few changes among sites. Additional constituents, such as chlorides, CBOD, TDS, and TSS had low concentrations. Bromides and sodium concentrations rose slightly from 2PC to 3PC and 3PC to 4PC, and strontium rose slightly from 3PC to 4PC. These increases corresponded with the slight increase in specific conductance measured above. Though modest changes of some concentrations were observed among sites, results were consistent with those generally seen from a predominantly forested stream with current and historical extraction activities within the basin. None of the concentrations were found to be exceeding water quality criteria.

Habitat

Habitat had some variations among sites, ranging from 156 at 1PC to 210 at 5PC (Table 5). The four most upstream sites scored in the suboptimal category, or between the suboptimal and optimal

categories. The two furthest downstream sites scored in the optimal category. Generally, upstream of the SPWWTP beaver activity was common, which led to low gradient reaches of stream, accumulations of fine sediment, and poorly developed riffle-run-pool sequences. Notable amounts of sand and silt, ultimately causing significant embeddedness, were observed, especially in the upper reaches. Beaver activity continued below the discharge, though in a lessened frequency as the study moved downstream. As Pithole Creek flowed off the plateau, downhill towards the Allegheny River, beaver activity dissipated, substrate became larger providing oxygen and additional fish and macroinvertebrate habitat, and the forest canopy grew larger, leading to increased riparian cover. Habitat likely had a moderate impact on macroinvertebrate communities and IBI scores in this study.

DISCUSSION AND CONCLUSIONS

The objective of this study was to examine the benthic community, water quality, and habitat of Pithole Creek prior to the construction and operation of a proposed wastewater treatment plant to be located approximately 10.6 miles upstream of Pithole Creek's confluence with the Allegheny River. Currently, Titusville Oil and Gas Associates Inc. has an NPDES permit to operate the SPWWTP, which treats shallow oil and gas wastewater from nearby stripper wells. This permit was approved in September 2014 and expires on August 31, 2019. Despite the issuance of the NPDES permit, the treatment plant has not yet been constructed, and therefore, is not operational. Prior to completion of this study, no previous comprehensive studies have been completed on Pithole Creek, though a sewage treatment plant survey was completed on the West Branch Pithole Creek and aquatic life use surveys have been completed near the mouth. Results from this study suggest Pithole Creek currently supports a healthy and diverse aquatic community.

At the time of this survey, as well as currently, the SPWWTP has not been constructed and a discharge is not operational. The SPWWTP was proposed to treat brine wastewater from nearby conventional oil and gas stripper wells. Stripper wells are generally characterized as wells nearing the end of production. Industrial brine wastewaters sometimes have notable concentrations of several constituents, including ammonia, calcium, magnesium, sodium, barium, boron, lithium, strontium, chlorides, bromides, sulfates, and total dissolved solids.

Water quality through the length of Pithole Creek was very good. Nutrient and metal concentrations were very low, well below the Department's water quality criteria. Constituents of a typical stripper well discharge (e.g. chlorides, bromides, sulfates, total suspended solids, and total dissolved solids) were also relatively low. In particular, chlorides and bromides were found at marginal concentrations. Differences among sites can generally be explained by the voracity of historic drilling practices within the watershed. A number of small metals seeps can be found through the basin. Additionally, there are a number of dirt or gravel roads within the basin contributing variable loads of fine sediment and small concentrations of metals or salts. Results from this study suggest water quality in Pithole Creek is not being significantly altered by these impacts. These findings are consistent for a stream buffered predominantly by forest.

Benthic assemblages observed in this study were robust with good numbers of pollution sensitive taxa through the length of Pithole Creek. Each site had at least twenty-four total taxa and sixteen EPT taxa.

Additionally, each site had at least seven mayfly taxa, which are commonly the first macroinvertebrates to decline from anthropogenic degradation. Pollution sensitive taxa comprised at least one-third of all individuals at each of the six sites, while pollution tolerant taxa (PTVs of eight or greater) totaled less than two individuals at each of the six sites. Two sites, 2PC and 5PC, had zero pollution tolerant individuals in their respective subsamples. Overall differences in the macroinvertebrate communities observed in this study are best explained by the differences in habitat. The upper reaches of Pithole Creek experience significant loading of fine sediment from dirt road runoff and beaver activity, leading to larger populations of midges and riffle beetles and a decline in the number of taxa requiring cobble and gravel habitat to survive. These results are consistent for a stream experiencing slight impacts from anthropogenic disturbances.

