Allegheny County Conservation District

Montour Run

Watershed Assessment and Implementation Plan

Funded by a Growing Greener Grant, part of the PA Environmental Stewardship Fund

Montour Run Watershed Association

ethos collaborative
water-energy-climate-community

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Background Information & Watershed Overview

i. Introduction

The overall purpose of this watershed plan is to restore and maintain the chemical, physical and biological integrity of waterbodies within the Montour Run Watershed, as set forth in the Clean Water Act of 1972. Additionally, this plan seeks to protect and conserve areas within the watershed that are currently unimpaired and considered "attaining" by the USEPA. Under PA State Code Title 25 (Environmental Protection), Chapter 93, the whole of Montour Run and tributaries has a protected water use of "TSF" or Trout Stocking, indicating that the water quality goal is the maintenance of stocked trout from February 15 to July 31, as well as the maintenance and propagation of flora and fauna that are indigenous to a warm water habitat. However, Montour Run is listed as a Category 1 Priority watershed on the 303(d) listing established by the Pennsylvania Department of Environmental Protection, meaning that it is "impaired" for aquatic life and there are identified pollutants or pollution that need to be mitigated. Impairments previously identified in the watershed include both acidic and net alkaline Abandoned Mine Drainage (AMD), de-icing agents and ammonia in runoff from airport operations, sediments and associated erosion and siltation, and nutrients (Thorne 2000). A TMDL developed in 2004 addressed AMD and stated that other needs would be addressed at a later date, particularly nutrients and sediment (PA DEP 2004). In particular, future growth is anticipated as the Southern Beltway Projects have the potential to create greater connections between the western Montour Watershed and the South Hills of Pittsburgh. This plan is an opportunity to record the main sources of water body impairment, identify priority conservation areas and outline a strategy for future efforts.

This work was funded by a Growing Greener grant, which is part of the PA Environmental Stewardship Fund. The ESF is a dedicated funding stream generated by dump tipping fees, and by law must allocate 37.4% of fees to abandoned mine remediation and watershed-based conservation efforts (Growing Greener Coalition 2013).

Stakeholders and Watershed Partners in the Montour Run Watershed

This plan is aimed at providing concrete guidance to key watershed partners and stakeholders, including watershed residents, businesses, landowners, community organizations, government groups, and environmental organizations. Importantly, this work builds on efforts already completed by these various stakeholders.

The Montour Run Watershed Association (MWRA) actively promotes watershed stewardship and implementation of water quality/environmental improvement aims. Stated goals include addressing problems in the watershed such as flooding, erosion, and abandoned mine drainage. The Hollow Oak Land Trust and Allegheny Land Trust (ALT) work to protect ecologically-significant areas of land in the Greater Pittsburgh Region through landowner conservation agreements. The Allegheny County Conservation District supports conservation efforts as they pertain to water quality, sustainability, and development and ensures that all federal and state regulations are followed.

Local organizations and clubs that provide outdoor recreation opportunities also have a vested interest in improving ecological quality in the Watershed. The Montour Trail Association maintains the 60+ mile long Montour Trail enjoyed by over 400,000 people annually. Local sporting clubs, including the Forest Grove Sportsmen's Club, the West Allegheny Chapter of Ducks Unlimited, and the Penn's Woods West Chapter of Trout Unlimited, are also deeply involved in the health of the Montour Run Watershed due to their close relationship with the natural resources it provides.

At the municipal level, local governments continue to grapple with issues that directly affect their residents, including regulatory requirements to reduce pollutant-laden runoff that is directed to the streams and increasing flooding concerns in Montour Run. Municipal representatives dealing in stormwater and related problems meet regularly as part of the Western Allegheny Stormwater Awareness Group, (WASAG) to share information and stay informed of progress.

Watershed Overview

The Montour Run Watershed is located at the western edge of Allegheny County, in southwestern PA. The Montour Run watershed is 36.6 square miles in size. Subwatersheds were grouped together to better categorize the problems each region experiences. For the puposes of this assessment, the watershed was divided into 6 subwatershed areas. **(Figure 1.1.1).** These subwatershed groupings were largely determined by influences/pollution sources and development patterns within each subwatershed. The PA DEP 303(d) listing for Montour Run is Stream Code 36684 within Watershed 20G; the hydrologic unit code (HUC) for the Watershed is 0503010. The Montour Run watershed includes areas of 6 different municipalities, including Moon Township, Coraopolis, North Fayette Township, Robinson Township, and Findlay Township.

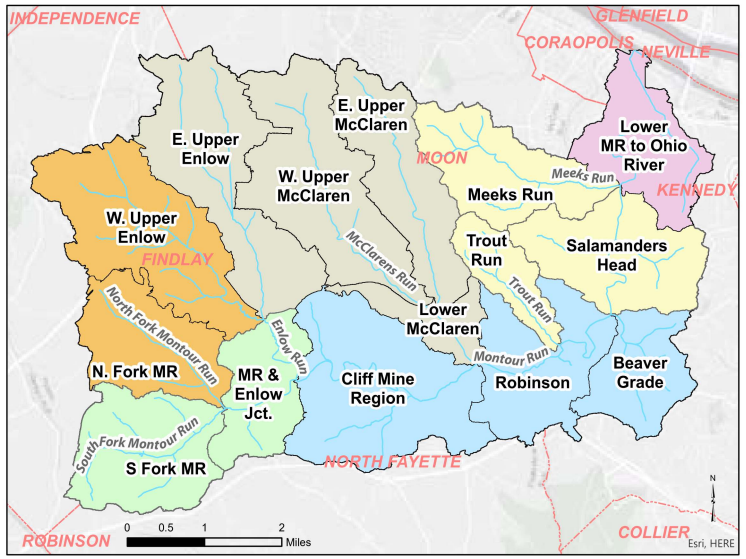

Figure 1.1.1-Montour Run watershed with the subwatershed groups delinated.

The western areas of the watershed encompass the headwaters of the North and South Forks of Montour Run. There is a history of strip mining and deep mining of coal in this area that has left vacant reclaimed land yet to be developed. The area is more rural in character with rural housing and a few warehouse developments. The northern and central regions are dominated by the Pittsburgh International Airport, the 911th Airlift Wing and the 171stAir Refueling Wing Air Force Reserves Base. The southern and eastern areas are largely suburban residential developments, highways and shopping malls with some commercial/industrial complexes. Interstate 376 runs through the center of the watershed and serves as the main transportation corridor to regions west of the City of Pittsburgh as well as between Pittsburgh and the airport.

The Montour Run Watershed contains several lands dedicated to recreation and conservation **(Figure 1.1.2)**. The Montour Run Trail, formerly the Montour Railroad line, begins on the western edge of the watershed, near the Ohio River, and runs along Montour Run for several miles. Connectors from the Montour Run Bike Trail include a trail to the Pittsburgh International Airport and other connectors that allow car-free access to locations throughout the South Hills neighborhoods.

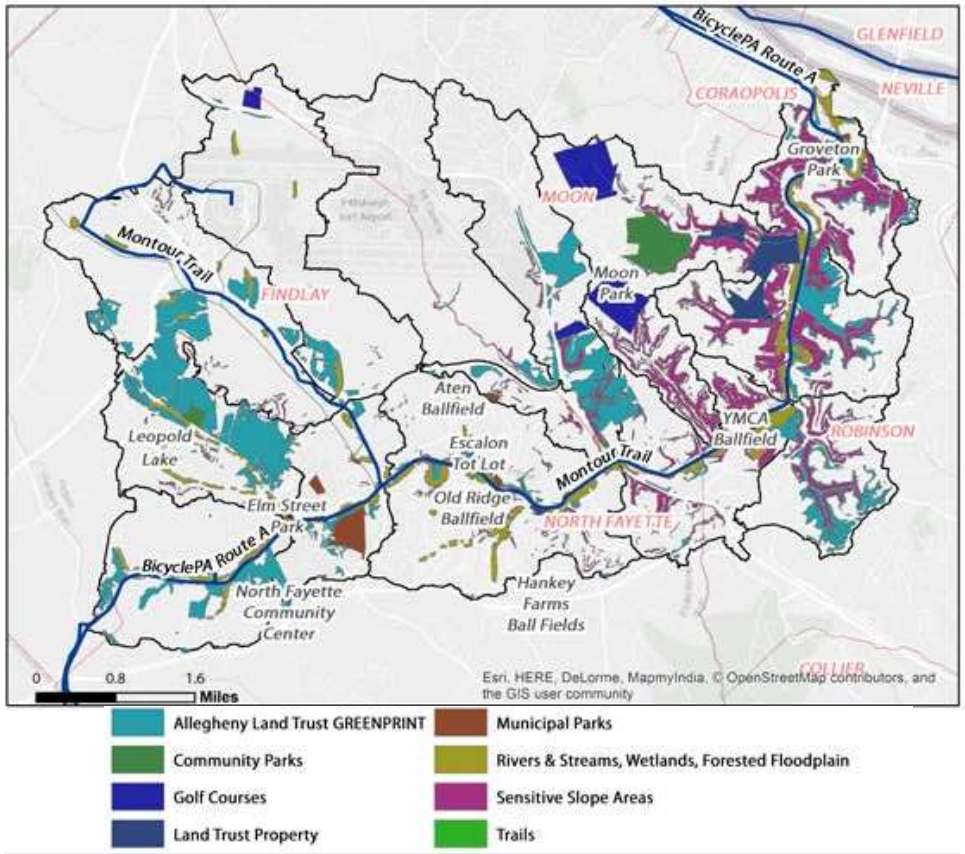

Figure 1.1.2-Montour Run watershed parks, conservation areas, and trails. (Pennsylvania Dept of Conservation and Natural Resources Bureau of State Parks 2015; Allegheny County Division of Computer Services Geographic Information Systems 2010; Bureau of Recreation and Conservation, Pennsylvania Department of Conservation and Natural Resources 2018)

Three areas identified in the Allegheny County Natural Heritage Inventory are found in the Watershed - the Montour Run Landscape Conservation Area (LCA), the Clinton Wetlands Biological Diversity Area (BDA), and the Ohio River BDA. The Western Pennsylvania Conservancy has identified these sites as some of the County's most significant natural areas.

The Hollow Oak Land Trust manages three Conservation Areas within the Montour Run Watershed. The Montour Woods Conservation Area is a ~300 acre property adjoining the Montour trail. The property emcompasses the confluence of Meeks Run and Montour Run. Meeks Run is one of two "Non-Impaired" streams in the Montour Run Watershed. The Forestbrook Conservation Area is ~7-acre of wetland area in North Fayette Township at mile 6 of the Montour Trail. This Conservation Area provides a wide flood-plain for the stream and a variety of habitat for fish, aquatic insects, birds, and other species. Finally, the Trout Run Conservation Area is ~88 acres of property ecompassing the other non-impaired stream in the watershed, Trout Run. The woodlands along Trout Run are dominated by stands of eastern hemlock trees above cliffs lining the stream valley. A second stream forms another valley down to Montour Run Road, near the former West Area YMCA.

Future conservation goals include further development of a greenway/trail system. The Trout Run Conservation Area is a capstone for this Montour Woods Greenway. The vision for this greenway includes a continuous 10-mile trail linking two conservation areas, with Moon Township Park and the Montour Trail. When complete, the greenway loop will extend up Trout Run parallel to Hookstown Grade Road to the public Moon Golf Club, crossing Beaver Grade Road to Moon Park, descending Meeks Run valley through Montour Woods Conservation Area, then following three miles of the Montour Trail.

Geography, Topography, Geology, Soils

The Montour Run Watershed is in the Pittsburgh Low Plateau physiographic province. To the north, this province is bordered by areas that were glaciated in the last glacial maximum. To the south, the Pittsburgh Low Plateau borders the Allegheny Front and Allegheny Mountains. The Montour Run landscape is composed of narrow valleys and smooth hilltops, creating a dendritic drainage pattern. Found in abundance are the Pittsburgh Red Beds, a sequence of claystones that are extremely susceptible to landslides when exposed by cuts for construction. Most of the landslides in the area have happened after a slope was over-steepened, overloaded, or modified in the course of development. The area has also been mined extensively, creating additional instabilities. Rocks are alternating layers of sandstone, coal, shale, siltstone and mudstone. The watershed contains strip mines and land reclaimed from mining. This legacy is discussed further in later sections.

ii. Water Resources

Precipitation

Pittsburgh averages 38.2 inches of precipitation per year. However, since 2016, the region has received ever-increasing rainfall amounts each year. In 2016, rainfall was 2.7 inches above average, in 2017, 8 inches above average, and in 2018 Pittsburgh received nearly double the average amount of rainfall, 33.8 inches above average **(Figure 1.2.1)**. The Pennsylvania Department of Environmental Protection [DEP] predicts the conditions will increase flooding in the winter and spring, as we experience more intense rainfall, and droughts in the summer and fall, as the snow evaporates earlier due to warmer temperatures.

Surface Water, Wetlands, Ponds

The main stem of Montour Run trends westerly for approximately 12.9 miles from where it empties into the Ohio River. The stream exhibits a dendritic drainage pattern. The stream runs through a valley with relatively steep sides, and a small floodplain on either side of the stream. This relationship between stream and banks creates a Sinuosity Index of approximately 1.4 along the length of the stream, classifying this stream as "twisty". In all, 48 stream miles in the Montour Run watershed are listed as "non-attaining" and 16 mile as "attaining" and the remaining small streams are unclassified.

The region contains no large natural ponds. There are a number of small man-made reservoirs that were constructed for specific purposes: recreation, stormwater detention, AMD treatment. In total, these ponds cover ~90 acres of the watershed. There are a number of small wetlands scattered throughout the watershed. In all, there are 92 acres classified as wetlands, range in size from ~ 0.1 acre to 6 acres. The wetlands are located for the most part in the riparian areas of streams.

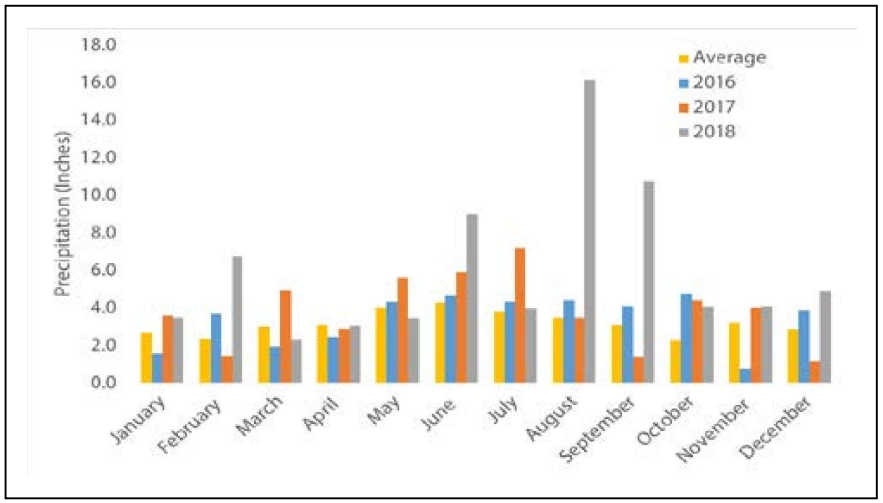

Figure 1.2.1- Monthly precipitation for the Pittsburgh Region.

iii. Previous Efforts to Identify and Address Pollution Sources

Areas of the Montour Run Watershed have been the focus of efforts on the part of conservation groups and the PA Department of Environmental Protection. Over the years, these stakeholders have worked to evaluate and improve water quality in the Montour Run Watershed, successfully reducing the effects of abandoned mine drainage and improving aquatic habitat. The extent of previous efforts discussed below highlights the additional improvement work needed to continue this trajectory.

Previous Water Quality Studies

Montour Run has long been identified as having impaired water quality. Stakeholder groups from private, public, and government sectors examined stream water quality and submitted studies over the years. These studies helped to define the water quality issues in Montour Run, focus restoration efforts, and build community support for conservation.

The Montour Valley Alliance, a precursor to the currently existing Montour Run Watershed Association, commissioned a study in 1997 from the Army Corps of Engineers detailing the water quality and aquatic life resources. Identified issues included streambank erosion, siltation with an accompanying decrease in habitat quality, flooding, and in particular degraded water quality from (AMD) and de-icing solutions used at the Pittsburgh International Airport. Notably, de-icing operations resulted in high biological oxygen demand and ammonia concentrations in affected streams (Thorne 2000).

