

# Pike County Surface Water Quality Report 2023



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Pike County  
Conservation District

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## Introduction

Bioassessment is a standard today in the scientific community for monitoring the health and quality of streams. Streams are assessed by observing the macroinvertebrate and fish communities as they have been shown to exhibit changes in response to stressors, such as non-point source pollution. Bioassessment using macroinvertebrate and fish communities has been shown and accepted to be an effective tool in water quality monitoring practices nationwide. Since the late 1990s, Pike County Conservation District (PCCD or District) has been monitoring the surface waters of the county using biological, chemical, and habitat assessments.

Pike County contains over 1,800 miles of streams. These streams are almost all within the Pennsylvania Code, Title 25, Chapter 93, Water Quality Standards for either High-Quality (HQ) or Exceptional Value (EV). It is rare a county possesses surface water quality such as this and thus it is critical to monitor the conditions. Recreational activities focused on the surface water and the resources tied to it are also of vital importance to Pike County residents and the economy. It is critical the surface waters continue to be monitored for water quality changes. The information collected from monitoring is important for detecting significant disturbances as well as for long term planning within the county.

## Methods

District staff sampled stream sites established at the inception of the program as baseline and non-point source sites by their proximity to areas of development and point-source discharge. The macroinvertebrate sites are sampled in the spring (April-May) with each site being sampled on a three-year rotational schedule. The fish sites were sampled in the fall (August-September) with each site being sampled on a five-year rotational schedule. Stream reaches are determined by choosing an area (100ft) that best represents all habitat conditions in the stream to get the most accurate sample. The District works with the Pennsylvania Fish and Boat Commission on the permitting required and the timing of the sampling. In addition, the District works closely with the landowners who have provided permission to access the stream sites through their properties over the past 20 years so the data is consistent in area and scope.

### Habitat

Habitat assessments using the Pennsylvania Department of Environmental Protection (PADEP) Water Quality Network Habitat Assessment form are completed at each site. This form ranks twelve stream characteristics from 1 to 20 with 1 being poor and 20 being optimal. These characteristics include stream embeddedness, sediment deposition, condition of banks, and riffle frequency (Table 4).

## **Chemistry**

Chemical measurements from the stream site as well as air temperature are recorded on the PA DEP Flowing Waterbody Field Data Form. The chemistry measurements are collected using a YSI ProQuatro Meter which is owned by the District and checked and calibrated as needed at the beginning of each sampling day to ensure accurate readings. The meter has several different probes and can measure pH, galvanic dissolved oxygen (DO), temperature (C), and conductivity. The meter also detects barometric pressure and can calculate the total dissolved solids (TDS), salinity, and specific conductance. Alkalinity is measured using a Hach alkalinity test kit. The air temperature is measured with a field thermometer (Table 5).

## **Macroinvertebrates**

Macroinvertebrate community samples are obtained utilizing the protocol described by PADEP in the Water Quality Monitoring Protocols for Streams and Rivers 2021 document. In each stream reach, six separate one-minute kicks are done using a D-frame kick net with 500um mesh. Each kick lasts for one minute with the net directly downstream of the kick area. Kicks are done starting downstream and heading upstream and are spaced throughout the targeted stream area to get a composite sample. After each one-minute kick, the net is emptied into a sample jar for the site. All six kicks from each site are deposited in the same jar for a composite sample. The contents of each jar are then preserved with 90% isopropyl alcohol and sent to be identified and enumerated. In 2023, Mike Bilger and his team analyzed the macroinvertebrate samples for PCCD.

Several metrics are calculated using the information from macroinvertebrate sample analysis. Bilger identified and enumerated the macroinvertebrate samples for each site using white pans marked with grids to delineate twenty-one 2 inch by 2 inch squares. Grids are then randomly selected, and organisms identified until the sample reaches 200 individuals. The individuals are identified to genus and species, if possible. PADEP has assigned tolerance values to each species of macroinvertebrate. The tolerance values and numbers of individuals at each value are then used to calculate several metrics.

Six separate metrics were calculated by Rachael Marques of PCCD which are used together to determine the Index of Biotic Integrity (IBI) for the site (Table 6). These six metrics are:

- Total Taxa Richness
- Ephemeroptera + Plecoptera + Trichoptera Taxa Richness (EPT)
- Beck's Index
- Shannon Diversity Index
- Hilsenhoff Biotic Index
- Percent Sensitive Individuals

These are all standard metrics and are described further in the PADEP Assessment Book 2021. The IBI is calculated and is used as a way to standardize all of the above-mentioned metrics.

The maximum IBI score is 100. These values can be used to determine if the stream is considered attaining or impaired. Attaining means the water body is of good enough quality to meet the criteria and uses designated by Pennsylvania Code, Title 25, Chapter 93. Uses for water bodies as defined by Chapter 93 include special protections such as the High Quality (HQ) and Exceptional Value (EV) status of the streams in Pike County. They can also include uses such as Fishing, Potable Water Supply, Migratory Fishes, and so on. A water body is considered impaired when the data shows the waterway is no longer able to meet the designated use.