Pithole Creek is a relatively healthy stream supporting diverse and robust aquatic assemblages. Our macroinvertebrate samples scored well above the aquatic life use attainment threshold of 50 at each of the six sites and the PFBC has classified the mainstem of Pithole Creek, from its headwaters to its confluence with the Allegheny River, as a naturally reproducing trout stream. Additionally, Pithole Creek supports annual stocking allotments by the PFBC of brook, brown, and rainbow trout. Currently, the stream has low concentrations, below detection limits at some sites, of constituents commonly associated with brine discharges.

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Figure 1. Map showing Seaton Products Wastewater Treatment Plant discharge and sampling locations on Pithole Creek.

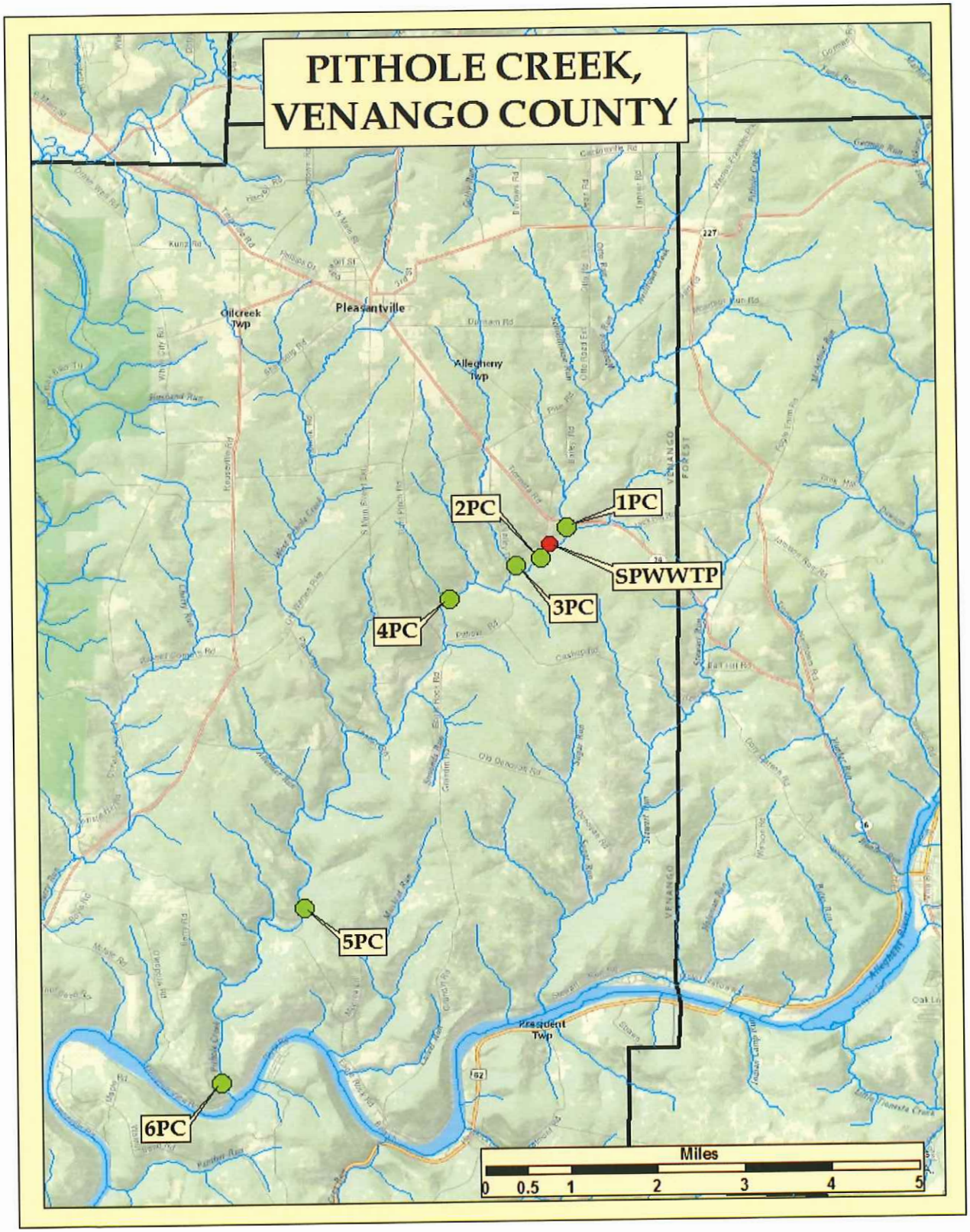

Table 1. Macroinvertebrates collected at six sites on Pithole Creek on May 18, 2016.