The same de-icing chemicals were cited as cause for concern in a May 2000 PA Fish and Boat Commission

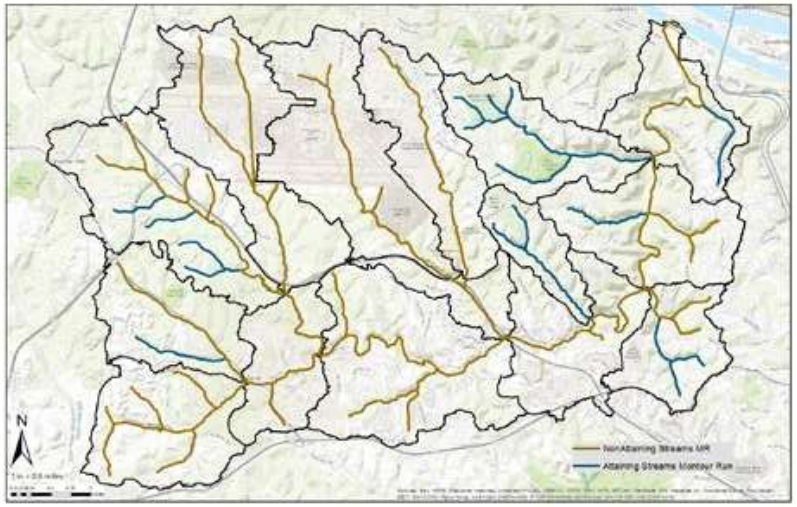

Figure 1.3.1-Attaining and non-attaining streams in the Montour Run Watershed.

study that examined the possibility of Montour Run for fish stocking (Smith and Lorson 2000). Urea, propylene glycol, and ethylene glycol were used as de-icing chemicals, producing toxic chemicals and excessive bacteria growth that decreased habitat quality.

Habitat improvements observed in a follow-up study in 2002 led to the beginning of fish stocking in 2003 (Lorson and Smith 2002). The follow-up study also documented the change to more environmentally friendly de-icing chemicals used by the Pittsburgh International Airport beginning in 1997.

A River Conservation and Land-use Plan for the Montour Run Watershed was written in 1999 in response to dramatic changes in land development within the watershed when it became clear that water quality and biological resources were being degraded.

The Montour Run River Conservation and Land Use Plan detailed cultural, historical, and natural resources, impairments within the watershed and provided management recommendations (1999, KCI Technologies, Inc). While some recommmendations from this plan have been implemented, others remain unchanged and just as relevent today when the plan was written.

In 2003, BIOMOST, INC., in conjunction with the Montour Run Watershed Association, published the Abandoned Mine Drainage Cleanup Plan, an assessment of abandoned mine discharge sites that affected stream water quality. This plan identified thirteen abandoned mine drainage sites in the watershed and evaluated twelve of those sites for potential treatment options.

These early assessments provided the groundwork for this Watershed Assessment and Implementation Plan. This assessment seeks to improve water quality by examining the watershed as a whole, identifying pollutant sources across the landscape, and defining mitigation strategies to address these contaminants.

Table 1.3.1-Causes of Impairments for Reporting Year 2004. From the ("Waterbody Quality Assessment Report | Water Quality Assessment and TMDL Information | US EPA" n.d.)

Cause of Impairment	Cause of Impairment Group	State TMDL Development Status
Ammonia, un-ionized	Ammonia	TMDL needed
Metals (other than Mercury)	Metals (other than Mercury)	TMDL completed
Nonpriority Organics	Toxic Organics	TMDL needed
Nutrients	Nutrients	TMDL needed
Organic Enrichment/Low Dissolved Oxygen	Organic Enrichment/Low Dissolved Oxygen	TMDL needed
Siltation	Sediment	TMDL needed
pH	pH/Acidity/Caustic Conditions	TMDL completed

Impaired and Un-impaired Stream Reaches in the Montour Run Watershed

The DEP developed TMDL's for stream sections that were identified in the 1996 Pennsylvania Section 303(d) listing of impaired waters (PA DEP 2004). In all, the PA DEP classified 48 stream miles in the Montour Run Watershed as "non-attaining" and 16 mile as "attaining" and the remaining small streams are unclassified (**Figure 1.3.1**).

The impairments identified by the PA DEP and their current TMDL status are discussed below (**Table 1.3.1**), with text outlining current status of these impairments and efforts to remediate them. It is noteworthy that the TMDL document only establishes limits for abandoned mine related problems such as acidity and metals, while stating that the other impairments should be studied more in-depth and evaluated for TMDL at a later date.

Assessing & Quantifying Watershed Health

i. Specific Conditions Contributing to Non-Attainment or Threatening Attainment

Pollution inputs are dominated by non-point sources in the Montour Run Watershed. For this reason, they are often challenging to address. This section identifies and quantifies sources that are causing the ongoing water quality problems in Montour Run. These sources will need to be abated or controlled to achieve the load reduction needed to significantly improve water quality.

Pollution Sources from Mining Related Impairments

The legacy of coal extraction efforts, both via surface mines and deep mines, has significantly impacted the Montour Run Watershed. Mining related impairments include sections of the stream that are affected by Abandoned Mine Drainage (AMD) and strip mine spoil piles. Runoff across these sites, and drainage from them, can contribute mining-related metals, acidity, and alkalinity to the stream. The main stem and many of the tributaries are listed as "impaired" by metals and pH in the watershed, and this category of impairment has received the most attention and management. The 2003 Abandoned Mine Drainage Cleanup Plan identified and assessed 13 abandoned mine discharge sites that affected stream water quality (**Figure 2.1.1**). This report also identified 5 sites considered "high priority", with the potential to significantly improve water quality should these sites be remediated.

Many of the sites identified in the 2003 AMD report have discharges with measured pH as low as 3.2. However, within the text of the 2004 TMDL the pH impairment for each site is categorized as "NOT addressed" and the lowest pH measured as part of the TMDL establishment process is 6.9, at the mouth of Milk Run. Previously, the 1996 report by the ACE also identifies some notably low pH readings in stream water or AMD drainages, particularly the Clinton AMD area with measured pH around 3. However, the authors of the report also note that "the use of locally available alkaline steel mill slag for fill, and as a concrete and bituminous aggregate [..] in massive highway, airport, and commercial construction projects in the basin, and exposed alkaline limestone in lower elevations of the Conemaugh Group strata, all tend to neutralize the acid produced by the Pittsburgh Coal Seam mining operations."

In other words, the geology and use of alkaline steel slag as a fill material in local building operations mitigate the pH impairment caused by upstream landscapes with acidic mine drainage. Ongoing mine drainage treatment, geology and use of slag in this watershed may alleviate the pH impairment enough that the stream could potentially be de-listed for pH.

Impairments Related to Toxic Organics

Although toxic organics are also listed as a source group causing impairment, the impairment in the Montour Run Watershed itself is identified as sources from nonpriority organics. Nonpriority organics are groups of pollutants

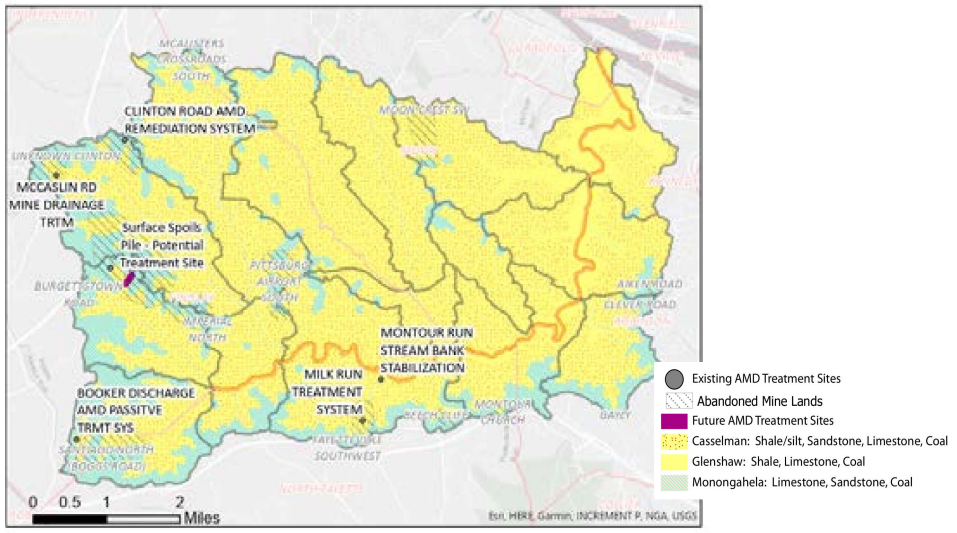

Figure 2.1.1-Mine Discharge points, AMD Treatment Systems and geology

which do not bioaccumulate or biomagnify up the food chain, but are considered toxic to aquatic life/human life. Priority pollutants are specific chemical pollutants for which there exist a set of published analytical testing procedures. In Montour Run, impairments due to toxic organics are noted along the entire length of the main stem, however the individual toxic substances are not specified. In the absence of more information, we assume that the toxic organics are the result of undifferentiated urban run-off from this developed stream corridor. The USEPA does not specify water quality standards for non-priority toxic organics. The best approach is to reduce urban run-off through the use of best managment practices (BMPs) that promote infiltration of water and nutrient retention.

Runoff Related Impairments

Runoff from stormwater causes erosion,siltation and sedimentation in Montour Run, and the associated water quality effects are identified as widespread issues affecting stream water quality. Sources of erosion and sediment are numerous, and include runoff from urban/paved areas, construction sites, agricultural areas and barren land. Excess stormwater runoff erodes stream banks and transports sediments and any other nutrients to the stream. Frequently, erosion and siltation increases the Total Suspended Solids (TSS) found in stream water. TSS are defined as solids in water that can be trapped by a filter. The solids consist of diverse materials including clay particles, metals, suspended organic particles, silt, and decaying plant and animal matter. Suspended sediment can cloud water, increase water temperatures, and lead to other problems such as low dissolved oxygen that ultimately affect habitat quality. Sediment deposition can coat stream substrate, decreasing overall habitat quality and availability. Evidence of this sedimentation problem can be observed on aerial photograph images and internet mapping applications such as Google/Bing maps as sediment laden water and the accumulation of sediment and a "sandbar" where Montour Run empties into the Ohio River **(Figure 2.1.2)**.

Nutrients/Low Dissolved Oxygen Impairments

Nutrient impairments, and the associated problems of low Dissolved Oxygen (DO) in stream water, frequently co-exist with sedimentation and erosion. Commonly,

Figure 2.1.2-Sediment-laden water drains from Montour Run (center, bottom of image) into the Ohio River. Blue arrows indicate two regions of visible sediment accumulation. Image downloaded from Google Maps-Imagery 2020

nutrient impairments are associated with phosphorus and fixed nitrogen concentrations in the stream water, although there is not a specific water quality standard for either. Runoff from urban surfaces, agricultural lands, sewage/septic systems, and other land cover delivers excess dissolved and particulate nutrients to streams. Nutrients promote algae growth, and the resulting growth reduces available DO in stream water. Nutrients and low DO impairments are widespread across the Montour Run Watershed.

Impairments Related to Un-Ionized Ammonia

The entire main stem of Montour Run is listed as "impaired" for ammonia. Ammonia is a breakdown product of urea, which can be sourced from de-icing compounds, municipal waste facilities, and sewage. The ACOE 1997 report measured Montour Run ammonia concentrations above the confluence with Enlow Run at 0.2 mg/L, while the concentrations rose to ~1.27 mg/L and higher below the confluence. In the headwaters of MClaren's and Enlow Runs (both draining the airport), concentrations were measured as high as 53.3 mg/L. This suggests that even with the presence of a municipal landfill facility (in the headwaters of the South Fork) and the potential for contributions from septic tanks, leaky sewers, and fertilizer, airport sources of ammonia dominate.

The current water quality standard for both chronic and acute exposure to ammonia is dependent on the temperature and pH of the water at the time the sample was taken. In the environment, urea is hydrolyzed by soil enzymes to ammonium, a process that also increases pH of the surrounding soil. When pH is higher, the un-ionized species, or ammonia (NH3), is present in increasingly higher concentrations compared to the ionized species ammonium (HN4+). Aquatic organisms cannot excrete ammonia from their bodies when stream water also contains ammonia, leading to buildup in internal tissues/blood and potentially death (EPA website, https://www.epa.gov/wqc/aquatic-life-criteria-ammonia). Un-ionized ammonia (NH3) is toxic even in relatively low concentrations to aquatic life.

High amounts of ammonia/ammonium in the soil also add to the nutrient problem downstream. Ammonia can be nitrified by soil bacteria. Denitrification in water-logged soils produces nitrate, gaseous nitrous oxide, gaseous nitric oxide and gaseous nitrogen. The gasses may be lost to the atmosphere, contributing to regional atmospheric nitrogen problems. Nitrate is easily transported by water and can contribute to downstream nutrient enrichment. Nitrate retained by the soil can be immobilized via uptake by plants, as nitrate is the preferred nitrogen format.

Ammonia is an impairment that should be examined carefully. In communications with airport environmental officers, it was revealed that urea was no longer being used as a de-icing compound. As this was the predominant source of ammonia identified in the ACOE report, if this ammonia source is removed and concentrations are significantly reduced in stream water as a result, Montour Run could potentially be re-evaluated and de-listed for the Ammonia impairment.

Flooding and Flood Zones

Flooding in the Montour Run Watershed damages property and infrastructure (bridges, roads), delivers pollution to the stream, and increases streambank erosion and in-stream sedimentation. The Federal Emergency Management Agency, or FEMA, has designated the riparian regions of the Montour Run main stem and most tributaries as "High Risk," with specific designations indicating a 1% annual chance of flooding. Climate change is predicted to bring more intense storms to the Pittsburgh Area in the future, which will exacerbate flooding risks. Increasing development pressures, particularly in the rural North and South Fork subwatersheds, will add to downstream flooding impacts.

Point Sources

Although non-point source pollution is the primary pollutant of interest in Montour Run, there are also permitted point sources of pollution that discharge directly to the stream. These include:

- The Imperial Landfill, discharges to the South Fork near Boggs Road.
- Municipal Separate Storm Sewer System (MS4's) discharge pipes, throughout the watershed. MS4's commonly collect non-point source pollution and discharge to the stream directly.
- Leonard L. Nary Wastewater Treatment Plant, Moon Township Sanitary Authority.
- The Robinson Township Municipal Authority Wastewater Treatment Plant. This does not directly discharge into Montour Run, but instead discharges into a tributary.

Municipal Survey Results

Municipal representatives that attended the Western Allegheny Stormwater Awareness Group (WASAG) meetings were invited to provide input on known stormwater problems in their regions, including zones with frequent flooding or regions that were highly eroded **(Figure 2.1.3)**. The input they provided largely coincided with observations of eroded or cut banks, sedimentation, and frequently flooded areas.

Existing water use in the watershed: Participants in the municipality poll also responded to questions about the source of their drinking water and sewage treatment facilities. The source of drinking water for residents of Montour Run does include groundwater sources and surface water sources **(Table 2.1.1)**. Sewage is treated primarily within municipality-managed treatment plants, with some small percentage overall of on-lot sewage treatment.

Location	Municipality	Complaint
7	Coraopolis	Heavy sediment from erosion
8	Coraopolis	Stream culvert flooding
17-Nyetimber Area	Moon	Flooding and mine drainage
18-Rosemont/Globe Car Wash/Parking	Moon	Flooding
19-Rosemont Mine Drainage	Moon	Mine drainage
20-Toad Hollow Road	Moon	Londonbury Pool, flooding
21-Sharon Hill Forest Glen	Moon	Flooding, Polo Club to Thorn Run Road Ext.
22-Lark & Philomena Drives	Moon	Flooding
23-Oakbine	Moon	Stormwater issues
24-Montour Trail/Snyder Steel	Moon	Flooding, erosion
25-Western Area YMCA	Robinson	Flooding
26-Wicks Furniture/At Home	North Fayette	Flooding
27-Airport Marriott	North Fayette	Flooding
28-Mahoney Road at Cliff Mine Road	Findlay	Frequent flooding

Figure 2.1.3-Municipality -identified areas observed flooding and erosion. Numbers on map are identified by the table.