**Table 1.** Example from PADEP Assessment Book 2021 of the metrics and calculation of the Index of Biotic Integrity (IBI).

**Table 3.** Index calculation process for Lycoming Creek.

Metric	Standardization Equation (using large-stream standardization values)	Observed Metric Value	Standardized Metric Score	Adjusted Standardized Metric Score Maximum = 100
Total Taxa Richness	$(\text{observed value} / 31) * 100$	33	106.5	100
EPT Taxa Richness	$(\text{observed value} / 16) * 100$	22	137.5	100
Beck's Index	$(\text{observed value} / 22) * 100$	40	181.8	100
Hilsenhoff Biotic Index	$[(10 - \text{observed value}) / (10 - 3.05)] * 100$	3.47	94.0	94.0
Shannon Diversity	$(\text{observed value} / 2.86) * 100$	2.67	93.4	93.4
Percent Sensitive Individuals	$(\text{observed value} / 66.7) * 100$	48.8	73.2	73.2
Average of standardized core metric scores = IBI Score =				93.4

## Fish Communities

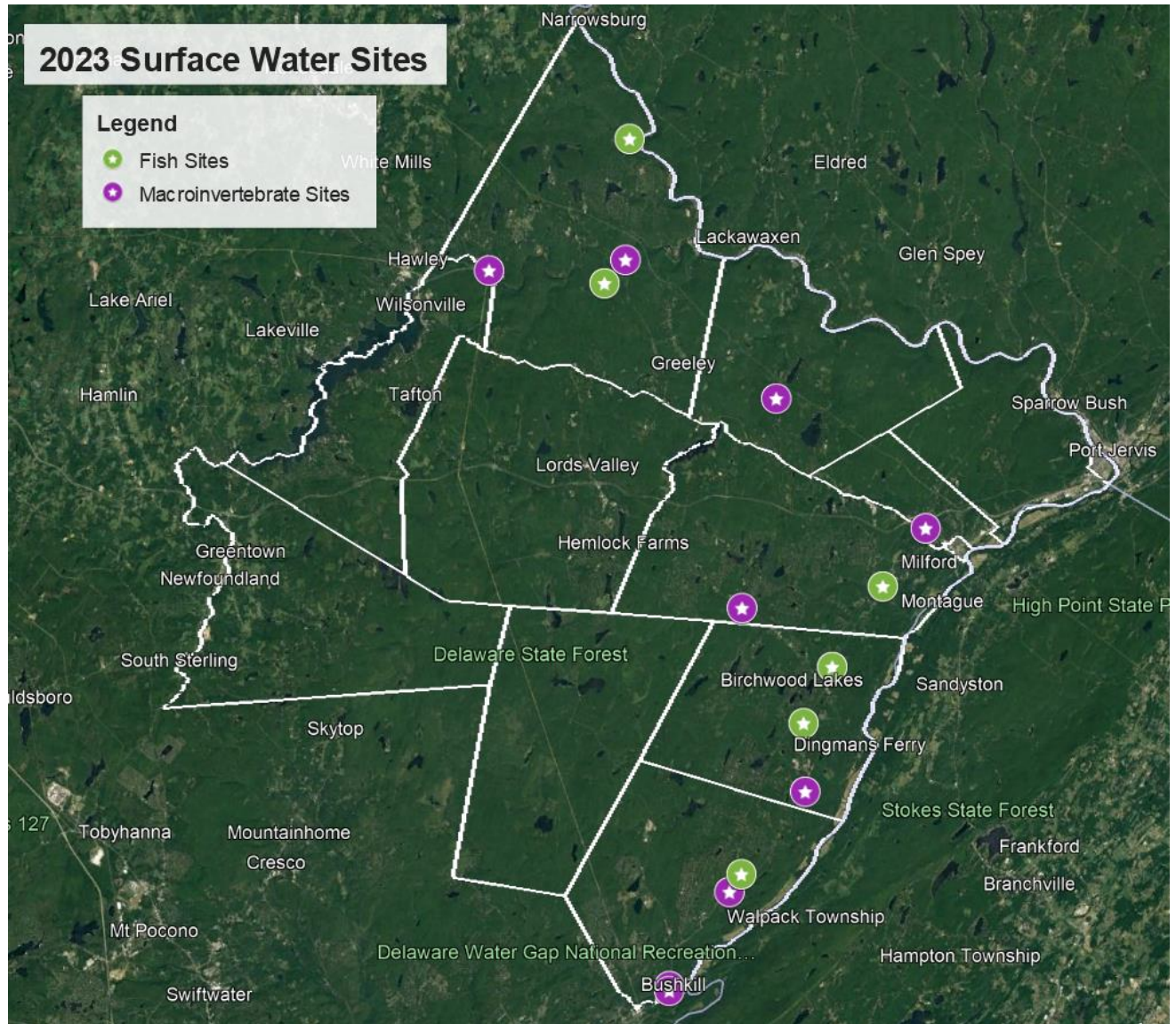
Fish communities are sampled using electrofishing procedures as outlined in the PADEP Water Quality Monitoring Protocols for Streams and Rivers 2021 document. Mike Bilger and Dave Isenberg operated their electrofishing equipment which includes a backpack with a battery, an anode staff, and a cathode to create a current. The voltage can be adjusted and varies by stream conditions such as conductivity. To sample as accurately as possible, the team moved upstream in a zig-zag movement instead of straight ahead. Each site was sampled until the group reached the end of the 100-meter stream reach. District staff, volunteers, and Bilger's team netted fish stunned by the current and all fish caught during that time were stored in a live well. Upon reaching the end of the stream reach, the fish were identified and enumerated, then returned to the stream as quickly as possible to avoid accidental mortality. Individuals were also observed for any abnormalities such as growths or deformities.