Taxa		Hilsenhoff Value	1PHC	2PHC	3PHC	4PHC	5PHC	6PHC
EPHEMEROPTERA (Mayflies)								
Ephemeridae	*Ephemera*	2	2				1	
Baetiscidae	*Baetisca*	4				1		
Isonychiidae	*Isonychia*	3	3	6	3	3	3	
Caenidae	*Caenis*	7	1			1		
Baetidae	*Acentrella*	4	24	33	50	59	69	33
	Baetis	6	8	1	8	2		1
	Acerpenna	6		1		2	2	
Ephemerellidae	*Eurylophella*	4	2	1	2	5	1	
	Drunella	1		1	9	6	7	10
	Ephemerella	1	7	3	2	15	6	8
	Teloganopsis	2				2	3	1
Heptageniidae	*Epeorus*	0					1	8
	Cinygmula	1					1	
	Maccaffertirum	3	13	4	14	5	3	1
	Leucrocuta	1	2					2
Leptophlebiidae	*Paraleptophlebia*	1		1			3	5
	Habrophlebiodes	6	1					
PLECOPTERA (Stoneflies)								
Nemouridae	*Amphinemura*	3		2	5	9		
Taeniopterygidae	*Taeniopteryx*	2		2				
Leuctridae	*Leuctra*	0	23	16	14	10	6	12
Perlidae	*Acroneuria*	0	1	1	1		1	4
	Paragnetina	1			1	1		3
	Perlesta	4			1		2	3
Perlodidae	*Isoperla*	2				1		1
Chloroperlidae	*Haploperla*	0	1				1	2
TRICHOPTERA (Caddisflies)								
Hydroptilidae	*Hydroptila*	6			1			
Hydropsychidae	*Cheumatopsyche*	6		1	1	1		
	Hydropsyche	5	2		5	3	2	3
Rhyacophilidae	*Rhyacophila*	1						2
Philopotamidae	*Chimarra*	4		1	2			
	Dolophilodes	0	9	25	18	11	22	58
Polycentropodidae	*Polycentropus*	6	1					1
Brachycentridae	*Micrasema*	2				4	1	
ODONATA (Dragonflies and Damselflies)								
Gomphidae	*Lanthus*	5			1	1		
MEGALOPTERA (Alderflies, Dobsonflies, and Fishflies)								
Corydalidae	*Nigronia*	2	1	1	2	6		
COLEOPTERA (Beetles)								
Psephenidae	*Ectopria*	5				1		
	Psephenus	4			1	1		
Elmidae	*Promoresia*	2			3			
	Oulimnius	5	1	1		1		
	Optioservus	4	35	26	35	21	3	9
	Stenelmis	5	1	4	2		1	1
DIPTERA (True Flies)								
Chironomidae		6	34	24	24	39	33	61
Athericidae	*Atherix*	2				1		
Empididae	*Clinocera*	6			1	1		
	Chelifera	6	1	4		7		
Simuliidae	*Prosimulium*	2	1		1			
	Simulium	6		8	24	9	19	5
Tipulidae	*Antocha*	3		1	2	3	1	2
NON-INSECT TAXA								
Cambaridae	*Cambarus*	6						1
Ancylidae		7				1		
Hydracarina		7				1		
Oligochaeta		10	2		2	2		1

Table 2. Raw macroinvertebrate metrics used to generate IBI scores from six sites on Pithole Creek.

Metric	1PHC	2PHC	3PHC	4PHC	5PHC	6PHC
Taxa Richness	24	24	29	34	24	26
Hilsenhoff Biotic Index	3.56	3.29	3.72	3.82	3.58	2.80
EPT Richness (PTV<4)	11	13	13	13	17	16
Beck's Index	19	17	18	16	26	29
% Sensitive Individuals (PTV<3)	35.8	37.5	31.9	31.8	31.2	50.0
Shannon Diversity	2.41	2.44	2.62	2.71	2.20	2.34
IBI Score	64.4	66.4	68.4	69.9	70.6	78.2

Table 3. Basic water quality data collected from six sites on Pithole Creek.