Municipality	Drinking Water Source	Supply Water To Other Municipality	Percent of Households w/ Private Wells	Sewage Treatement Methods	Percent On-Lot Septic Systems
Coraopolis	Groundwater Well	Yes-Moon Township	0-20	Municpality collects and treats all sewage at centralized plant	0-20
Allegheny Co. Airport Authority	Purchased from Findlay and Moon Townships	N/A	N/A	Municpality collects and treats all sewage at centralized plant	N/A
Moon Township	Groundwater Wells, primary; Surface water (Ohio River), secondary	Yes-Findlay, Crescent, Intermunicipal Network	0-20	Municpality collects and treats all sewage at centralized plant	0-20
Findlay Township	Purchased from Robinson Township	No	20-40	Sewage is directed to partnering municipality for treatment-Moon Township	20-40
North Fayette Township	Purchased from Western Allegheny County Municpal Authority	No	0-20	Combination of centralized treatment plant in township and other municipalities w/ some septic systems	0-20

Table 2.1.1-Results from muncipal survey identifying drinking water sources and sewage treament facilities.

ii. Assessing and Quantifying Watershed Health

Introduction

The health of the watershed and stream were assessed through water quality sampling, physical observations and evauluations of stream banks for erosion, and landscape-based, watershed-wide pollutant control modeling. The Water chemistry and macroinvertebate samples were collected from six sites along the main stem of Montour Run and at the mouth of two impacted tributaries (Enlow Fork and McClaren Run) in the Fall of 2017 and Spring of 2018 **(Figure 2.2.1).**

MR08-North and MR07-South Forks of Montour Run were sampled near the intersection of Lincoln Highway and Santiago Road in Imperial, PA. MR08-North Fork flows through heavy residential areas with some commercial development along Route 30. The banks at MR08 were heavily eroded and steep on both sides. The water appeared brown in color and very turbid. Heavy algal growth was present in May 2018. MR07-South Fork of Montour Run flows through a relatively forested area with some residential communities before flowing past Republic Services Landfill in Imperial. The stream then enters a residential area for approximately one mile before combining with the North Fork of Montour Run.

The bank conditions at MR07 show some erosion, but were starkly better than MR08-North Fork with easy access to the flood plain. The water appeared clear with little sedimentation visible. Small amount of brown algal growth was present in May 2018.

MR05-Enlow Fork was sampled on Clinton-Enlow Road just South of I-376. Surrounding area is mainly forested with some residential development. Pittsburgh International Airport and I-576 comprise most of the drainage area of this tributary. Water appeared clear, except after heavy rains when it was more turbid. Bank conditions are relatively stable with some undercutting of banks and erosion in bends.

MR06-Montour Run downstream of Enlow Fork was sampled near the intersection of Main Street and Enlow Road in Imperial, PA, at a site that used to be a ball field. The stream channel is wide and slow here with some erosion on banks and in bends. Water is cloudy and brown in appearance, moreso after heavy rains. Heavy algal growth was present in May 2018 that impaired sample collection to some extent.

MR04-McClaren Run was sampled at the intersection of Cliff Mine Road and Aten Road beside the Airport Marriott Hotel. Water appeared clear, except following heavy rains when it appeared more turbid. Heavy brown algal growth was present in May 2018 on stream bottom. A persistent

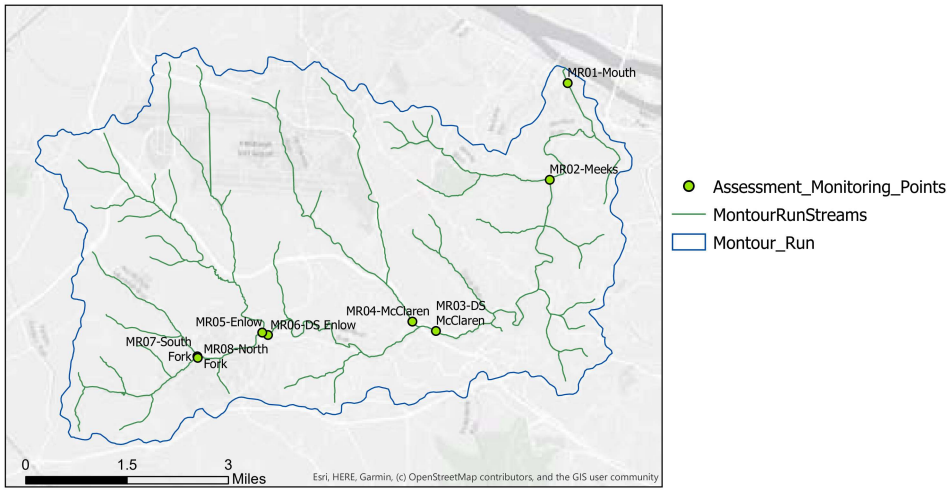

Figure 2.2.1-Sampling Location Map

unknown odor was present at every sampling which may be attributed to the algae. Stream banks at MR04 are heavily modified with Gabion Baskets along the west side; and engineered banks of Interstate 376 on the east side.

MR03-Montour Run downstream of McClaren was sampled at the intersection of Montour Run Road and Casteel Drive beside the Pitt Stop Airport Parking. Large commercial and residential developments surround MR03. Water appeared clear with heavy brown algal growth in May 2018. A persistent unknown odor was present during sampling and could be attributed to the addition of McClaren Run to the main stem of Montour Run. Stream banks are eroded and relatively sharp.

MR02-Meeks Run was sampled near the intersection of Hassam Road and the Montour Trail. The site is heavily forested with clear water. Little algal growth was present. Stream banks are gently sloped, giving the stream easy access to the flood plain.

MR01-The Mouth of Montour Run was sampled 650 feet from its entrance to the Ohio River near the soccer fields on Route 51. Commercial development and residential areas are present upstream of MR01. Water was clear with moderate levels of algal growth on the stream bottom. Stream banks were eroded on both sides with no other modifications.

Water Quality Data

Two sets of grab samples were collected during these two sampling events. One was tested in the field utilizing a combination of Hanna Instruments HI98130 pH and conductivity tester, Hach DR 900 colorimeter and Hach field test kits. The second was collected and delivered to Test America Labs per their collection protocol for quality assurance/quality control of field testing methods. Lab and field results were very similar in all parameters but sulfate and manganese. Much of the analysis is solely based on the lab results between from Fall 2017 and Spring 2018 during the time period of this study. In addition, volunteer data was collected between March and October of 2017 at various sites for the same parameters. These data were used to calculate average and median values for parameters as well as for analysis of glycol in McClaren Run and Enlow Fork. These data were also reviewed for any differing trends than that shown in the laboratory data. Parameters tested included pH, conductivity, water temperature, alkalinity, chloride, sulfate, iron, aluminum, manganese, phosphate, nitrate and ammonia. Additional testing for glycol was performed at all sites via lab in fall of 2017 and at two tributary sites via field kit in March and April of 2018 targeting snow events. These parameters were selected based on impairments identified by DEP and the TMDLs identified for Montour Run.

Much of the watershed is listed as impaired for pH from abandoned mine drainage (AMD). However, the pH throughout the watershed is relatively high, ranging from 7.5 to 9.0 **(Figure 2.2.2)** with an average of 8.35 and a median 8.43 for all samples. Since the PADEP evaluation, local watershed group efforts have resulted in treatment of five of the largest AMD discharges in the watershed. The higher pH also results from the geology of the area and presence of carbonate-based rocks, which serve to raise pH. The lower pH values observed at the mouth of Montour Run most likely indicate the mixing of Montour Run with water from the much larger Ohio River. This data supports previous evidence that the stream could be de-listed for its pH impairment.

Conductivity is also relatively high indicating the presence of many dissolved ions in the water. Pollution inputs from any remaining untreated abandoned mine drainage and, more likely, stormwater runoff throughout the watershed are the most probable reasons. There was not much change in conductivity between sites in either fall 2017 or spring of 2018 with the exception of a significant drop in the fall at MR02 **(Figure 2.2.3)**. This site is at the mouth of Meeks Run and is one of the cleanest tributaries in the watershed. The drop in conductivity could be from dilution during a heavy spring rain event or an outlier caused by a bad test. Conductivity is generally higher in spring, corresponding with other indicators of higher water resulting in heavier pollution inputs in spring.

Related to conductivity and pH, alkalinity was measured utilizing LaMotte Field Kit 4491 to evaluate the stream's buffering capacity or ability to withstand change. Alkalinity averaged 156 ppm throughout the watershed, indicating good buffering capacity. Alkalinity is lowest at MR08, especially in spring when it drops down to 75 ppm. However, even at this level the stream still possesses the ability to neutralize any acidic inputs from abandoned mine drainage. In spring there is also a drop down to 85 ppm at MR02, the mouth of Meeks Run, and at MR06, downstream of Enlow Fork **(Figure 2.2.4)** corresponding with pH and conductivity and potentially reflecting the dilution of stream water with higher spring precipitation.

Montour Run is also listed for impairment due to metals associated with abandoned mine drainage. In 2003, the

Montour Run Watershed Association engaged BioMost, Inc. to investigate of abandoned mine discharges in the watershed. In the report 13 discharges were evaluated and prioritized for treatment. All identified discharges were located in the headwaters of the North and South Forks except one at the headwaters of Milk Run. Since that initial report, substantial progress has been made on AMD in the Montour Run Watershed. Five of the top six priorities identified have been treated with passive treatment systems, with the Milk Run System coming online in 2019.

Several parameters were used to evaluate the stream for abandoned mine drainage impacts including sulfate, iron, aluminum and manganese. Samples were evaluated in the lab and in the field using using the Hach DR900 colorimeter. Sulfate levels in Montour Run are below the recommended limits for domestic water supply, which is 250 ppm. While most samples yielded sulfate values below the recommended limits, there were episodic instances of values exceeding this level. Sulfate in streams naturally occurs through the breakdown of leaves, plants and other material inputs into the stream, however elevated levels often occur when pyrite wastes from abandoned mines are chemically broken down to form sulfate compounds which then bond with water molecules. Average sulfate concentrations are 246 ppm, just below the 250 ppm recommented in the water quality standards. The median was 195 ppm. Sulfate concentrations were higher in the spring 2018 than fall 2017 (**Figure 2.2.5**) which is not surprising given the record setting rainfall levels that occurred spring of 2018. While dilution often plays a major role in treating pollution, in this case the excessive rains resulted in the filling and overflowing of underground mine pools that then released polluted water into the streams. In previous years, under "normal" conditions these mine pools contain the contaminated water within. Given the coal mining history in the watershed, it is not surprising there are elevated sulfate levels at MR03, the McClaren Run Tributary, MR05, the Enlow Fork and MR08, the North Fork of Montour. These sites have known AMD discharges likely contributing to the higher sulfate concentrations. Problems caused by sulfates are most often related to their ability to form strong acids which lowers the pH, however this was not observed for pH in Montour Run most likely due to basic geology in the watershed or dilution from unpolluted waters.

Iron, aluminum and manganese are metals commonly associated with AMD in the area. The average concentrations of aluminum and iron are 0.20 and 0.26 ppm, respectively. Both of these metals show higher concentrations in the headwaters, specifically in the spring 2018 with decreasing concentrations as one progresses downstream. The average aluminum and iron concentrations at MR08-North Fork were 1.8 and 1.8 ppm, respectively. At MR07-South Fork the average aluminum and iron concentrations were 0.43 and 0.25, respectivley. This corresponds to AMD discharges identified by the 2003 AMD Cleanup Plan. The concentrations at MR05 are also high for these parameters where there are known AMD discharge points (**Figure 2.2.6**, **Figure 2.2.7**). The current aquatic life standard for iron is less than 1.0 ppm. This is being exceeded at MR08 and MR05. The aquatic life standard for dissolved aluminum is 0.00063 to 3.2 ppm for chronic exposure (over 4 days) and 0.0001 to 4.8 ppm for acute exposure (less than 1 hour). Aluminum can be particularly toxic to macoinvertebrate and fish populations as it can inhibit an aquatic organism's ability to regulate salt concentrations and clog gills, potentially resulting in death or affecting growth and reproduction. A similar trend can be seen in manganese concentrations, but at much lower amounts. Concentrations of manganese were measured in ppb. The currently aquatic life standard for manganese is 50 ppb which is exceeded at several locations in the Spring 2018 (**Figure 2.2.8**). All measured metal concentrations matched patterns observed in the sulfate and iron analysis, ie. higher concentrations in 2018 versus 2017, likely due to the overflow of mine pools caused by extreme precipitation events. If higher precipitation rates continue to occur, as predicted by many climate change models, this would negatively impact both water chemistry and aquatic life in Montour Run.

Phosphate, nitrate, ammonia, total suspended solids (TSS) and chloride were measured to evaluate the nutrients, organic enrichment/low dissolved oxygen, and siltation, for which Montour Run is listed as impaired. Dissolved oxygen was measured utilizing Lamotte field kit #5860. Low dissolved oxygen was not observed during the sample period at any location in the stream and averaged 9.3 ppm. Lab results for phosphate were below the detectable limit of 0.5 ppm in all samples (**Figure 2.2.9**). Field testing in Fall 2017 confirmed the lab results showing very low levels of phosphate in all samples. Given the low levels found, field analysis was not performed for phosphate in Spring 2018. Laboratory results still yielded levels below the detection limit in Spring 2018. Nitrate concentrations were variable throughout the watershed with highest concentrations found in the headwaters of the North and South Forks, in Meeks Run and downstream of MR04 (**Figure 2.2.10**). Nutrient loading in the watershed is most likely the result of upstream landuses conveying overland flow to the stream via untreated stormwater rather than agricultural influences, as there is very little cropland in this watershed. The headwaters of the watershed are largely comprised by the Pittsburgh International Airport, with associated buildings, runways and parking lots, along with major highway connectors to the airport, contribute significant amount of runoff to the stream. The headwaters of Meeks Run are mainly comprised of residential lawns and the golf course at Montour Heights Country Club. Nitrate values are presumably higher in this watershed due to fertilizer inputs from these types of land use. The landuse surrounding MR04 consists of large commercial development around the Mall at Robinson and the Pointe at North Fayette. That being said, concentrations throughout the watershed were still relatively low for nitrate, given the federal drinking water standards is 10 ppm and levels found in Montour Run were all less than 1 ppm.

Ammonia was highest in the South Fork of Montour Run, particularly in the spring 2018 (**Figure 2.2.11**). The South Fork has experienced more warehouse development over the last several years. In addition Republic Services

Water Quality Sampling

Table 2.2.1-Glycol concentration in ppm during episodic storm events in late spring 2018. Dashed respresent no sample taken, while 0 represents a non-detectable level.

Site	3/21/2018	4/2/2018	4/5/2018	4/5/2018
MR04	25	4	3	8
MR05	---	30	0	0
MR06	---	0	0	---

Landfill could also be contributing to the South Fork, however, ammonia levels were very low throughout the watershed and further diluted as sampling progressed downstream. In addition, there appears to be a significant reduction in ammonia concentrations throughout the watershed since Pittsburgh International Airport switched from urea to propylene glycol as an anti-icing agent and added containment facilities to control runoff of these chemicals.

Total Suspended Solids (TSS) measures particles floating in the water column. Typically they are inorganic, such as silt, algae or plankton, but organic particles from decomposing materials can also contribute to TSS. The concentrations of TSS are notably higher and more variable in spring corresponding with higher stormwater influences (**Figure 2.2.12**).

Chloride is a major contributor to total dissolved solids (TDS). Chloride concentrations in Montour Run averaged 168 ppm for all sampling events with a median value of 172 ppm. However, this average does not include winter sampling where chloride levels would presumably be much higher due to the use of salt in de-icing roadways. The chloride criteria for Pennsylvania indicates that the 4-day average concentration in stream should not exceed 113 ppm. This indicated that chloride levels in Montour Run are high enough on a continuing bases to negatively affect aquatic life and plants. Laboratory results for Fall 2017 and Spring 2018 showed chloride concentration increasing from upstream to downstream to the mouth where the highest concentrations were observed (**Figure 2.2.13**). There are higher instances of roadway-stream interaction occur from upstream to downstream in the watershed supporting the conclusion that stormwater runoff, particularly from de-icing road salts, are contributing persistent chloride to the stream even though road salts were not actively being applied at the time of sampling.

Glycol is the final parameter was evaluated for water chemistry. Laboratory testing in the spring 2018 and fall 2017 did not yield any samples above the detection limit of 10 ppm. In addition to the laboratory testing, glycol was evaluated in the field at three sites, MR04, MR05 and MR06 following 3 snow events in early spring 2018. The K-4815 Glycol CHEMets Visual Kit was used for field evaluation. These specific sites were sampled as MR04 and MR05 are the 2 tributaries within the airport drainage area. The third site, MR06 is just downstream of the Enlow Tributary on the main stem of Montour Run. Glycol was detected during these events at both MR04 and MR05, the two tributaries that directly receive airport runoff. Glycol was not detected at MR06, meaning it is most likely diluted or degraded by the time it reached the main stem of Montour Run. While glycol was detected at MR04 during all 4 sampling events, it was highest during the 3/21/2018 event, while MR05 was highest during the 4/2/2018 sampling event (**Table 2.2.1**), most likely reflecting a change in runway usage from one area to another on the airport complex.. The impact of deicing fluids on the environment is most notably related to the high oxygen demand they exert when released to rivers and streams. A large slug of glycol can quickly deplete the dissolved oxygen in receiving waters. Additional sampling of both macroinvertebrates and glycol, specifically during storm events is needed to better assess the impacts that current airport deicing operations is having on these two tributaries.