The Pennsylvania Department of Environmental Protection (PADEP) has begun using a metric, the Thermal Fish Index (TFI), to look at fish communities and stream health. The Thermal Fish

Index (TFI) is calculated as described in the PADEP Assessment Methodology for Streams and Rivers 2021. Each fish species is given a thermal class by PADEP as described in the Technical Development of a Thermal Fish Index. These values range from 1 to 5 with 1 being cold and 5 being warm thermal classes. The percentage of individuals in each sample belonging to each of the five thermal classes was calculated by Rachael Marques of PCCD and used to calculate a TFI value (Table 7). The values range from 2 to 10 with scores closer to 2 being an assemblage of cold water and 10 being an assemblage of warm water. Values in the middle would be considered transitional. These indices can be used to determine if a waterway is attaining or impaired for its assessed use.



## Sampling Stations



**Figure 1.** Site map of the surface water monitoring sites for the 2023 season.

## Macroinvertebrates:

**Table 2.** The stream sites sampled for macroinvertebrates in spring 2023.

Site ID	Stream Name
2	Big Bushkill Creek
3	Little Bushkill Creek
5	Hornbecks Creek
7	Adams Creek
15	Lackawaxen River
20N	Toms Creek
24N	Sawkill Creek
43N	Lackawaxen River
57N	Walker Lake Creek
58N	Dwarfskill Creek

## Fish:

**Table 3.** The stream sites sampled for fish in fall 2023.

Site ID	Stream Name
4	Toms Creek
6	Dingmans Creek
7	Adams Creek
8	Raymondskill Creek
16	Masthope Creek
40N	Westfalls Creek



## Results

### Habitat Assessments

**Table 4.** The data from the habitat assessment forms for each site using the PADEP Assessment Form.

	Big Bushkill Creek	Little Bushkill Creek	Hornbecks Creek	Adams Creek	Lackawaxen River	Toms Creek
<b>Site Number</b>	<b>2</b>	<b>3</b>	<b>5</b>	<b>7</b>	<b>15</b>	<b>20N</b>
<b>Date Sampled</b>	4/5/2023	4/5/2023	4/18/2023	4/18/2023	4/4/2023	4/5/2023
<b>Instream Cover</b>	20	20	10	20	20	20
<b>Epifaunal Substrate</b>	20	20	10	20	20	20
<b>Embeddedness</b>	18	20	20	20	20	20
<b>Velocity/Depth Regimes</b>	20	15	20	20	15	15
<b>Channel Alteration</b>	15	20	15	19	15	20
<b>Sediment Deposition</b>	18	20	20	20	18	19
<b>Frequency of Riffles</b>	20	20	20	20	20	20
<b>Channel Flow Status</b>	20	20	20	18	18	20
<b>Banks Condition</b>	20	11	20	18	19	15
<b>Bank Vegetative Protection</b>	13	19	15	20	20	20
<b>Disruptive Pressure</b>	20	20	20	20	20	20
<b>Riparian Vegetative Zone Width</b>	10	18	16	17	14	20
<b>Total Habitat Score</b>	<b>214</b>	<b>223</b>	<b>206</b>	<b>232</b>	<b>219</b>	<b>229</b>

**Table 4.** (continued)

	<b>Sawkill Creek</b>	<b>Lackawaxen River</b>	<b>Walker Lake Creek</b>	<b>Dwarfskill Creek</b>	<b>Toms Creek</b>	<b>Dingmans Creek</b>
<b>Site Number</b>	<b>24N</b>	<b>43N</b>	<b>57N</b>	<b>58N</b>	<b>4</b>	<b>6</b>
<b>Date Sampled</b>	4/20/2023	4/4/2023	5/16/2023	4/18/2023	8/28/2023	8/28/2023
<b>Instream Cover</b>	20	19	16	20	18	20
<b>Epifaunal Substrate</b>	20	20	20	20	20	20
<b>Embeddedness</b>	18	18	17	19	19	18
<b>Velocity/Depth Regimes</b>	18	15	16	19	18	17
<b>Channel Alteration</b>	15	15	15	15	18	20
<b>Sediment Deposition</b>	19	20	20	20	20	20
<b>Frequency of Riffles</b>	20	20	20	20	20	20
<b>Channel Flow Status</b>	16	18	20	20	20	20
<b>Banks Condition</b>	20	20	20	19	17	18
<b>Bank Vegetative Protection</b>	20	20	20	20	20	20
<b>Disruptive Pressure</b>	20	19	20	18	20	20
<b>Riparian Vegetative Zone Width</b>	17	20	20	15	16	17
<b>Total Habitat Score</b>	<b>223</b>	<b>224</b>	<b>224</b>	<b>225</b>	<b>226</b>	<b>230</b>