Field Parameter	1PHC	2PHC	3PHC	4PHC	5PHC	6PHC
Temperature (°C)	12.6	11.2	10.5	10.2	9.5	9.8
pH (Units)	7.66	7.48	7.95	7.43	7.56	7.55
Specific Conductivity (µS/cm)	93.7	94.9	123.8	155.1	130.8	141.0
Alkalinity (mg/L)	12	12	14	12	12	14

Table 4. Water chemistry grab samples from six sites on Pithole Creek.

Parameter	1PHC	2PHC	3PHC	4PHC	5PHC	6PHC
Phosphorus (mg/L)	0.012	0.012	0.012	0.010	<0.010	<0.010
Nitrite/Nitrate (mg/L)	<0.05	<0.05	0.05	0.06	0.06	0.06
Ammonia (mg/L)	<0.02	<0.02	<0.02	<0.02	<0.02	0.02
Calcium (mg/L)	6.867	7.034	8.323	9.910	9.890	9.700
Magnesium (mg/L)	1.933	1.976	2.336	3.002	2.916	2.886
Sodium (mg/L)	6.657	6.721	8.089	14.300	11.800	11.800
Aluminum (µg/L)	<200	<200	<200	<200	<200	<200
Arsenic (µg/L)	<3.0	<3.0	<3.0	<3.0	<3.0	<3.0
Barium (µg/L)	43.0	45.0	53.0	66.0	70.0	66.0
Boron (µg/L)	<200	<200	<200	<200	<200	<200
Iron (µg/L)	610	568	580	499	360	236
Lithium (µg/L)	<25	<25	<25	<25	<25	<25
Manganese (µg/L)	48.0	50.0	51.0	58.0	18.0	<10
Molybdenum (µg/L)	<70	<70	<70	<70	<70	<70
Selenium (µg/L)	<7	<7	<7	<7	<7	<7
Strontium (µg/L)	38.0	38.0	42.0	80.0	71.0	69.0
Zinc (µg/L)	<10	<10	<10	<10	<10	<10
Sulfates (mg/L)	7.19	7.58	7.44	7.41	7.25	7.61
Chlorides (mg/L)	11.78	12.20	16.47	31.40	25.59	26.31
Bromides (µg/L)	85.70	83.09	114.00	240.56	185.19	192.00
CBOD (mg/L)	6.30	3.80	6.30	3.50	5.80	3.30
TDS (mg/L)	72	72	84	110	100	98
TSS (mg/L)	14	<5	<5	<5	<5	<5
Alkalinity (mg/L)	18.0	20.4	22.8	22.0	23.4	23.6
Hardness (mg/L)	25	26	30	37	37	36
pH (Units)	7.2	7.2	7.2	7.2	7.3	7.3
Osmotic Pressure (mOsm)	<1	<1	<1	<1	1	1
Specific Conductivity (µmhos/cm)	100.1	101.1	117.7	169.0	150.7	150.1

Table 5. Habitat scores from six sites on Pithole Creek.

Parameter	Score Range	1PHC	2PHC	3PHC	4PHC	5PHC	6PHC
1. Instream Cover	0-20	11	16	11	13	18	18
2. Epifaunal Substrate	0-20	10	16	17	12	18	16
3. Embeddedness	0-20	8	11	13	11	15	16
4. Velocity/Depth Regimes	0-20	11	17	16	17	18	19
5. Channel Alteration	0-20	16	18	18	16	17	18
6. Sediment Deposition	0-20	15	14	15	10	15	14
7. Frequency of Riffles	0-20	8	15	13	11	18	18
8. Channel Flow Status	0-20	16	16	18	17	17	13
9. Condition of Banks	0-20	13	14	11	10	15	14
10. Bank Vegetative Protection	0-20	15	17	19	18	19	19
11. Grazing/Disruptive Pressures	0-20	15	16	19	18	20	20
12. Riparian Vegetation Zone Width	0-20	18	16	18	18	20	20
Total Score	**0-240**	**156**	**186**	**188**	**171**	**210**	**205**
Rating		Suboptimal	Suboptimal	Suboptimal	Suboptimal	Optimal	Optimal