Macroinvertebrates Assessment

Assessment Methodology: No comparable historic data is available for macroinvertebrate populations within the Montour Run Watershed. The data collected in these samples is the first to be sorted and identified using a microscope to the genus level and collected with consistent monitoring protocols and standards. Therefore, it cannot be extrapolated outside of the date range which it was taken: November 2017 to May 2018. In addition to the data collected for this report, the Montour Run Watershed Association collected macroinvertebrate data in April 2017 and again in April 2018, and identified organisms to family. Subsequent collections will be taken to refine trends and more thoroughly assess the watershed's macroinvertebrate populations.

Macroinvertebrate sampling with a kick net

Macroinvertebrates were sampled at the same 8 locations water chemistry was evaluated (**Figure 2.2.1**). EPA's Rapid Bioassessment Protocol For Use in Stream and Wadable Rivers, specifically methodologies for multiple habitats with d-frame dip net, was utilized for sampling. Sampling was conducted twice, in Spring and Fall. As noted, this is the first year for this comprehensive, routine sampling. Additional samples will be taken in the future to monitor population trends, make recommendations to improve habitat and restore favorable water quality conditions, and evaluate environmental changes in the watershed.

A variety of metrics assessed macroinvertebrate populations at each of eight sampling locations (**Table 2.2.2**). These metrics include species richness, EPT richness index, Hilsonhoff Biotic Index, Simpson's Diversity Index and Shannon's Diversity Index.

- Percent EPT is a calculated ratio of total numbers of Ephemeroptera (mayflies), Plecoptera (stoneflies), and Trichoptera (caddisflies) to the total number of organisms found in a sample. Some macroinvertebrate orders, such as Diptera (true flies), are generally tolerant to higher levels of pollutants in streams. Other orders, such as Ephemeroptera (mayflies), Plecoptera (stoneflies), and Tricoptera (caddisflies), are very sensitive to many pollutants in the stream environment.
- The EPT Richness Index estimates water quality by the relative abundance of three major orders of stream insects that have low tolerance to water pollution. A large percentage of EPT taxa indicates good water quality.
- The Hilsenhoff Biotic Index (HBI) estimates the overall tolerance of the community in a sampled area, weighted by the relative abundance of each taxonomic group (family, genus, etc.). For HBI, the lower the calculated score is, the better the quality of the environment.
- The Simpson's Diversity Index (DI) is a measure of diversity which takes into account the number of species present, as well as the relative abundance of each species. As species richness and evenness increase, so diversity increases.

	Total Organisms	Species Richness	Shannon Diversity Index	Simpson Diversity Index	Hilsenhoff Biotic Index (HBI)	%EPT
MR01 – Mouth 2017	343	24	2.37	0.87	4.53	47.81%
MR01 – Mouth 2018	46	11	1.79	0.79	4.39	8.70%
MR02 – Meeks 2017	465	28	2.44	0.88	4.92	23.66%
MR02 – Meeks 2018	93	15	2.02	0.82	4.83	21.51%
MR03 – DS McClaren 2017	493	23	1.92	0.78	4.46	41.18%
MR03 – DS McClaren 2018	169	12	1.45	0.36	5.23	4.73%
MR04 – McClaren 2017	267	19	2.15	0.86	4.72	12.36%
MR04 – McClaren 2018	54	10	1.46	0.68	5.00	3.70%
MR05 – Enlow 2017	83	14	1.92	0.78	4.78	25.30%
MR05 – Enlow 2018	262	22	1.49	0.55	3.80	6.11%
MR06 – DS Enlow 2017	191	22	2.41	0.86	4.31	36.65%
MR06 – DS Enlow 2018	70	14	1.73	0.68	5.32	4.29%
MR07 – South Fork 2017	470	16	2.08	0.82	4.08	69.79%
MR07 – South Fork 2018	423	22	2.04	0.80	4.49	11.82%
MR08 – North Fork 2017	69	14	2.31	0.90	3.11	26.09%
MR08 – North Fork 2018	99	21	2.45	0.89	4.75	17.17%

Table 2.2.2-November 2017 and May 2018 Macroinvertebrate population metrics.

- The Shannon Diversity Index is very similar, however, Shannon accounts for both abundance and evenness within a sample set, rather than relative abundance and evenness. This means that if only one or two organisms of a particular genus are present, it will impact the Simpson's DI value less than the Shannon DI.

Overview: The Montour Run Watershed has been impacted by Abandoned Mine Drainage (AMD), urban runoff, and siltation from erosion for many years. While the quality of the watershed and macroinvertebrate populations within it appear to be decreasing between the November 2017 and May 2018 collections **(Table 2.2.3)**, this is most likely due to historic rainfall totals in the region having caused underground mine pools with polluted water to overflow into Montour Run. The headwaters of Montour Run in Subwatershed Areas 2-North Fork and West Enlow and 3-South Fork and Lower Enlow are impacted by detrimental influences, but have maintained relatively strong diversity and population counts. Subwatershed Areas 1-Airport Drainage and 4-Robinson/Beaver Grade are heavily impacted by runoff from Pittsburgh International Airport, heavy commercialization downstream of the airport, and compacted residential areas present throughout. These tributaries show low population counts, limited diversity, and the presence of only a few pollution sensitive organisms.

Subwatershed Area 5-Meeks, Trout and Salamanders Head Tributaries run through healthy, relatively forested areas with low anthropogenic impacts. This subwatershed area shows high quality water, greater macroinvertebrate population counts, and greater diversity with higher populations of pollution sensitive organisms. Contributions in flow from these tributaries dilute contaminants in Montour Run further downstream in Subwatershed Areas 5 and 6, diminishing their impact on water quality and the macroinvertebrate populations. This results in Subwatershed Area 6-Lower Montour Run being relatively healthy compared to the upstream Subwatershed Areas. Further study will be required to assess long-term effects of the increased AMD discharges from the winter of 2018 within this watershed.

Area 1: Airport Drainage - McClaren and East Enlow Fork McClaren Run are impacted by Pittsburgh International Airport drainage and ever increasing concentrations of commercial development along its bank. The drop in the Shannon Diversity Index score was the largest of all eight sample sites. These changes likely indicate an increase in AMD flow within this tributary during heavy storm flows. Further water and macroinvertebrate testing will be needed for comparison to confirm this.

The headwaters of the eastern portion of Enlow Fork begin directly north of Pittsburgh International Airport and are then tunneled beneath the airport until just north of Enlow Road. Sediment and urban runoff from the airport, the I-376 Business Loop, and upstream development heavily impact this stream, particularly during precipitation events. This portion of Enlow Fork was not sampled for macroinvertebrate populations.

Area 2: North Fork Montour and West Enlow- The main factors impacting the North Fork are urban runoff/sewer overflow, siltation due to habitat modification, and AMD, according to the PA DEP. Visual observations in the North Fork include cloudy water, heavy erosion along the banks, and high concentrations of development throughout. These headwater impairments are easily seen in the data collected for Area 2. North Fork had very low species abundance counts for November 2017, which increased in May 2018, as did diversity and species richness metrics. These increased metrics are due to the extremely low species abundance counts. West Enlow Fork is impacted by drainage from Interstates 376 and 576. This upper region was not sampled for macroinvertebrates.

Area 3-South Fork Montour Run and Lower Enlow-The South Fork of Montour Run is heavily impacted by "erosion from derelict land" causing sedimentation on the outskirts of the landfill at the headwaters. In addition, AMD throughout and urban runoff/sewer overflow in the downstream portion have also contributed to erosion. South Fork increased in Genera Richness between 2017 and 2018, however all other metrics decreased from 2017 to 2018. Genera Richness was higher in May than in November, but species abundance decreased compared to the other Subwatershed Areas. South Fork changed the least from November 2017 to May 2018. This indicates that there was little change in water quality at this site, most likely because no additional AMD overflows occurred upstream of this site between November 2017 and May 2018. Decreases in diversity and species abundance could also be attributed to seasonal differences in populations resulting from macroinvertebrate lifecycles.

Enlow Fork is impacted by Pittsburgh International Airport drainage, residential developments, commercial zoning, and Interstates 376 and 576 with some forested land bordering West Enlow Fork. These impairments are shown in November 2017 with extremely low metrics in both species abundance and diversity. In 2018, species abundance and average pollutant tolerance did increase slightly. All other metrics decreased even further. Compared to other sampling sites, this site decreased less in quality. Coupled with the increase in species abundance and decrease in pollution tolerance, the decrease in diversity could mean water quality has not been impacted significantly within the sampling timeframe.

	Total Organisms	Number of Genera	Shannon Diversity Index	Simpson Diversity Index	Hilsenhoff Biotic Index (HBI)	%EPT
MR01 – Mouth	-86.59%	-54.17%	-24.39%	-9.22%	-3.14%	-81.80%
MR02 – Meeks	-80.00%	-46.43%	-17.28%	-6.40%	-1.90%	-9.09%
MR03 – DS McClaren	-65.72%	-47.83%	-24.52%	-53.77%	17.32%	-88.51%
MR04 – McClaren	-79.78%	-47.37%	-31.91%	-20.82%	5.93%	-70.06%
MR05 – Enlow	215.66%	57.14%	-22.35%	-29.34%	-20.49%	-75.85%
MR06 – DS Enlow	-63.35%	-36.36%	-28.11%	-21.55%	23.37%	-88.29%
MR07 – South Fork	-10.00%	37.50%	-1.74%	-2.64%	9.91%	-83.06%
MR08 – North Fork	43.48%	50.00%	6.14%	0.37%	52.42%	-34.19%

Table 2.2.3-Percent change in macroinvertebrate popluation metrics between November 2017 and May 2018. Green highlights represent metrics that increased between 2017 and 2018.

Dragonfly nymph found in Montour Run during November 2018 sampling

Area 4: Robinson/Beaver Grade-Montour Run is impacted in Area 4 by the addition of Tributaries in Areas 1, 2, and 3, as well as heavy commercialized areas at The Pointe at North Fayette and the Mall at Robinson which have a high percentage of impervious area, few greenspaces, and narrow riparian buffers (not present at all in some areas). This part of Montour Run is classified as "Non-attaining and Impaired" due to urban runoff/storm sewers causing excess nutrient concentrations, siltation, organic enrichment, and low DO; AMD; and the presence of un-ionized ammonia.

Both sample sites in Area 4 decreased in every metric from 2017 to 2018. In comparison to other sites that also decreased (Area 3-Lower Enlow and Area 1-McClaren), the difference is comparable to others. This could be due to seasonal changes, a source of increased pollution/AMD in the watershed, more concentrated commercialization, or all of the above.

Area 5: Meeks, Trout, and Salamander's Head-In both November 2017 and May 2018, the highest quality stream point for macroinvertebrates in this watershed is Meeks Run; this stream appears to be an ideal reference stream for conditions throughout the watershed. Meeks Run is currently the only stream sampled in the macroinvertebrate assessments that is listed as "attaining" by the Pennsylvania Department of Environmental Protection; it has been assessed for aquatic life and does meet that purpose as shown by this data.

The headwaters of Meeks Run are located on the outskirts of Montour Heights Country Club, which consists of forested parcels and a golf course with little impervious area. It then passes through heavily forested Moon Park before entering the Montour Woods Conservation Area owned by Hollow Oak Land Trust, and property owned by Forest Grove Sportsmen Club. Nearly all of Meeks Run flows through forested area with little impervious area, significantly decreasing and preventing the siltation and runoff contamination. These attributes provide an ideal environment for macroinvertebrate life cycles.

Meeks Run has consistently healthy metrics compared to other sites in 2017, except for HBI and %EPT. The scores for those two particular calculations were not significantly lower than other areas in the watershed, but were not as high as expected given the high quality of the stream. The pollution tolerance score increased in 2018, but was still low; this is due to the high number of midge larvae and isopods found within the sample. While they can tolerate high levels of pollution, it is not a strict indicator of low water quality. Overall in 2018, the metrics were higher than surrounding sample sites. Species richness and abundance decreased, but were still higher compared to other sites (Area 4-Montour Run DS Enlow, Area 1-McClaren, Area 4-Montour Run DS McClaren). This stream is still the highest quality sample when all calculations and data are evaluated on a combined scale. Other streams within Area 5 are Salamander's Head and Trout Run. These streams have similar surrounding land use to Meeks, but were not sampled for macroinvertebrate populations.

Area 6: Lower Montour Run to the Ohio River-The mouth of Montour Run was sampled approximately 650 feet from the confluence with the Ohio River. At least 14 tributaries contribute to the flow along the main stem of Montour Run at this site. Upstream land use consists of urbanized area, both commercial and residential, with an established riparian buffer present along most of the stream. This buffer continues along the Montour Trail upstream to the mouth of Meeks Run. This land use and the contribution of Meeks Run, Trout Run, and Salamander's Head all help to dilute the runoff pollution present in the upstream portions of Montour Run.

This land use contributes to a comparatively healthy sample site. The 2017 sample ranked higher in metrics compared to other sampling sites. From November 2017 to May 2018, species abundance and species richness dropped drastically; the only metric to increase was HBI tolerance. Balanced with other metrics, this does not indicate a sudden or drastic change in water quality.

In May, the total number of organisms identified decreased at all but two sites in the watershed compared to the same samples taken in November; species abundance increased at only three sites: Area 3: Lower Enlow, Area 3: South Fork of Montour Run, and Area 2: North Fork of Montour Run. Low genera counts are likely due to the late collection of samples allowing for emergence periods to occur before collection, but may be influenced by other factors.

All %EPT and over half of HBI (5 out of 8) calculations decreased in quality. Mayflies were named due to their typical emergence period: early to late May. Because the 2018 samples were collected in May, it is possible that some of the mayfly nymphs had already emerged from the water as adults; this could also be the case for stoneflies and caddisflies, as their emergence periods are very similar to mayflies. The strong decrease in %EPT for all sites from November 2017 to May 2018 and the decrease in quality for five out of eight HBI calculations

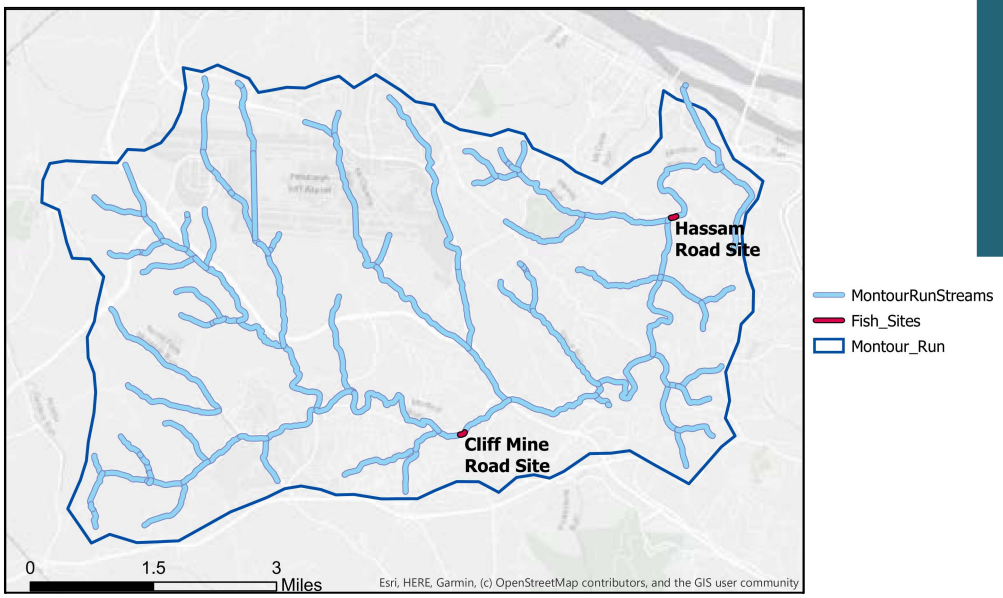

Figure 2.2.14-Fish Survey sites along Montour Run.

could indicate either an early emergence period in 2018 or a decrease in water quality within the watershed between November 2017 and May 2018 that resulted in a decrease %EPT.

HBI values for all 16 samples range from 3.1140 to 5.3167, which indicates a presence of organisms that, when averaged together, can tolerate only low to mid-level water pollution. Within most samples, there were organisms that could tolerate very high levels of pollution, but organisms were also found that have an extremely low tolerance to pollution, which is an indicator of high water quality. Three sites had a decrease in HBI values (indicating a lower pollution tolerance) from 2017 to 2018; although small, this change is positive, as it is possible that water quality improved at those particular sites.