**Table 4.** (continued)

	<b>Adams Creek</b>	<b>Raymondskill Creek</b>	<b>Masthope Creek</b>	<b>Westfalls Creek</b>
<b>Site Number</b>	<b>7</b>	<b>8</b>	<b>16</b>	<b>40N</b>
<b>Date Sampled</b>	8/28/2023	8/14/2023	8/14/2023	8/14/2023
<b>Instream Cover</b>	18	20	20	20
<b>Epifaunal Substrate</b>	20	20	20	20
<b>Embeddedness</b>	20	18	20	19
<b>Velocity/Depth Regimes</b>	20	17	15	18
<b>Channel Alteration</b>	15	19	20	18
<b>Sediment Deposition</b>	17	18	20	17
<b>Frequency of Riffles</b>	20	16	20	20
<b>Channel Flow Status</b>	20	20	20	20
<b>Banks Condition</b>	18	15	20	15
<b>Bank Vegetative Protection</b>	20	20	20	20
<b>Disruptive Pressure</b>	20	18	20	20
<b>Riparian Vegetative Zone Width</b>	15	15	18	16
<b>Total Habitat Score</b>	<b>223</b>	<b>216</b>	<b>233</b>	<b>223</b>

## **Site Chemistry**

**Table 5.** Chemical data collected at each site with the YSI ProQuatro meter and Hach alkalinity kit. Total dissolved solids (TDS) and Salinity are blank for some sites because we had not yet started sampling for those parameters at the time of the field visit for that site.

	<b>Big Bushkill Creek</b>	<b>Little Bushkill Creek</b>	<b>Hornbecks Creek</b>	<b>Adams Creek</b>	<b>Lackawaxen River</b>	<b>Toms Creek</b>
<b>Site Number</b>	<b>2</b>	<b>3</b>	<b>5</b>	<b>7</b>	<b>15</b>	<b>20N</b>
<b>Date Sampled</b>	4/5/2023	4/5/2023	4/18/2023	4/18/2023	4/4/2023	4/5/2023
<b>Water Temp °C</b>	11.0	10.9	12.2	11.9	10.6	9.5
<b>Dissolved Oxygen (mg/L)</b>	11.91	11.25	10.25	10.22	12.3	11.38
<b>pH</b>	7.80	7.37	7.08	7.16	8.63	7.50
<b>Conductivity (uS/cm)</b>	58.1	46.4	125.8	85.3	69.6	95.6
<b>Specific Conductance (uS/cm)</b>	79.4	63.5	166.7	113.7	96.0	135.8
<b>Alkalinity (mg/L CaCO<sub>3</sub>)</b>	20	15	15	15	20-25	20
<b>TDS (g/L)</b>	0.0515	0.0413	0.1083	0.0739	0.0625	0.0882
<b>Salinity (ppt)</b>	0.04	0.03	0.08	0.06	0.05	0.06

**Table 5.** (continued)

	<b>Sawkill Creek</b>	<b>Lackawaxen River</b>	<b>Walker Lake Creek</b>	<b>Dwarfskill Creek</b>	<b>Toms Creek</b>	<b>Dingmans Creek</b>
<b>Site Number</b>	<b>24N</b>	<b>43N</b>	<b>57N</b>	<b>58N</b>	<b>4</b>	<b>6</b>
<b>Date Sampled</b>	4/20/2023	4/4/2023	5/16/2023	4/18/2023	08/28/2023	8/28/2023
<b>Water Temp °C</b>	9.9	9.6	17.3	8.9	17.6	20.8
<b>Dissolved Oxygen (mg/L)</b>	11.78	12.06	7.82	10.87	8.86	7.55
<b>pH</b>	7.68	8.16	6.40	6.32	7.54	7.36
<b>Conductivity (uS/cm)</b>	69.7	63.3	25.4	16.2	104.1	66.8
<b>Specific Conductance (uS/cm)</b>	97.9	89.7	29.8	23.4	121.4	72.7
<b>Alkalinity (mg/L CaCO<sub>3</sub>)</b>	15	20	10	10	25	15
<b>TDS (g/L)</b>	0.0636	0.0583	0.0144	0.0152	0.0789	0.042
<b>Salinity (ppt)</b>	0.05	0.04	0.02	0.01	0.06	0.04