In conclusion, nearly all calculated metrics decreased from November 2017 to May 2018; only 10 out of 48 (21%) increased. This, in and of itself does not appear to bode well for the Montour Run Watershed. However, these sample results only reflect one year of sampling and were most likely impacted by historic rainfall totals. Because most of the assessed values did not change drastically and there is no historical data with which to compare population metrics, the observed changes cannot be shown to be a direct result of water pollution changes. Further evaluation on Montour Run and its tributaries is needed to have a complete assessment on changes within the watershed.

Fish Assessment

Fish surveys were conducted in November of 2018 with assistance from Duquense University Biology Professor, Dr. Brady Porter and students from his Sream Field Biology class. were completed at two locations in the watershed in November 2018 (**Figure 2.2.14**). The first site, most upstream, started at Cliff Mine Road surveying a 100 m reach upstream of the bridge. The site is located in the upper section of Subwatershed Area 4-Robinson/Beaver Grade and encompasses drainage from Subwatershed Areas 1-Airport Drainage, 2-North Fork and West Enlow and 3-South Fork and Lower Enlow. These drainage areas

are a mixture of one highly developed area, the airport, and mostly undeveloped land with rural housing. The second site, furthest downstream, started in the Montour Trail Bridge at Hassaam Road (40.491208, -80.150347) surveying a 100 m reach upstream of the bridge. The site is located in the Lower Section of Subwatershed Area 5-Meeks, Trout and Salamander's Head and ecompasses drainage from Subwatershed Areas 4-Robinson/Beaver Grade and 5-Meeks, Trout, and Salamanders Head. These drainage areas are more developed, with commercial suburban housing land uses. In addition to these samples, previous surveys completed by the US Army Corps of Engineers totaled 16 species with an IBI score rating of poor and fair.

Surveys were conducted using backpack electrofishing with a Smith-Root, Model #LR-24 unit as well as three dip nets and one 6'x8' fine mesh seine. Species identifications, counts and weights were collected both on and off site by the survey team. All raw data from the fish survey can be found in the appendix. Fish community analysis was done using Simpson's Reciprocal Diversity Index to measure biodiversity and the Ohio Regional Modification of the original IBI (Karr et. al. 1986). The modified IBI uses the following ten biometrics: 1) total number of fish species, 2) number and identity of benthic insectivorous species, 3) number and identity of trout and/or sunfish species, 4) number and identity of intolerant species, 5) proportion of individuals as white suckers, 6) proportion of individuals as generalists, 7) proportion of individuals as insectivorous cyprinids, 8) proportion of individuals as non-stocked trout or proportion of individuals as piscivores, 9) number of individuals in the sample and , 10) proportion of individuals with disease or anomalies.

Fish Survey along Montour Run

Hassam Rd. Site: The sampling at the Hassam Road site resulted in the capture of 1,193 individuals of 15 species. The IBI score of 50 out of a possible 60, showed the Hassam Road site scored in the 'Exceptional' Quality Range for the Western Allegheny Plateau Ecoregion in a wading stream. The Simpson's Reciprocal Diversity Index score of 3.23 out of a possible 15 with an equitability of 0.22 out of 1, indicates low evenness for this survey. The raw data show a predominance of Minnow and Carp species, with a high number of Mimic Shiners (N = 614) representing 52% of the total count (N = 1193). While evenness is low, the most abundant species are classified as pollution intolerant. Thus, their presence and abundance is another indication of good water quality.

Cliff Mine Rd. Site: The sampling at the Cliff Mine Road site resulted in the capture of 328 individuals of 15 species. The IBI score of 54 out of 60 showed the Cliff Mine Road site is also in the 'Exceptional' range for the Western Allegheny Plateau Ecoregion. The Simpson's Reciprocal Diversity Index score for this site was 5.52 out of a possible 15 with an equitability of 0.35 out of 1, indicating a slightly higher evenness than at the Hassam Road site. Again, 9 out of 16 species caught are classified as pollution intolerant and their presence is indicative of good water quality.

Based on the samples collected, both sites appear to be much improved in water quality than in previous surveys. Both sites scored in the "exceptional" range for IBI. This is vastly improved from previous surveys where IBI scored in the "poor" and "fair" range. While a similar number of species were collected in previous surveys, it would appear that more pollution intolerant species were collected in 2018 than previously sampled.

Habitat Assessment/Streambank Survey

The Stream Visual Assessment Protocol (SVAP) was used as an initial evaluation of the overall condition of the streams, their riparian zones, and their instream habitats. It was suitable as a basic first estimate of stream condition and to identify areas in need of more assessment of a particular aspect of the aquatic system. Using the SVAP

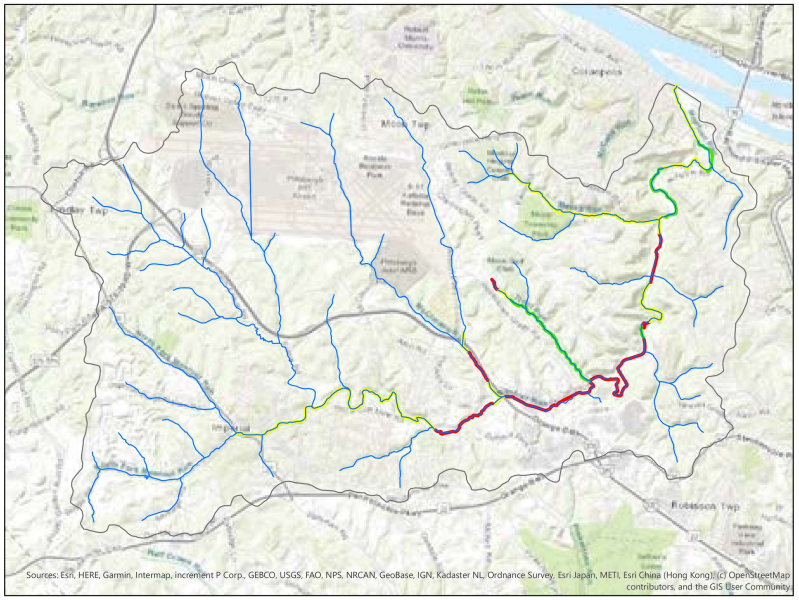

Figure 2.2.15 - Stream Visual Assessment stream reach conditions color coded such that Red = Poor, Yellow = Fair and Good = Green

protocol, streams were evaluated based on stream reach. A stream reach is a length of stream with relatively consistent gradient and channel form. Each reach is evaluated for 12 characteristics on a scale of 10-1, with 10 being the highest score and 1 being the lowest. These individual scores are then averaged to determine the overall condition of the reach. In addition to the ranked characteristics, several other physical descriptions were documented as well as the suspected cause of impairment. Waypoints and photos were also taken throughout each reach to document areas of significance, problem areas and potential projects.

Field assessment was completed for the entire length of the main stem of Montour Run and 3 tributaries-Meeks Run, Trout Run and Enlow Run. The information was compiled into an ArcGIS geodatabase to give an overall view of the watershed. The averaged SVAP scores were color coded red, yellow and green for an easy visual of stream conditions in the watershed (**Figure 2.2.15**). Within this map sections of the stream that ranked in the poor category are concentrated is Subwatershed Area 4-Robinson where a lot of paved surfaces are contributing stormwater runoff directly to the stream. Other areas of note include the green reaches of Trout Run and downstream of Meeks Run. These sections represented high rankings in most characteristics and should be considered as areas to preserve. The Meeks Run Tributary ranked fair despite the fact it is known to have good water quality and many species of macroinvertebrates and fish. This tributary does have some streambank erosion issues, fish passage barriers and receives stromwater from upstream development in the headwaters.

Several sections of the watershed were not able to be assessed in this way for a variety of reasons. For these sections, GIS modeling was used for assessment.

Development of Distributed Landscape-Based Pollution Accumulation Models

The distributed, non-point source nature of nutrient and TSS impairments increases the complexity of efforts to quantify loading rates. GIS-based tools were used to

quantify loading additions and reductions as surface run-off, as the associated pollutant loads moved across the landscape.

This process developed yearly loading estimates of total suspended solids (TSS), total phosphorus (TP), and Nitrate (NO_3-) in surface runoff using a modification of the Simple Method, which were then mapped using ArcGIS. Runoff curve numbers, generated as part of the process, were used to calculate release rates for areas of interest in the county, along with landcover data to estimate runoff on an event-based, pixel-by-pixel basis, which was then accumulated to represent a year of rainfall (42 inches). An event mean concentration (EMC) was assigned to each landcover type in milligrams per liter for NO_3-, TP, and TSS based on the EMC's found in the PADEP BMP manual.

The EMC was multiplied by yearly runoff in liters for each corresponding pixel to obtain an expected annual pollutant load across the watershed. Pollution accumulation and decay could then be modeled by utilizing the information about expected loads, reductions to loads, and a digital elevation model in ArcGIS with the "TauDEM" hydrological modeling tools/ methods developed by David Tarboton (David Tarboton 2015). Weights applied to the "accumulation" hydrology tool include a grid of the expected pollution input in pounds, as well as the expected percent reductions in pollution as runoff moves across landcover such as forest or shrub lands. Therefore, this calculates pollution accumulation as runoff moves from pixel to pixel, as well as any reductions in pollution based on landcover type.

To further this analysis, the tree canopy in riparian buffers was also calculated. Virtual riparian buffers 30 meters wide and 60 meters long were constructed on either side of the stream and tributaries using ArcGIS. The average percent tree canopy was then calculated in each riparian buffer using the NLCD tree canopy dataset. This procedure allowed a focused examination of stream reaches that may have sparse buffers, or completely lack them altogether, and is a simple method to target areas which may be good locations to reduce sediment transport and pollution to the stream via the use of BMP's (landscape restoration, green infrastructure, etc).

It should be stressed that the sediment and nutrient loading values produced via this method are estimates. The strength of this exercise is that it is a relatively simple method which requires only a few data inputs and can help to estimate the magnitude of stormwater runoff and associated pollutant loadings on receiving waters. This method uses a digital elevation model to understand the flow and accumulation of runoff and associated pollutants. This prediction allows us to identify regions where significant accumulation occurs. This method also can pinpoint regions that act as sinks along flow paths, so that these area can be targeted for conservation measures. The resulting maps are in the appendix and are discussed below.

Modeling estimates of TSS accumulation indicate that the greatest export of TSS occurs from the most urbanized portions of the watershed. The two subwatersheds draining the airport (East Enlow and McClaren) in particular add suspended solids to the stream (see Montour max TSS accumulation). It was also estimated that the highly developed shopping region (Robinson Towne Center, the Pointe at North Fayette etc) contributed large annual loads to the stream. Similarly, TP and NO_3- loadings are also significant from the airport and from the highly urbanized portions of the watershed.

These areas contain impervious surfaces where sediment and nutrients are entrained in runoff and delivered efficiently to the stream via storm sewers/urban infrastructure. Direct delivery of runoff to the stream also effectively removes any possibility of the landscape to attenuate/capture flow and sediment. In contrast, runoff from the less developed subwatersheds may travel from a sediment source (e.g. cultivated or urban) into a "sediment sink," or region where the runoff is slowed and infiltrates to the soil and groundwater. Therefore, even though these areas may contribute significantly to initial sediment loads, a portion of that load is reduced as the water travels across the landscape.

iii. Subwatershed Area Inventory

Introduction

The regional inventory is divided up by the previously referenced subwatershed groups as determined by influences/pollution sources and development patterns within each subwatershed. The distributed landscape-based pollution accumulation model was run on each of the 6 subwatershed areas and a series of resulting maps were produced. The series of maps has been added to the Appendix of this document and those referenced in the following text can be found there.

Subwatershed Area 1-Airport Drainage

Watershed characterization, geography, topography: This subshed group is dominated by the influence of the Pittsburgh International Airport. Stream valleys in the subwatershed headwaters are predominately paved and flattened for runways and highways. From the top airport area, stream valleys drop down to the main stem of Montour Run. Of the 10.6 square miles / 6780 acres in this subshed group, 4312 acres, or 64% of the land is owned by the Airport Authority. The land owned by the airport is at the geographic top of the watershed.

There are 18.19 miles of classified streams in the watershed. Of these, 10.4 miles are located within property owned by the airport. Streams in this subshed region include the East and West Forks of McClarens' Run and the northern section of the East Fork of Enlow Run, which joins with the West Fork of Enlow Rd near the Clinton-Enlow Rd. Every classified stream mile is considered Impaired for Aquatic Life uses. The habitat quality is affected by Urban Runoff / Storm Sewers, Siltation, Organic Enrichment leading to low Dissolved Oxygen in the water, and Abandoned Mine Drainage (acidity, metals). Some of the small classified tributaries are not visible on the land surface, as they are directed under the Airport runways and terminal building.

Impervious Surface, Tree Cover, and Land Use: In all, the subwatershed group has a high impervious surface area, with an average of 33% impervious surface overall (Figure 2.3.1). This relatively high percentage of impervious surface, particularly in the upper portions of the subwatersheds, contributes storm runoff to the stream.

The subwatershed contains 25% tree canopy (Figure 2.3.2). The lack of tree canopy decreases the landscape's ability to slow and infiltrate stormwater, decreases evapotranspiration, and increases sediment and nutrients that are transported in stormwater downstream. Similar to the impervious surfaces in this region, most areas lacking tree canopy are Airport runways or highways.

As with all elements of this area of the watershed, landcover uses are dominated by the Airport property and surrounding highways that are attendant on the Airport (Figure 2.3.3). Of the 6780 total acres in this subwatershed area, only 22.1% is deciduous forest. Over 70% of the landscape is developed, 47% of the landcover is deciduous forest, and less than 3% of the landcover exists as herbaceous, evergreen forest, hay/pasture, woody wetlands, cultivated crops, and barren land **(Figure 2.3.4)**.

According to the Allegheny County Greenways data set (http://www.pasda.psu.edu/uci/DataSummary.aspx?dataset=1208), landscapes in this area of the Montour Run Watershed include a significant amount

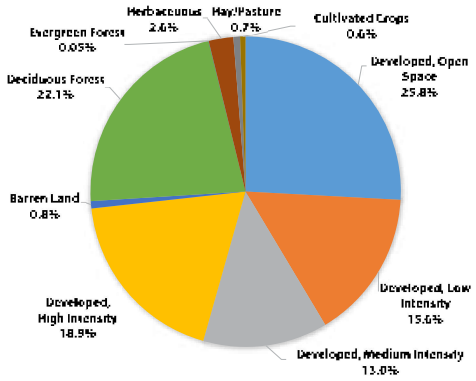

Figure 2.3.4-Landcover types in Subwatershed Area 1-Airport Drainage. The watershed overall is considered 73.3% developed.

of unprotected land **(Table 2.3.1, Figure 2.3.5).** In all, approximately 468 acres are undeveloped and unprotected. In addition, the Greenways identified approximately 50 acres of riparian buffer, wetlands, forested floodplains, and sensitive slope areas that were un-protected. These areas, undeveloped as of yet, are important to target for future conservation efforts. These are delineated in order to highlight the regions that should be considered for protection because of their intrinsic environmental value for the public good. Regions with steep slopes contribute to greater flow, increased erosion, and subsequently greater rates of sedimentation in receiving waters such as Montour Run and the Ohio River. The steep slope areas, in particular, are also commonly within the riparian buffer along either side of the main stream course due to the local topography. Therefore, these are important areas for conservation and restoration in order to decrease current and potential erosion from these areas.

Area Pollution Trends: Each of the watersheds that make up this subwatershed group comprise runoff mainly associated with the airport and cooresponding highways. TSS **(Figure 2.3.6)** and nutrient **(Figures 2.3.7, 2.3.8)** modeling suggests that the majority of the pollution inputs are sourced from airport-based stormwater runoff. These large areas of impervious surface area collect atmospheric deposition and dust. During storms, sediment and nutrients are washed from these surfaces into drainage structures, and eventually the stream.

The riparian buffer protecting the streams in this subwatershed area is highly fragmented **(Figure 2.3.9)**. In most of the airport properties, the stream is no longer on the surface of the landscape. Without further information, it is difficult to determine whether it is culverted, or simply relocated altogether. The riparian buffer in these areas is similarly missing, replaced by runways, airport hangers, and terminal buildings. Other areas of the watershed with a weak tree canopy in the riparian buffer include areas where the highway was built alongside the stream.

Table 2.3.1-The Greenways data for Subwatershed Area 1-Airport Drainage shows a significant amount of land that is both undeveloped and un-protected.

Type	Acres	Protected?
Allegheny Land Trust GREENPRINT	468	No
Rivers, Streams, Wetlands, Forested Floodplain	29	No
Sensitive Slope Areas	22	No
Trails	0.07	No
Golf Courses	42	Yes
Municipal Parks	5	Yes

Subwatershed Area 2-North Fork and West Enlow

Watershed characterization, geography, topography: Subwatershed Area 2 includes a sizeable portion, 3.4 mi^2 / 2167 acres, of Pittsburgh International Airport property. However, airport property in this region is comparatively sparsely developed, without the expanses of runway, terminal buildings, and hangers that dominate the rest of the airport parcel. In all, this watershed section is 5.8 mi2 / 3696 acres in size, with 2167 (59%) acres owned by the airport.

There are 11.7 miles of classified streams in the watershed. Of these, 7.6 miles are classified as non-attaining for aquatic life. All non-attaining streams drain from areas actively used as parking and terminals by the airport to the West Fork of Enlow Run.

Non-Attaining status is caused by Urban Runoff/Storm sewers, Organic Enrichment/Low Dissolved Oxygen, habitat modification, and abandoned mine drainage. The tributaries that drain to the West Fork of Enlow from non-active, undeveloped Airport properties are considered attaining for aquatic life. In addition, a little tributary to North Fork is considered attaining.

Impervious Surface, Tree Cover, and Land Use: This subwatershed group has an average of 9% impervious area **(Figure 2.3.10)**. This is low overall when compared with other regions of Montour Run. This relatively low percentage of impervious surface, particularly in the upper portions of the subwatersheds leads to less pollution from stormwater runoff from impervious surfaces, allowing some tributary streams maintain a higher quality of ecological habitat.

The subwatershed contains 50% tree canopy, on average, across the region **(Figure 2.3.11)**. The higher amount of tree canopy increases the landscape's ability to slow and infiltrate stormwater, increases evapotranspiration, and decreases sediment and nutrients transported to the stream in stormwater. Similar to the impervious surfaces in this region, most areas lacking tree canopy are Airport regions or highways.

Of the 3696 total acres in this subshed group, nearly 60% is deciduous forest **(Figure 2.3.12)**. Only 30% of the landscape is developed, and within that 18 % is considered the less-impacted "developed, open space" **(Figure 2.3.13)**.

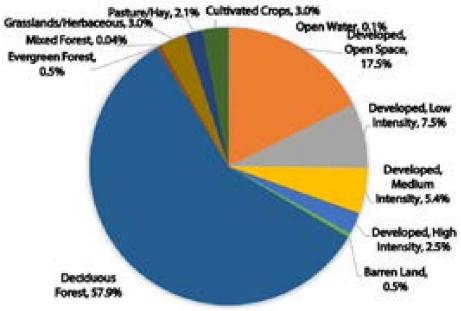

Figure 2.3.13-Landcover types in Subwatershed 2-North Fork and West Enlow. The watershed overall is approximately 73.3% developed.

According to the Allegheny County Greenways data set, landscapes in this area of the Montour Run Watershed include a significant amount of unprotected land. In all, approximately 468 acres are undeveloped, and unprotected. In addition, the Greenways identified approximately 50 acres of riparian buffer, wetlands, forested floodplains, and sensitive slope areas that were unprotected **(Table 2.3.2, Figure 2.3.14)**.

These areas, undeveloped as of yet, are important to target for future conservation efforts. These are delineated in order to highlight the regions that should be considered for protection because of their intrinsic environmental value for the public good.

Regions with steep slopes contribute to greater flow, increased erosion, and subsequently greater rates of sedimentation in receiving waters such as Montour Run and the Ohio River. The steep slope areas, in particular, are also commonly within the riparian buffer along either side of the main stream course due to the local topography. Therefore, these are important areas for conservation and restoration to decrease current and potential erosion from these areas.

Area Pollution Trends: TSS **(Figure 2.3.15)** and nutrient **(Figures 2.3.16, 2.3.17)** modeling suggests that the

majority of the pollution inputs are sourced from highway and airport-based stormwater runoff. These large areas of impervious surfaces collect atmospheric deposition and dust. During storms, sediment and nutrients are washed from these surfaces into drainage structures, and eventually the stream.

Subwatershed Area 2 has also historically been impacted by abandoned mine drainage, resulting in pollution from metals and acidity. There are four passive treatment systems constructed in this subwatershed area that treat water quality from four discharge sites identified in the 2013 AMD Cleanup Plan (**Figure 2.3.18**). These systems recently underwent maintenance and were cleaned out in 2017 which could have contributed to a decline in water quality and macroinvertebrates observed during this period, as maintenance activities can contribute untreated flow to the stream.

The riparian buffer within the subwatershed area remains much intact. There are a few areas closer to the developed portions of the airport property that are lacking riparian buffer (**Figure 2.3.19**), which are in headwater areas of smaller tributaries.

Table 2.3.2-The Greenways data for Subwatershed 2-North Fork and West Enlow.

Type	Acres	Protected?
Allegheny Land Trust GREENPRINT	60	No
Rivers, Streams, Wetlands, Forested Floodplain	8.7	No
Sensitive Slope Areas	3.5	No
Trails	0.4	No
Community Parks	1.7	Yes

Subwatershed Area 3-South Fork Montour Run

Watershed Characterization, Geography, Topography: This area is 2730 acres characterized by small headwater streams and wetland areas. The watershed topography is composed of rolling hills and wider shallow stream valleys. This area of interest includes portions of Findlay and North Fayette Townships, as well as the small town of Imperial, PA. Hillsides are dotted with stands of trees interspersed with clusters of houses that roll down the slopes. In all, this area is less than 10% impervious. There are 9.2 miles of characterized streams in this region, and none of them are considered "attaining" for the designated use of Aquatic Life.

Impervious Surface, Tree Cover, and Land Use: The land use in this subwatershed is largely undeveloped, much of it less that 1% impervious cover (**Figure 2.3.20**). There is significant open space and deciduous forest (18% and 48%, respectively, for a total of 66% of the total landcover)(**Figure 2.3.21**). Notably, the landscape contains 5% Barren Land, most of which refers to a Municipal Waste Facility owned by Allied Waste Systems of PA (**Figure 2.3.22**). Not surprisingly, as much of the landcover is deciduous forest, canopy cover in this subwatershed is very high as compared to other subwatersheds (**Figure 2.3.23**).

According to the Allegheny County Greenways data set, landscapes in this area of the Montour Run Watershed include lands identified by the Allegheny Land Trust Greenprint analysis (identified focus areas with the highest capacity for biological diversity, water management, and scenic character), about 88 acres of protected land including municipal parks and trail, and the rivers/streams/floodplains that make up the Montour Run stream valley (**Table 2.3.3, Figure 2.3.24**). Importantly, the Greenways data set also identified whether the lands were Protected or Unprotected, i.e., was there some restriction on the parcels that would prevent future development. The Greenways data set helps to identify the protected regions, and pinpoint regions that should be considered for protection because of their intrinsic environmental value for the public good. The Greenways dataset also delineates landscape regions with "Sensitive Slopes." The change in topography here is evident, with fewer acres classified as "Steep Slopes" than is seen in other, lower portions of the Montour Run watershed.

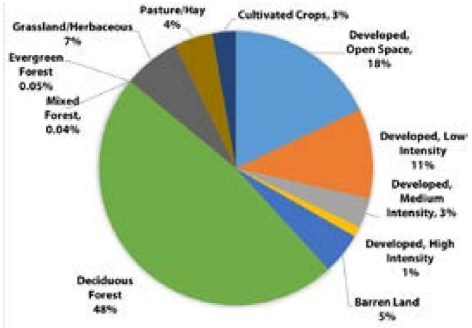

Figure 2.3.22-Landcover classification in Subwatershed Area 3-South Fork Montour Run.

Area Pollution Trends: TSS export in the Imperial subshed is higher modeled at 50,587 lbs per year (**Figure 2.3.25**) than in the less urbanized section of the subwatershed, which is modeled at 11,318 lbs per year. The higher amount modeled is likely the result of the impervious surfaces and lack of a buffer (**Figure 2.3.26**) between sections of road and stream in the subshed containing Imperial, PA. Despite the high percentage of deciduous forest, riparian buffer is lacking in many areas and very fragmented. contributing to higher pollutant loads.

Sources of the nutrient phosphorus in urban areas includes nonpoint sources such as atmospheric deposition, runoff, seepage from septic systems, and stream bank erosion. Agricultural lands are commonly a significant source of phosphorus due to fertilizer use. However, there is little agricultural land in this watershed, or other landscapes that require fertilizer, like golf courses. The modeled results for this subwatershed area show only 15 lbs of phosphorus exported per year (**Figure 2.3.27**). Modeling suggests that the downstream subshed area contributes 151 lbs of phosphorus per year. This difference is likely due to the higher impervious surface area in the Imperial subshed region, where urban runoff contributes higher phosphorus export.

The landscape pollution modeling process estimated that this subwatershed area contributes very little nitrogen to the stream (**Figure 2.3.28**). It should be noted that this analysis only considers the landscape-based pollution sources and may not capture regional sources of emissions. Manufacturing or electricity generation processes emit a significant amount of nitrogen oxides

as a by-product of fuel combustion. These nitrogen oxides can be deposited on the land surface and washed into the storm sewers and the stream during rain events. The nutrient accumulation model may not capture the cumulative effect of the non-point sources that are deposited on the landscape and then washed to the stream during storms.

Nutrient modeling indicates nitrate export from the less-developed region of these subwatershed group is less than 12 lbs per year, reflecting the little impervious surface and lack of development in this subshed group. Downstream, the town of Imperial and associated impervious surface contributes an estimated 192 lbs per year of nitrogen to the stream.

Each of the townships that make up this region are considered "MS4" communities, and are therefore required to obtain permits to discharge stormwater into waters of the US, and develop stormwater management programs (SWMPs) that describe the stormwater control practices that will be implemented to minimize the discharge of pollutants that may be in storm runoff. There are no known specific spill or illicit discharges in these subwatersheds.

The region has a history of abandoned mine drainage (Figure 2.3.29). In 2005, the Montour Run Watershed Association constructed the Boggs Road AMD Treatment site in order to treat a surface alkaline mine drainage problem. The Boggs Road site treats an estimated 6 million gallons of water per year, removing 2,300 pounds of iron and 3,300 pounds of acidity per year, according to the MRWA website, effectively eliminating iron loading to the South Fork of Montour Run.

However, increased precipitation in recent years may lead to events in which the AMD treatment systems overflow and release untreated AMD discharges into the stream. For example, water quality data from 2017 versus 2018 indicates higher iron concentrations in stream water with increasing precipitation. Similarly, corresponding invertebrate data in 2017 versus 2018 indicates species diversity changes / is lower with higher precipitation. Additionally, increased precipitation may decrease resiliency of the system. Increasing sediment deposition resulting from increased effluent, for example, which will require more frequent maintenance. Increasing discharge may also tax the ability of the system to treat water, and increase untreated AMD to the stream. Resiliency evaluations for sites such as the one at Boggs Road site, for example, may be required. Also, an evaluation of maintenance programs and deposition removal frequency would help to ensure the continued function of the site over time.

Table 2.3.3-The Greenways data for Subwatershed Area 3-South Fork Montour Run.

Type	Acres	Protected?
Allegheny Land Trust GREENPRINT	225	No
Municipal Parks	83.8	Yes
Rivers, Streams, Wetlands, Forested Floodplain	113.6	No
Sensitive Slope Areas	4.7	No
Trails	4.3	Yes

Subwatershed Area 4-Robinson, Cliff Mine, Beaver Grade

Watershed Characterization, Geography, Topography: This area is 5,140 acres in size, and characterized by incised stream valleys, large shopping plazas, and roadway systems. This area of interest includes portions of Findlay, Moon, Robinson, and North Fayette Townships. The majority of the shopping plazas are located in the Robinson subwatershed, however the Cliff Mine area also contains industrial and commercial centers such as the RIDC park, an office building and manufacturing complex, which adds to the overall impervious surface cover.

Impervious Surface, Tree Cover, and Land Use: This subwatershed is largely developed, with extensive shopping malls and suburban housing tracts resulting in much of the subwatershed being over 50% impervious cover (Figure 2.3.30) and of the 5140 acres in this subwatershed area, over 65% of the landcover is developed/urban land (Figure 2.3.31). The other dominant landcover type is deciduous forest at 32%, with less than 1% of the landcover existing as barren land, herbaceous, hay/pasture, or cropland **(Figure 2.3.32).** These heavily developed landscapes lack a high percentage of canopy cover (Figure 2.3.33) and are characterized by impervious surfaces that contribute significant sediment and nutrients to the stream. During rain storms, sediment and pollution that accumulates on these surfaces is often directed to streams via stormwater infrastructure.

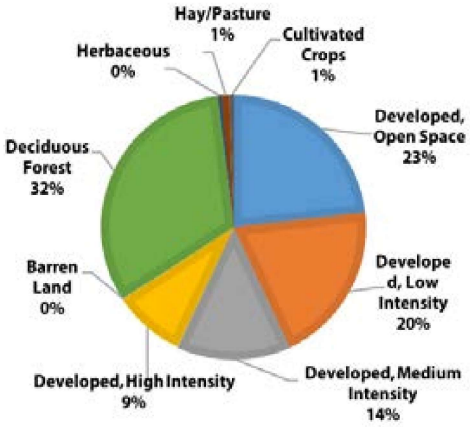

Figure 2.3.32-Landcover classification in the Subwatershed 4-Robinson, Cliff Mine, Beaver Grade Road.

According to the Allegheny County Greenways data set, landscapes in this area of the Montour Run Watershed include lands identified by the Allegheny Land Trust "Greenprint" analysis (identified focus areas with the highest capacity for biological diversity, water management, and scenic character), areas under conservation easements, a few acres of municipal parks, and the rivers/streams/floodplans that make up the Montour Run stream valley **(Table 2.3.4, Figure 2.3.34).** The Greenways data set helps to identify the regions that are protected, and pinpoint regions that should be considered for protection because of their intrinsic environmental value for the public good. The Greenways dataset also delineates landscape regions with "Sensitive Slopes." Regions with steep slopes contribute to greater flow, increased erosion, and subsequently greater rates of sedimentation in receiving waters such as Montour Run and the Ohio River. It is vitally important that these steep slopes in particular can maintain or grow stable plant communities and therefore decrease current and potential erosion from these areas.

Importantly, the Greenways data set also identified whether the lands were Protected or Unprotected, i.e., was there some restriction on the parcels that would prevent future development.

Area Pollution Trends: Each of the three watersheds that make up this subwatershed group are highly urbanized, and likely will experience continued growth. This region contains highway interchanges, routes, and stopping locations between the City of Pittsburgh and the International Airport. Although there is no expected increase in road/highway construction in this area, beyond regular maintenance, there will likely be an increase in residential/commercial development.

The Cliff Mine Road section of Montour Run contains moderate density housing tracts, scattered commercial buildings, and an extensive industrial park (RIDC Park West). The main thoroughfare and stream share the narrow, steep-sided river valley at some points, increasing the susceptibility to flooding. Runoff modeling of nutrients and TSS indicates the commercial and industrial

neighborhoods each contribute upwards of 10,000 lbs of NPS sediment per year to receiving waters .

The Beaver Grade and Robinson subwatersheds contain a heavily urbanized region (The Mall at Robinson, and other suburban shopping malls) in the southwest portion and low-to-moderate density housing in the remaining areas. Pollution accumulation modeling across the landscape suggests that the housing areas do not contribute significantly to stream nutrient loads, as there is forested buffer between the housing regions and the stream that may intercept pollutants in runoff. TSS (**Figure 2.3.35**) and nutrient (**Figures 2.3.36, 2.3.37**) modeling suggests that the majority of the pollution inputs are sourced from the large urban shopping and industrial complexes, particularly in the Robinson portion of the subwatershed.

Sources of the nutrient phosphorus in urban areas include nonpoint sources such as atmospheric deposition, runoff, seepage from septic systems, and stream bank erosion. Agricultural lands are commonly a significant source of phosphorus due to fertilizer use. However, there is little agricultural land in this watershed, or other landscapes that require fertilizer, like golf courses. Urban runoff is most likely the cause of the high amount of phosphorus export from this subwatershed area.

The landscape pollution modeling estimated most of the nitrogen from this area is contributed by the most developed of the three subwatersheds. For these areas, the primary source of nitrate is likely atmospheric deposition. Automobiles, manufacturing and electricity generation processes emit a significant amount of nitrogen oxides as a by-product of fuel combustion. These nitrogen oxides can be deposited on the land surface and washed into the storm sewers and the stream during rain events. The nutrient accumulation model captures the cumulative effect of the non-point sources that are deposited on the landscape and then washed to the stream during storms.