**Table 5.** (continued)

	<b>Adams Creek</b>	<b>Raymondskill Creek</b>	<b>Masthope Creek</b>	<b>Westfalls Creek</b>
<b>Site Number</b>	<b>7</b>	<b>8</b>	<b>16</b>	<b>40N</b>
<b>Date Sampled</b>	8/28/2023	8/14/2023	8/14/2023	8/14/2023
<b>Water Temp °C</b>	18.1	20.5	21.1	18.3
<b>Dissolved Oxygen (mg/L)</b>	8.29	7.55	7.68	8.80
<b>pH</b>	7.15	7.17	7.65	7.72
<b>Conductivity (uS/cm)</b>	93.1	109.3	50.6	103.3
<b>Specific Conductance (uS/cm)</b>	107.2	119.7	54.6	118.4
<b>Alkalinity (mg/L CaCO<sub>3</sub>)</b>	20	25	10	10
<b>TDS (g/L)</b>	0.0697	0.0777	0.0355	0.0769
<b>Salinity (ppt)</b>	0.05	0.06	0.03	0.06

## Macroinvertebrates

**Table 6.** Index of Biotic Integrity calculations for the macroinvertebrate sites sampled in spring 2023.

	<b>Big Bushkill</b>	<b>Little Bushkill</b>	<b>Hornbecks Creek</b>	<b>Adams Creek</b>	<b>Lackawaxen River</b>	<b>Toms Creek</b>
<b>Site Number</b>	<b>2</b>	<b>3</b>	<b>5</b>	<b>7</b>	<b>15</b>	<b>20N</b>
<b>Total Taxa Richness</b>	25	35	32	32	34	27
<b>EPT Taxa Richness</b>	13	15	14	14	15	15
<b>Modified Beck's Index</b>	22	40	22	33	25	31
<b>Shannon Diversity Index</b>	2.12	2.82	2.77	2.83	2.74	2.42
<b>Hilsenhoff Biotic Index</b>	3.56	2.65	4.04	2.94	3.87	3.06
<b>Percent Sensitive Individuals</b>	48.82	66.20	41.31	65.07	37.33	50.00
<b>INDEX OF BIOTIC INTEGRITY</b>	<b>83.61</b>	<b>91.11</b>	<b>74.62</b>	<b>86.78</b>	<b>88.96</b>	<b>78.64</b>

	<b>Sawkill Creek</b>	<b>Lackawaxen River</b>	<b>Walker Lake Creek</b>	<b>Dwarfskill Creek</b>
<b>Site Number</b>	<b>24N</b>	<b>43N</b>	<b>57N</b>	<b>58N</b>
<b>Total Taxa Richness</b>	32	26	22	27
<b>EPT Taxa Richness</b>	17	16	7	9
<b>Modified Beck's Index</b>	41	23	8	19
<b>Shannon Diversity Index</b>	2.89	1.72	2.16	2.62
<b>Hilsenhoff Biotic Index</b>	2.75	2.17	5.39	4.03
<b>Percent Sensitive Individuals</b>	57.99	76.14	14.35	39.82
<b>INDEX OF BIOTIC INTEGRITY</b>	<b>90.75</b>	<b>90.69</b>	<b>46.36</b>	<b>66.13</b>

## **Fish Communities**

**Table 7.** The Thermal Fish Index (TFI) calculations for the 6 sites sampled for fish species in fall of 2023.

Toms Creek- 4		
Thermal Class	P Values	
1	0.01	0.01
2	0.52	1.04
3	0.47	1.40
4	0.00	0.00
5	0.00	0.00
	<b>TFI</b>	<b>4.92</b>

Dingmans Creek- 6		
Thermal Class	P Values	
1	0.00	0.00
2	0.07	0.13
3	0.81	2.44
4	0.09	0.35
5	0.03	0.16
	<b>TFI</b>	<b>6.18</b>

Adams Creek- 7		
Thermal Class	P Values	
1	0.00	0.00
2	0.01	0.02
3	0.89	2.66
4	0.07	0.28
5	0.03	0.17
	<b>TFI</b>	<b>6.26</b>

Raymondskill Creek- 8		
Thermal Class	P Values	
1	0.00	0.00
2	0.00	0.00
3	0.54	1.62
4	0.46	1.83
5	0.00	0.00
	<b>TFI</b>	<b>6.92</b>

Masthope Creek- 16		
Thermal Class	P Values	
1	0.00	0.00
2	0.00	0.00
3	0.90	2.71
4	0.10	0.39
5	0.00	0.00
	<b>TFI</b>	<b>6.20</b>

Westfalls Creek- 40N		
Thermal Class	P Values	
1	0.00	0.00
2	0.21	0.43
3	0.69	2.07
4	0.00	0.00
5	0.10	0.49
	<b>TFI</b>	<b>5.96</b>

## Conclusions

In 2023, all but one of the ten sites sampled for macroinvertebrates were considered attaining and not impaired.

According to the PA DEP Assessment Methodology, High-Quality (HQ) and Exceptional Value (EV) streams should have an IBI score of 63 or higher. Site 57N, Walker Lake Creek, was the only site to score significantly below the threshold. This does not necessarily mean that it is impaired. The Methodology also states that, for HQ and EV streams, IBI values lower than the baseline value by 11 or more points would be a cause for further investigation. This is the first time that the District has sampled this site as a part of the Surface Water Monitoring Program. This means that we have no baseline of comparison for this site. It is also relatively close to a wetland that certainly has an impact on the site. The proximity to the wetland could be the reason for the lower score. The District will sample here in the future to gather more data and determine what “normal” is for this stream section.

In terms of the new thermal fish index (TFI) for the 2023 fish sites, the values were spread out, but Toms Creek was at an ideal value. Values closer to 2 are more ideal and indicative of a colder water environment while values closer to 10 are potentially indicative of impairment and warm water conditions. This could have been due to many factors, which include the time of the sampling. Due to several heavy rainfall events during the sampling season, the District ended up having to sample later than anticipated but still within the acceptable window noted in the DEP protocol.

After speaking with the DEP Biologist Tim Wertz, it became apparent that the smaller streams of Pike County are very closely connected to other surface waters. Wetlands, lakes, and ponds typically attract different fish species could be part of the reason we found some warmer water fish species in the streams we sampled. These influences can be part of the reason that some of the values for the fish index ended up being higher than anticipated based on the water quality data PCCD has.

The District will continue to monitor the sites noted in the future to determine whether or not the numbers are outliers and not representative of the actual stream conditions. We will also be continuing to work with PADEP to assess the data we currently have and navigate the relatively new fish metrics.

In 2024, the PCCD will be monitoring eleven macroinvertebrate site and eight fish sites. The District is hoping to get back on track after an interruption of the normal rotational schedule due to COVID-19. PCCD will continue to monitor on the same rotational basis as has been done historically. The District will also be working on updating protocol as more information becomes available from PA DEP.

## **Literature Cited**

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# Appendix A

## Macro Species Table

Pike County Conservation District 2023 Macroinvertebrate Data

Species	2 Big Bushkill	3 Little Bushkill	5 Hornbecks Creek	7 Adams Creek
Chironomidae	87	29	53	27
Ephemerella spp ( E)	20	51	14	34
Simulium	0	0	1	2
Prosimulium	1	0	0	0
Isoperla (P)	16	3	10	44
Epeorus spp ( E)	31	18	0	0
Hydropsyche	6	3	18	4
Drunella spp. ( E)	8	13	0	0
Cheumatopsyche	3	9	11	2
Psephenus	1	3	6	5
Amphinemura (P)	0	0	18	15
Leuctra (P)	0	3	17	14
Paraleptophlebia ( E)	14	3	0	0
Teloganopsis ( E)	1	17	1	0
Promoresia	0	0	14	6
Stenelmis	1	4	4	0
Rhyacophila (T)	0	0	2	11
Acerpenna	0	0	5	2
Maccaffertium ( E)	2	0	2	0
Baetis	0	4	6	2
Acroneuria (P)	1	8	1	2
Diplectrona (T)	0	1	0	3
Chimarra (T)	1	0	4	5
Clitellata	5	6	0	0
Blepharicera	3	5	0	0
Optioservus	0	0	0	0
Oulimnius	1	2	2	3
Dolophilodes (T)	0	6	0	7
Acariformes	0	2	3	4
Isonychia ( E)	0	0	2	0
Stylogomphus	0	0	0	6
Collembola	0	0	0	10
Sweltsa (P)	0	0	0	4
Leucrocuta ( E)	3	2	1	0
Nigronia	0	0	0	1
Perlesta (P)	0	0	0	0
Gammarus	0	0	0	0
Hexatoma	0	1	0	0
Clinocera/Trichoclinocera	1	1	0	0
Polycentropus	0	4	1	2
Paragnetina (P)	0	2	1	0
Eurylophella ( E)	0	1	0	1
Hyaella	0	0	7	0
Pisidiidae	0	0	0	0
Pteronarcys (P)	0	0	1	1