Each of the townships that make up this region are considered "MS4" communities, and are therefore required to obtain permits to discharge stormwater into waters of the US, and develop stormwater management programs (SWMPs) that describe the stormwater control practices that will be implemented to minimize the discharge of pollutants that may be in storm runoff. There are no known specific spill or illicit discharges in these subwatersheds.

While each subwatershed in this group does contain abandoned mine sites, most are dry or do not contribute significant pollution to downstream receiving waters (**Figure 2.3.38**). The exception is Milk Creek, a small stream in the Cliff Mine sub-shed influenced by mine discharge that carries significant amounts of dissolved aluminum, giving the stream its characteristic milky color and name. Milk Run is currently the focus of restoration efforts on the part of the Allegheny County Conservation District and the Montour Run Watershed Association. An in-stream treatment system, completed in July 2019, now significantly reduces metal concentrations in the stream before Milk Run enters Montour Run.

Significant areas of this subwatershed are lacking riparian buffers (**Figure 2.3.39**). GIS analysis of the tree canopy in the riparian buffer zones suggests that there is greater than 9,000 linear feet with less than 15% intact tree canopy (**Table 2.3.5**). An established riparian buffer intercepts sediments and nutrients transported via overland flow, and helps to prevent bank erosion by slowing inflow. Riparian areas identified with minimal tree canopy should be a focus of conservation and tree planting efforts in the Montour Run Watershed. It is understood, however, that the regions with the most sparse tree canopy in the riparian buffer are largely developed or built up areas where the road closely follows the stream course, therefore there is little opportunity to plant trees and strengthen the existing near-stream region.

Table 2.3.4-The Greenways data for Subwatershed Area 4-Robinson, Cliff Mine, Beaver Grade Road, which indicates significant land that is not developed is also on steep slopes. These sites in particular should be preserved from further development in order to prevent future sedimentation.

Type	Acres	Protected?
Allegheny Land Trust GREENPRINT	457	No
Land Trust Property	5.3	Yes
Municipal Parks	6.4	Yes
Rivers, Streams, Wetlands, Forested Floodplain	292.8	No
Sensitive Slope Areas	378.3	No
Trails	4.5	Yes

Table 2.3.5-GIS analysis of tree canopy within Sub-watershed Area 4-Robinson, Cliff Mine Beaver Grade riparian buffer zones (within 100 feet of the stream).

Percent Tree Canopy in ~100 ft Riparian Buffer	Linear Feet of Tree Canopy in each Percent Category
0-15	457
16-30	5.3
31-45	6.4
46-60	292.8
61-75	378.31
76-90	4.5

Subwatershed Area 5-Meeks, Trout, and Salamander's Head

Watershed Characterization, Geography, opography: Meeks, Trout and Salamander's Head are grouped together by their shared geography and exceptional water quality, in comparison with the majority of streams in the Montour Run Watershed. This 3,780 acre region of the watershed is characterized by wooded, incised stream valleys, a few bisecting roads, and lower density development.

As a result, Meeks Run, Trout Run, and Salamander's Head (together a total stream length of 8.75 miles) are classified as "attaining" their designated use as supporting aquatic life. Only 1.4 miles of stream in this area (not including the main stem of Montour Run) are classified as "not attaining". This watershed group contains less developed parts of Robinson and Moon townships.

Impervious Surface, Tree Cover, and Land Use: In all, the landscape in this area has a low overall amount of Impervious Surface. Meeks and Trout Run average 7% impervious surface, each, and Salamander's Head averages 11% impervious surface **(Figure 2.3.40)**. This low percentage of impervious surface allows water to soak into the ground, feeding groundwater and mitigating pollution, erosion, and sedimentation problems associated with stormwater runoff across impervious surfaces.

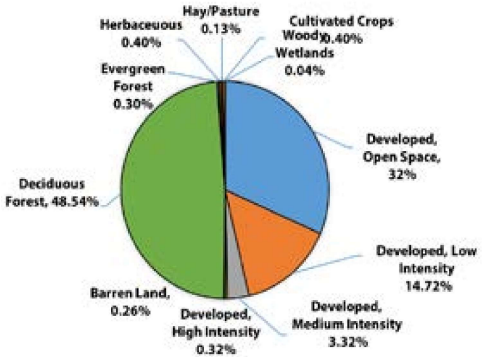

Figure 2.3.42-Landcover classification in the Subwatershed 5-Meeks, Trout, and Salamander's Head.

The subwatershed area contains about 50% tree canopy (Figure 2.3.41). More tree canopy helps to slow and infiltrate stormwater, prevent erosion, and absorb nutrients that would be transported in stormwater downstream.

Of the 3,780 acres in these subwatersheds, nearly 50% of the landcover is deciduous forest **(Figure 2.3.42, 2.3.43)**. Further, the developed portion of the landscape is largely dominated by open space (32%), rather than the high-density development patterns seen in other areas of Montour Run. Less than 1% of the landcover is classified as barren land, herbaceous, hay/pasture, woody wetlands, developed/high intensity, or croplands. As a result of the less-developed nature of these subwatersheds, the water quality itself in this area is not considered "impaired," and these streams are stocked and fished for trout.

According to the Allegheny County Greenways data set, landscapes in this subwatershed area include a significant amount of undeveloped land **(Table 2.3.6, Figure 2.3.44)**. In all, approximately 45% of these three subwatersheds is listed as "undeveloped" in the Greenways data set. These lands identified by the Allegheny Land Trust Greenprint analysis include areas under conservation easements, a few acres of municipal parks, three golf courses, and the rivers/streams/floodplans that make up the Montour Run stream valley (Greenways, PASDA). Importantly, the Greenways data set helps to identify the regions of the open space that are protected (651 acres) and not protected (1,054 acres)

These are delineated in order to highlight the regions that should be considered for protection because of their intrinsic environmental value for the public good. For example, the Greenways map shows significant areas with "Sensitive Slopes" that are not protected. Regions with steep slopes contribute to greater flow, increased erosion, and subsequently greater rates of sedimentation in receiving waters such as Montour Run and the Ohio River. The steep slope areas, in particular, are also commonly within the riparian buffer along either side of the main stream course due to the local topography. Therefore, these are important areas for conservation and restoration in order to decrease current and potential erosion from these areas.

Area Pollution Trends: Each of the three watersheds that make up this subwatershed group are low to moderately developed, and each also contains significant lands in some sort of protected status. This results in one of the most pristine areas of the Montour Run watershed, and fewer pollution inputs. TSS **(Figure 2.3.45)** and nutrient **(Figures 2.3.46, 2.3.47)** modeling suggests that the majority of the pollution inputs are sourced from the large areas of open space – including the golf courses and park lands. The Moon Golf Club, owned by Moon Township, is located in the upper headwaters of one branch of Trout Run.

Additionally, the private Montour Heights Country Club is located in the headwaters of the Meeks Run, and the public Moon Park is farther downstream. Golf courses, in particular, can create significant environmental degradation on their landscape. The trees were long since removed, and replaced with a grass monoculture.

Specialized grasses to create the greens require significant inputs of pesticides and chemical fertilizers.

Similarly, a park with acres of mown grass can also be a pollution source. It should be emphasized that golf courses and parks can provide ecological benefit, as well. These spaces will likely remain open and undeveloped in the future. Water features and "rough" zones could provide wildlife habitat in particular for birds. The conservation and management efforts pursued by the club owners and park managers should be discussed in an effort to accurately quantify the water pollution and downstream impacts of specific management regimes.

The riparian buffer protecting the streams in this subwatershed group is largely intact **(Figure 2.3.48)**. GIS analysis of the tree canopy in the riparian buffer zones indicates that there is less than 2,500 linear feet of riparian buffer area with less than 15% tree canopy **(Table 2.3.7)**. A strong riparian buffer can intercept sediment and nutrients that are flowing overland towards the stream and help to prevent erosion of bank sediments by slowing water. The regions with the most sparse tree canopy in the riparian buffer include the headwater portion of Meeks Run where the Moon Golf Course is located.

Table 2.3.6- The Greenways data for Subwatershed Area 5-Meeks, Trout, and Salamander's show a significant amount of land that is minimally developed and also highlights areas for focused conservation efforts in the future. For example the 340 acres identified as Greenprint lands are undeveloped and also unprotected.

Type	Acres	Protected?
Allegheny Land Trust GREENPRINT	340	No
Community Parks	169	Yes
Golf Parks	277	Yes
Land Trust Property	204	Yes
Rivers & Streams, Wetlands, Forested Floodplain	89	No
Sensitive Slope Areas	625	No
Trails	1.5	Yes

Table 2.3.7-GIS analysis of tree canopy within Sub-watershed Area 5-Meeks, Trout, and Salamander's riparian buffer zones (within 100 feet of the stream).

Percent Tree Canopy in ~100 ft Riparian Buffer	Linear Feet of Tree Canopy in each Percent Category
0-15	2,446
16-30	4,041
31-45	4,238
46-60	68,288
61-75	12,978
76-90	34,616

The Salamander's Head region of the watershed contains the most low-density housing areas. Pollution accumulation modeling across the landscape suggests that the housing areas do not contribute significantly to stream nutrient loads, as there is forested buffer between the housing regions and the stream that likely intercepts pollutants in runoff.

Subwatershed Area 6-Lower Montour Run to Ohio River

Watershed Characterization, Geography, Topography: This small portion of the Montour Watershed is made up of Moon, Coraopolis, and Robinson Townships. Here, the narrower stream valley opens onto the Ohio River floodplain, winding its way though the urbanized Coraopolis riverfront. This 1,235 acre sub-shed contains 4.08 miles of stream, including a small tributary that joins Montour Run from the east. Seventy percent of the stream miles, or 2.9 miles of stream are considered impaired, and 1.6 unimpaired. Montour Run is conveyed through a deep waterway through this portion of the watershed, at times controlled by concrete-lined channels.

Impervious Surface, Tree Cover, and Land Use: In all, the landscape in this area has a low overall amount of impervious surface. The subwatershed averages 11.3% impervious surface, with the impervious surface clustered along the Ohio River in Coraopolis (Figure 2.3.49). Minimal impervious surface area allows water to soak into the ground, feeding groundwater and mitigating pollution, erosion, and sedimentation problems

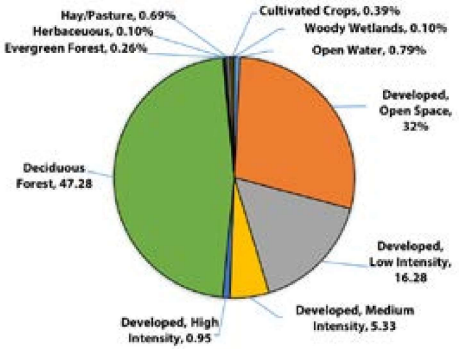

Figure 2.3.52-Landcover types in each subwatershed of interest. The parks and golf courses in these areas contribute to a high overall "open space" type of land cover.

associated with stormwater runoff across impervious surfaces.

The subwatershed contains 49% tree canopy (Figure 2.3.50). More tree canopy helps to slow and infiltrate stormwater, prevent erosion and absorb nutrients transported by overland flow. Importantly, Montour Run itself has an average of 48% tree canopy in the riparian buffer, the ~100 foot zone to either side of the stream. This riparian buffer canopy serves as a buffer to pollutants entering a stream from runoff, controls erosion, and provides habitat and nutrient input into the stream.

Landcover in this area is a mix of low-density development, green space, and densely settled regions of Coraopolis (Figure 2.3.51). Of the 1,235 acres in this subwatershed, 47% of the landcover is deciduous forest. Further, the developed portion of the landscape is largely dominated by open space (32%), rather than the high-density development patterns seen in other areas of Montour Run (**Figure 2.3.52**). Less than 1% of the landcover exists as herbaceous, evergreen forest, hay/pasture, woody wetlands, developed/high intensity, or croplands. The small tributary does not contribute significantly to stream flow or pollutant loads.

According to the Allegheny County Greenways data set, landscapes in this subwatershed area include a significant amount of undeveloped land (**Table 2.3.8,** Figure 2.3.53). In all, approximately 376 of the 1325 acres, or 28% of this subwatershed is listed as "undeveloped" in the Greenways data set. The lands identified by the Allegheny Land Trust Greenprint analysis include 2 acres under conservation easements, 3 acres of municipal parks, and 2 acres along the Montour Trail (Greenways, PASDA). Importantly, the Greenways data set helps to identify the regions of the open space that are protected (7 acres) and not protected (369 acres).

These are delineated in order to highlight the regions that should be considered for protection because of their intrinsic environmental value for the public good. For example, the Greenways map shows significant areas with "Sensitive Slopes" that are not protected. Regions with steep slopes contribute to greater flow, increased erosion, and subsequently greater rates of sedimentation in receiving waters such as Montour Run and the Ohio River. The steep slope areas, in particular, are often located within the riparian buffer along either side of the main stream course due to the local topography. Therefore, these are important areas for conservation and

restoration in order to decrease current and potential erosion from these areas. In this subwatershed, 18 acres of sensitive slopes are identified, and it is noted that they are not protected from development. In addition, the large areas of wetlands and forested floodplains, as well as privately owned green space, are unprotected. These areas, in particular the regions earmarked wetlands and forested floodplains, should be considered for protection and preservation, as these measures increase riparian buffer along the stream bank and help to prevent non-point source pollution inputs.

Area Pollution Trends: Each of the three watersheds that make up this subwatershed group are low to moderately developed, and each also contains significant lands in some sort of protected status. This results in one of the most pristine areas of the Montour Run Watershed, and fewer pollution inputs.

TSS (**Figure 2.3.54**) and nutrient (**Figures 2.3.55**, **2.3.56**) modeling suggests that the majority of the pollution inputs are sourced from the large areas of open space – including the golf courses and park lands . The Moon Golf Club, owned by Moon Township, is located in the upper headwaters of one branch of Trout Run. Similarly, the private "Montour Heights Golf Club" is located in the headwaters of the Meeks Run, and the public Moon Park is farther downstream. Golf courses, in particular, can create significant environmental degradation on their landscape. The trees were long since removed, and replaced with a grass monoculture. Specialized grasses to create the greens require significant inputs of pesticides and chemical fertilizers. Similarly, a park with acres of mown grass can also be a pollution source. It should be emphasized that golf courses and parks can provide ecological benefit, as well. These spaces will likely remain open and undeveloped in the future. Water features and "rough" zones could provide wildlife habitat in particular for birds. The conservation and management efforts pursued by the club owners and park managers should be discussed in an effort to accurately quantify the water pollution and downstream impacts of specific management regimes.

The riparian buffer protecting the streams in this subwatershed area is fragmented and poorly defined (**Figure 2.3.57**). In some areas the stream is deep within a heavily armored bank. GIS analysis of the tree canopy in the riparian buffer zones indicates that there is ~ 3,600 linear feet of riparian buffer area with less than 15% tree canopy **(Table 2.3.9)**. A strong riparian buffer can intercept sediment and nutrients that are flowing overland towards the stream and help to prevent erosion of bank sediments by slowing water. The regions with the most sparse tree canopy in the riparian buffer include the suburban housing areas of North Forest Grove Road and Ewings Mill Road, as well as the small area of houses and the Allegheny Valley School located along Coketown Road. In particular, here, the buildings and road are spaced far enough from the stream that the riparian buffer could be augmented with more trees. However the stream in this area is largely buffered.

Type	Acres	Protected?
Allegheny Land Trust GREENPRINT	232	No
Rivers & Streams, Wetlands, Forested Floodplain	119	No
Sensitive Slope Areas	18	No
Trails	2	Yes
Municipal Parks	3	Yes
Land Trust Property	2	Yes

Table 2.3.8- The Greenways data for the area of interest shows a large amount of minimally developed land and also highlights areas for focused conservation efforts in the future. For example the 340 acres identified as Greenprint lands are undeveloped and also unprotected.

Table 2.3.9-GIS analysis of tree canopy within Sub-watershed Area 6-Lower Montour Run to Ohio river riparian buffer zones (within 100 feet of the stream).