Species	2 Big Bushkill	3 Little Bushkill	5 Hornbecks Creek	7 Adams Creek
Atherix	1	1	0	0
Caecidotea	0	0	0	0
Hemerodromia	0	0	0	0
Hypogastruridae	1	1	0	3
Tallaperla (P)	0	0	0	4
Cinygmula ( E)	0	0	0	0
Lepidostoma (T)	0	1	0	0
Diphetor	0	1	0	0
Agnetina (P)	0	0	0	0
Microcyloepus	0	0	3	0
Prostoia (P)	0	0	0	0
Dicranota	0	0	0	0
Argia	0	0	0	0
Probezzia	0	0	0	0
Ameletus ( E)	0	0	0	2
Glossosoma (T)	0	2	0	0
Rhithrogena ( E)	0	2	0	0
Wormaldia (T)	0	0	0	0
Macronychus	0	0	1	1
Aeschnidae	0	0	0	0
Antocha	0	2	0	0
Bolotoperla (P)	1	0	0	0
Gomphidae	0	1	0	0
Leptoceridae (T)	0	0	1	0
Hydroptila	0	0	0	0
Agapetus (T)	0	0	0	0
Psilotreta (T)	0	0	0	0
Culoptila/Protoptila (T)	0	0	0	0
Corduliidae/Libellulidae	0	0	0	0
Cultus (P)	1	0	0	0
Labiobaetis ( E)	0	0	0	0
Perlodidae (P)	1	0	0	0
Taeniopteryx (P)	0	0	0	0
Perlidae (P)	0	0	0	0
Corydalus	0	0	0	0
Pycnopsyche (T)	0	0	0	0
Tipula	0	0	1	0
Anchytarsus	0	0	0	1
Hydrophilidae	0	0	1	0
Lanthus	0	0	0	0
Staphylindae	0	0	0	1
Calopteryx	0	0	0	0
Habrophlebia	0	0	0	0
Neoplasta	0	1	0	0
Stegopterna	0	0	1	0
Tabanidae	0	0	0	0

Species	2 Big Bushkill	3 Little Bushkill	5 Hornbecks Creek	7 Adams Creek
Neureclipsis	0	0	0	0
<b>Total</b>	211	213	213	229

Species	15 Lackawaxen River	20N Toms Creek	24N Sawkill Creek
Chironomidae	54	14	18
Ephemerella spp ( E)	32	25	30
Simulium	0	0	0
Prosimulium	2	85	1
Isoperla (P)	1	5	2
Epeorus spp ( E)	2	14	24
Hydropsyche	20	3	5
Drunella spp. ( E)	16	8	11
Cheumatopsyche	2	0	21
Psephenus	6	2	26
Amphinemura (P)	0	3	0
Leuctra (P)	0	0	2
Paraleptophlebia ( E)	0	12	15
Teloganopsis ( E)	5	5	9
Promoresia	0	4	3
Stenelmis	12	0	0
Rhyacophila (T)	2	4	4
Acerpenna	0	0	0
Maccaffertium ( E)	5	0	0
Baetis	1	2	12
Acroneuria (P)	6	3	3
Diplectrona (T)	0	4	0
Chimarra (T)	2	0	0
Clitellata	3	0	0
Blepharicera	0	9	0
Optioservus	13	0	0
Oulimnius	0	3	5
Dolophilodes (T)	0	0	3
Acariformes	0	0	0
Isonychia ( E)	3	1	2
Stylogomphus	1	0	0
Collembola	0	0	0
Sweltsa (P)	0	3	3
Leucrocuta ( E)	2	0	0
Nigronia	1	0	2
Perlesta (P)	5	0	0
Gammarus	5	0	0
Hexatoma	0	4	3
Clinocera/Trichoclinocera	1	0	1
Polycentropus	1	0	0
Paragnetina (P)	0	1	3
Eurylophella ( E)	0	0	0
Hyaella	0	0	0
Pisidiidae	1	0	0
Pteronarcys (P)	0	0	2



Species	15 Lackawaxen River	20N Toms Creek	24N Sawkill Creek
Atherix	2	0	1
Caecidotea	0	0	0
Hemerodromia	5	0	0
Hypogastruridae	0	0	0
Tallaperla (P)	0	0	0
Cinygmula (E)	0	4	0
Lepidostoma (T)	0	0	1
Dipheter	0	1	2
Agnetina (P)	0	0	2
Microcylloepus	0	0	0
Prostoia (P)	2	0	0
Dicranota	0	1	1
Argia	0	0	0
Probezzia	0	1	0
Ameletus (E)	0	0	0
Glossosoma (T)	0	0	0
Rhithrogena (E)	0	0	0
Wormaldia (T)	0	0	0
Macronychus	0	0	0
Aeschnidae	0	0	0
Antocha	0	0	0
Bolotoperla (P)	0	1	0
Gomphidae	0	0	1
Leptoceridae (T)	0	0	0
Hydroptila	0	0	0
Agapetus (T)	0	0	1
Psilotreta (T)	1	0	0
Culoptila/Protoptila (T)	1	0	0
Corduliidae/Libellulidae	0	0	0
Cultus (P)	0	0	0
Labiobaetis (E)	0	0	0
Perlodidae (P)	0	0	0
Taeniopteryx (P)	0	0	0
Perlidae (P)	0	0	0
Corydalus	1	0	0
Pycnopsyche (T)	0	0	0
Tipula	0	0	0
Anchytarsus	0	0	0
Hydrophilidae	0	0	0
Lanthus	0	0	0
Staphylindae	0	0	0
Calopteryx	0	0	0
Habrophlebia	0	0	0
Neoplata	0	0	0
Stegopterna	0	0	0
Tabanidae	0	0	0

Species	15 Lackawaxen River	20N Toms Creek	24N Sawkill Creek
Neureclipsis	1	0	0
Total	217	222	219

Species	43N Lackawaxen River	57N Walker Lake Creek	58N Dwarfskill Creek
Chironomidae	19	44	46
Ephemerella spp ( E)	122	0	23
Simulium	0	83	37
Prosimulium	0	0	17
Isoperla (P)	3	0	8
Epeorus spp ( E)	0	0	0
Hydropsyche	4	1	1
Drunella spp. ( E)	5	0	0
Cheumatopsyche	1	4	0
Psephenus	1	0	0
Amphinemura (P)	1	0	12
Leuctra (P)	1	5	6
Paraleptophlebia ( E)	0	0	0
Teloganopsis ( E)	2	0	0
Promoresia	0	1	10
Stenelmis	1	16	0
Rhyacophila (T)	0	0	9
Acerpenna	0	14	10
Maccaffertium ( E)	2	17	0
Baetis	0	0	0
Acroneuria (P)	1	0	0
Diplectrona (T)	0	0	14
Chimarra (T)	2	5	0
Clitellata	1	3	0
Blepharicera	0	0	0
Optioservus	4	0	0
Oulimnius	0	0	1
Dolophilodes (T)	0	0	0
Acariformes	0	0	6
Isonychia ( E)	5	0	0
Stylogomphus	0	5	0
Collembola	0	0	2
Sweltsa (P)	0	0	0
Leucrocuta ( E)	2	0	0
Nigronia	1	4	1
Perlesta (P)	5	0	0
Gammarus	5	0	0
Hexatoma	0	0	1
Clinocera/Trichoclinocera	4	0	0
Polycentropus	0	0	0
Paragnetina (P)	0	0	0
Eurylophella ( E)	0	0	5
Hyaella	0	0	0
Pisidiidae	0	6	0
Pteronarcys (P)	1	0	0

Species	43N Lackawaxen River	57N Walker Lake Creek	58N Dwarfskill Creek
Atherix	0	0	0
Caecidotea	0	5	0
Hemerodromia	0	0	0
Hypogastruridae	0	0	0
Tallaperla (P)	0	0	0
Cinygmula ( E)	0	0	0
Lepidostoma (T)	2	0	0
Dipheter	0	0	0
Agnetina (P)	1	0	0
Microcylloepus	0	0	0
Prostoia (P)	1	0	0
Dicranota	0	0	1
Argia	0	3	0
Probezzia	0	0	2
Ameletus ( E)	0	0	0
Glossosoma (T)	0	0	0
Rhithrogena ( E)	0	0	0
Wormaldia (T)	0	0	2
Macronychus	0	0	0
Aeschnidae	0	2	0
Antocha	0	0	0
Bolotoperla (P)	0	0	0
Gomphidae	0	0	0
Leptoceridae (T)	0	1	0
Hydroptila	0	0	2
Agapetus (T)	0	0	0
Psilotreta (T)	0	0	0
Culoptila/Protoptila (T)	0	0	0
Corduliidae/Libellulidae	0	0	1
Cultus (P)	0	0	0
Labiobaetis ( E)	0	1	0
Perlodidae (P)	0	0	0
Taeniopteryx (P)	0	1	0
Perlidae (P)	0	1	0
Corydalus	0	0	0
Pycnopsyche (T)	0	0	1
Tipula	0	0	0
Anchytarsus	0	0	0
Hydrophilidae	0	0	0
Lanthus	0	0	1
Staphylindae	0	0	0
Calopteryx	0	1	0
Habrophlebia	0	0	1
Neoplasta	0	0	0
Stegopterna	0	0	0
Tabanidae	0	0	1

Species	43N Lackawaxen River	57N Walker Lake Creek	58N Dwarfskill Creek
Neureclipsis	0	0	0
Total	197	223	221



## **Appendix B**

### Fish Species Table

2023 Pike County Conservation District Fish Data

	4	6	7	8	16	40N
Species	Toms Creek	Dingmans Creek	Adams Creek	Raymondskill Creek	Masthope Creek	Westfalls Creek
Brook Trout	3	0	0	0	0	0
Brown Trout	164	6	1	0	0	22
American Eel	6	1	0	0	12	33
Blacknose Dace	128	50	97	0	2	38
Longnose Dace	0	0	0	38	11	0
Creek Chub	13	6	6	0	0	0
Cut-lip Minnow	0	0	0	0	15	0
White Sucker	0	14	0	0	0	0
Yellow Perch	0	3	0	0	0	0
Tesselated Darter	0	0	0	21	0	0
Shield Darter	0	0	0	0	5	0
Northern Hog Sucker	0	0	0	0	1	0
Red-breast Sunfish	0	0	0	5	0	0
Pumpkinseed	0	0	8	0	0	0
Margined Madtom	0	8	0	41	3	0
Fallfish	0	0	0	3	1	0
Redfin Pickerel	0	0	0	1	0	0
Smallmouth Bass	0	0	0	0	1	0
Bluegill	0	3	4	0	0	10
<b>Total</b>	<b>314</b>	<b>91</b>	<b>116</b>	<b>109</b>	<b>51</b>	<b>103</b>