Percent Tree Canopy in ~100 ft Riparian Buffer	Linear Feet of Tree Canopy in each Percent Category
0-15	3,600
16-30	7,000
31-45	10,000
46-60	10,900
61-75	16,400
76-90	28,900

Future Goals & Recommendations

i. Quantifiable Goals & Objectives

Water Treatment and Best Management Practices (BMPs) Already Implemented or Planned

Existing Stormwater BMPs and Enhancements to Existing BMPs: We identified over 40 sites where Best Management Practices, (BMPs) were employed to manage stormwater **(Figure 3.1.1)**. Two rain gardens, documented as part of the 3 Rivers Wet Weather Green Infrastructure Atlas (http://www.3riverswetweather.org/green-infrastructure), are located in the business district of the E. Upper McClaren subwatershed. One raingarden is located on property next to the Moon Township Municipal Building and the second is located on the grounds of the Kenny Ross Toyota dealership. There may be other BMPs located in the Montour Run Watershed. In particular, smaller-scale green infrastructure installations such as residential-scale rain gardens cannot be located via GIS/spatial analysis.

Through visual assessment of spatial data and specific spatial analysis, over 30 detention basins were identified, designed to capture stormwater from impervious surfaces and release it to receiving waters. We also identified 10 retention basins, designed to capture and hold water. There are also likely other smaller detention basins that could not be identified via spatial analysis. These detention and retention basins were commonly located down-gradient from large parking lots in shopping centers and suburban housing developments.

Usually, existing detention basins were not designed to capture and detain frequent small storms, instead channeling water to nearby streams quickly. Storm basins can be retrofitted to hold, absorb, and filter stormwater runoff. For example, adding a sediment forebay (via the addition of a berm to the bottom of the basin) slows water and allows sediment to drop out, increasing the removal effectiveness. Decreasing the orifice size in the outflow control structure increases retention time in the basin. This allows the water to infiltrate into the soil, undergo biofiltration and evapotranspiration processes, and capture a greater range of storms. Converting the detention basin to a bio-retention basin through the use of filtering media, engineered soils, plants, etc. adds wildlife habitat, increases biofiltration evapotranspiration processes, and increases nutrient and sediment retention.

AMD Treatment Sites, Existing and Planned: To date, there are five AMD treatment sites in the watershed that significantly reduce metal loading into Montour Run **(Table 3.1.1)**. As a result of these treatment sites, BioMost projected that metal loading could be reduced by between 23-25 tons annually and ~45 tons of acidity may be removed from the stream water (Stream Restoration, Inc.).

AMD increases sediment and metals (part of sediment) and can change pH of water. Bedrock in Western Pennsylvania has a high carbonate content that buffers acid effects from the AMD, which makes pH less of an issue in this area. The BioMost report on AMD evaluated each site, measured water quality parameters in water draining from each site, and then quantified the pollutants from each site. The study also provided specific conceptual plans for remediation and quantified reductions based on these conceptual plans. For Subwatershed Areas 2 and 3

Table 3.1.1-Abandoned mine discharges in the Montour Run Watershed as identified in the AMD Cleanup Plan.

Site	Treatment?	Estimated Sediment (as metals) - from BioMOST study	Approx. Costs
MP5 (McCaslin Road)	No	1.1 tons/year	$160,000
NFMU9/(MP1) (North Fork)	Yes	2.8 tons/year	$330,000
MP2	No	1.4 tons/year	$450,000
NFMU5/(MP8)	No	1.9 tons/year	$550,000
NFMU6	No	1.3 tons/year	$600,000
MP6	No	1.6 tons/year	$230,000
SFMU2/Pre1 (Boggs Road)	Yes	1.7 tons/year	$120,000
SFMS6	Yes	2.3 tons/year*	$520,000
SFMS7	No	1.3 tons/year	$330,000
SFMD7	No	0.4 tons/year	$300,000
SFMD3	No	0.1 tons/year	$250,000
MKR3* (Milk Run)	Yes	3.9 tons/year*	$1,200,000
Pre2 (Clinton Road)	Yes	21.4 tons/year	$282,000

*This discharge is largely Aluminum, which can be fatal to aquatic life in high concentrations.

in particular, focus should be placed on implementing the remediation plans outlined in the BioMost report, including:

- address the sites examined, but not yet remediated.
- evaluate the efficacy of each existing AMD treatment site.
- continue to make sure existing and future sites are climate-change ready.

Increases in groundwater volume will potentially result in drainage from mines to streams, which will lead to an increase in sedimentation and erosion. The increasing drainage is accompanied by increases in water-borne sediment and erosion. Therefore, it is important to ensure that the AMD remediation sites are adequately sized for increased water inputs due to changing rain regimes.

General Policy and Focus Recommendations for the Montour Run Watershed

Focus on up-gradient efforts that filter/detain runoff and prevent it from directly entering the stream: The Montour Run Watershed has two major categories of water quality problems that can be sourced to either Abandoned Mine Drainage or non-point source (NPS) stormwater inputs. AMD sources can generally be traced to a point source and are relatively well-quantified. On the other hand, stormwater carries pollution from across the landscape to the stream, and concentrated flow paths cause erosion. Existing TMDLs for the Montour Run Watershed address abandoned mine drainage. The NPS erosion, pollution inputs, and sediment caused by stormwater runoff is not covered by a specific water quality standard or TMDL agreement. Water quality improvement efforts should focus on this gap and work to reduce NPS pollution, including sediment and nutrients, entering streams. Increasing infiltration of surface runoff to groundwater will increase the physical filtration of sediments, add to groundwater resources, and aid in the mitigation of downstream flooding. In addition, infiltration increases contact time with soil bacteria and plants that can process chemicals and/or incorporate nutrients into biomass, thereby preventing transportation downstream. Each of these problems is best addressed in the upland or source zones, before overland flow enters the stream.

Pursue a Better Basemap to increase modeling efficiency and accuracy: Stormwater and associated problems are the other category of water quality problems in Montour Run. Stormwater rushes across the land surface carrying pollutants from atmospheric deposition, leaking

cars, sediment and nutrients with it. Stormwater that enters stream carries pollutant along with it and accelerates the erosion process. Stormwater and associated pollution loads are difficult to quantify primarily because it is dispersed across the landscape. Therefore, modeling methods are used to quantify pollutant loads from stormwater such as sediment, flow paths and TSS contributions from the landscape to the stream.

The modeled locations of high TSS input strongly correspond with observed problem areas. These areas included observations of erosion, sediment deposition, and locations of BMP needs. Therefore, these modeling techniques can be utilized in the future to make targeted observations, reducing manpower and associated costs. Models can also be used to estimate inputs where it is physically difficult to access, i.e., small streams on private property, or otherwise remote streams. For example, the North Fork and South Fork were physically assessed due to private property access and narrow stream channels covered in dense vegetation. Consequently, inaccessible stream sections were evaluated by modeling, which has proven to provide consistent data as compared to physically assessed sites. However, modeling efforts need to be improved due to variations in resolutions; the topographic resolution was small, and the landcover resolution was large (30 m). Improved land cover data sets would strengthen the prediction capabilities and understanding of NPS pollution inputs from the landscape.

Engage Stormwater Officials from Municipalities in Enhancing Existing Pollutant Reduction Plans:
Each of the municipalities in the Montour Run Watershed has an MS4 permit that requires reductions in sediment and nutrient loading related to stormwater. Each municipality has developed a Pollution Reduction Plan (PRP) by outlining specific projects to reduce the sediment and nutrient loading required within each watershed. On a very broad level, solutions should take into account planned changes within these municipalities and consider (1) enhancements to design BMPs that will fulfill required nutrient and sediment loading reductions and (2) pursue and/or budget funding to implement the projects. Enactors of this plan should coordinate with each municipality and pursue projects that were outlined in the PRPs.

As part of fulfilling their MS4 PRPs, North Fayette Township, Findlay Township, Coraopolis Borough, and Moon Township have developed or plan to enact a Stormwater Fee program (**Table 3.2.1**). These fees will generate revenue to fund the PRP projects. The proposed fee is usually charged per ERU, or Equivalent Runoff Unit. An ERU is the measure of impervious ground cover in a typical single-family lot, as calculated by statistical analysis of parcels in the municipality. The Allegheny County Airport Authority is a large landowner in Sub-Watersheds 1 and 2, and is also required to fufill MS4 requirements. Every effort in these areas should be coordinated with the Allegheny County Airport Authority. The Airport, located in the upper regions, controls downstream contributions of sediment and nutrients for a significant portion of the watershed. The plateau of the airport drains down to stormwater detention basins that contain water from airport drainages at the new head of the E. Fork of Enlow Run. Water is then released to the historic Enlow Run Stream channel. Similarly, water draining the east side of the Airport, historically McClarens Run, is directed to a dry detention basin located on the grounds of the 171st Air National Guard base just south of the Airport. Estimated TSS routed yearly through each of these basins is upwards of 60,000 lbs per year, NO3 at 2500 lbs per year, and TP at 1500 lbs per year. Retrofitting existing basins to capture more water and create opportunities for bio-infiltration by planting vegetation that does not require mowing could spread and reduce runoff, and increase detention time.

Table 3.2.1-Stormwater fees by municipality and the planned implementation year.

Municipality	Proposed Fee	Implementation
Coraopolis	$7.00 per ERU	2019
Moon	$5.50 per ERU	2020
North Fayette	$3.50 per ERU	2018
Findlay	$3.50 per ERU	2020
Robinson	Unknown	Unknown

Recommended BMP Types, Estimated Effectiveness, and Estimated Costs

Costs were estimated by comparing recently completed projects, evaluating unit costs, and comparison with the Green Values National Stormwater Management Calculator (accessed online December 2019, www.creenvalues.cnt.org/national/cost_detail.php) **(Table 3.3.1)**. It is important to note these costs are estimates and depend on many factors, some of which are noted.

Riparian Buffer or streambank restoration costs depend on the width of area that will be restored (i.e., distance of the buffer from the stream bank) as well as the restoration strategy imposed. Riparian buffer tree plantings can be relatively inexpensive. Streambank restoration strategies range from volunteer-based willow plantings to more intensive interventions such as bank armoring, which may require the use of heavy machinery.

Table 3.3.1-Best management strategies for reducing pollutants from urban runoff, including their percent reduction and estimated costs.

Best Management Practice/Green Infrastructure Strategy	Sediment Reduction	Nitrogen Reduction	Phosphorus Reduction	Estimated Cost
Riparian Buffer/Streambank Restoration	65%	50%	50%	$200-$700 per LF
Basin Retrofit	70%	30%	60%	$80,000-$195,000
Rain Garden	85%	30%	85%	$58 per SF
Bioswale	85%	30%	85%	$30-$278 per LF
Pervious Pavement/Pavers (including Green St/ Alley)	85%	30%	85%	$179 per LF
Wetland Restoration/Treatment Wetlands	85%	30%	85%	$100,000 per acre

Basin Retrofits include multiple strategies. Adding a sediment forebay (via the addition of a berm to the bottom of the basin) slows water and allows sediment to drop out, increasing the removal effectiveness. Decreasing the orifice size in the outflow control structure increases retention time in the basin, allowing the water to infiltrate into the soil, undergo biofiltration and evapotranspiration processes, and capture a greater range of storms. Adding a depth control structure, such as an Opti "Smart Valve" could increase detention by closing off the outflow from the pond, or releasing it at a controlled rate. Converting the detention basin to a bio-retention basin adds wildlife habitat, increases biofiltration evapotranspiration processes, and increases nutrient and sediment retention. For detention basins targeted for retrofitting, increased sediment and stormwater retention could be enhanced by including elements listed above not already planned for these basins.

Rain Garden costs include excavation, bioretention soil, plantings, stone and outlet control structures.
Bioswales can vary considerably based on the existing conditions at the planned locations, necessary connections to overflow structures such as existing stormwater inlets, and stone, excavation, curb cuts or other hardscaping, and any soil/plantings needed. The range of costs shown above takes into account existing conditions along a range from simple grass swales to the demolition of existing hardscape (gutters, concrete medians).

Pervious or Porous Pavers Costs estimated above include the demolition of existing pavement, overflow connections to storm sewers, and new materials to be put in place. The cost effectiveness of these intensive retrofitting BMPs increases when coordinated with street re-pavement or other infrastructure repair / revitalization projects.

Wetland Restoration or Treatment Wetlands costs vary greatly based on existing conditions, water treatment goals, and design elements chosen. Estimates used here do not include amenities such as trails, wildlife viewing stations, or boardwalks, etc, because not every project will include these.

Recommended BMPs by Subwatershed Area

The following recommended strategies and BMP's reflect specific to pollution inpts and opportunities in each sub-watershed group. Space and land ownership are important considerations when choosing to implement BMP's. We chose to focus our recommendations on areas that were within or adjacent to publicly accessible parcels: municipal, federal, state, or county-owned properties, properties owned by local Boards of Education, fire or EMS departments, Allegheny County Airport Authority, places of worship and local parks. These parcels are publicly owned or accessible, or are larger tracts of land and therefore have greater potential to house an appropriate BMP. It should be noted that this WIP effort did not include landowner negotiations or easements, or property acqisition. Rather, the sites highligted in the following sections are recommendations of locations where BMP"s would be effective and relevent.

These parcels were then correlated with the visual assessment, modeled TSS data, and the percent tree canopy in the riparian buffer. A list of priority focus areas was developed through the analysis. A map of potential projects for each subwatershed group is included, and the table below contains information on the potential cost range for each type of project, and the expected reduction in sediment/nutrients.

Note that there is some uncertainty about the exact location of the parcel boundaries. Further, although the geographic location of recommended remediation sites is depicted as a spot along the stream, often there is a length of stream that needs to be addressed that is not restricted by parcel ownership boundaries.

These identified priorities are a limited list of the many projects that are possible to pursue in this region. The sites are located both along the stream bank / riparian buffer and in upland areas of the watershed, thereby offering opportunities to reduce delivery of sediment and nutrients to the stream in the first place.

Subwatershed Area 1-Airport Area: Suggested sites for this sub-watershed group are shown in Figure 3.4.1. Most of the stream miles were inaccessible for the visual assessment on this stretch. Chosen sites were based on pollution accumulation modeling and prioritized by publicly accessible parcels, or parcels owned by municipalities, state or federal government, school districts, parks, churches, etc.

1A: Address erosion and other in-stream problems observed via the visual assessment. These were the only stream miles walked in this sub-watershed group, and a number of sites along this short section showed evidence of erosion and infrastructure problems. Recommended solutions include bank armoring against erosion, riparian buffer plantings, and infrastructure assessments. Approximately 390 ft of streambank are recommended for intervention, for a total projected cost of $273,000.

1B: Parking lot and roof capture in a bioswale or rain garden at the Moon Township Municipal Building and Police Station, located at Beaver Grade and Thorn Run Rds. Modeling estimates show these sites produce significant amounts of sediment from the parking lots and roof areas. There are currently two rain gardens on the site. The site has additional capacity to capture stormwater potentially from the nearby road storm drain, building roofs, and additional parking areas. A hydrological analysis would help to determine the amount of stormwater that reaches the gardens. Directing stormwater from these areas to a rain garden or bioswale would increase the impact of rain gardens on this site. Preliminary observations indicate that up to 6,000 SF could be dedicated to a rain garden on the edge of the property, downslope from the existing parking lots and buildings. The preliminary cost estimate of this project is $345,0000.

1-C: Retrofit detention basin at the Moon Township Public Works building, at the end of Stevenson Mill Road. This site is estimated to produce significant amounts of sediment from the parking lots and roofs. The existing detention basin could be enhanced to encourage evapotranspiration and biofiltration for a projected cost of $80,000.

1-D: Rain garden and permeable pavement/pavers at the Moon Middle and High School Complex. This region includes significant parking areas and would be an ideal location to partner with the school district to organize BMP design and installation as a teaching opportunity. The campus could support upward of 10,000 square feet of rain garden ($580,000 potential cost) and 600 linear feet of bioswale (estimated at $100 per linear foot, installed along current location of grassy road edge) to help manage pollution in stormwater runoff.

1-E: Basin retrofit in the Forest Green Commons apartment plan. The detention basin receives water from the adjoining Moon Middle and High School complex, and drains through the apartment complex through a wooded area. Enhancing this site through a basin retrofit would control stormwater and complement could be completmented with nature trails and signs for students and apartment residents to enjoy. Estimated costs, $80,000.

1-F: RIDC Park Idustrial Complex stormwater master plan. There is ample opportunity to control stormwater runoff from the entire complex through basin retrofits, bioswales, and rain gardens, which have the added benefit of increasing habitat and natural access for workers on-site. Costs for this plan would vary significantly depending on the BMPs employed. A comprehensive stormwater management plan for this site could be rolled out in phases.

Subwatershed Area 2-North Fork and West Enlow: Subwatershed Area 2 is located within the boundaries of Findlay Township). In general, the landscape here is more rural and therefore generates less stormwater flow, with water quality problems primarily caused by abandoned mine drainage and spoils piles. Priorities for this area should focus on continually working to implement the BioMost Abandoned Mine Drainage Cleanup Plan of 2003 to treat AMD.

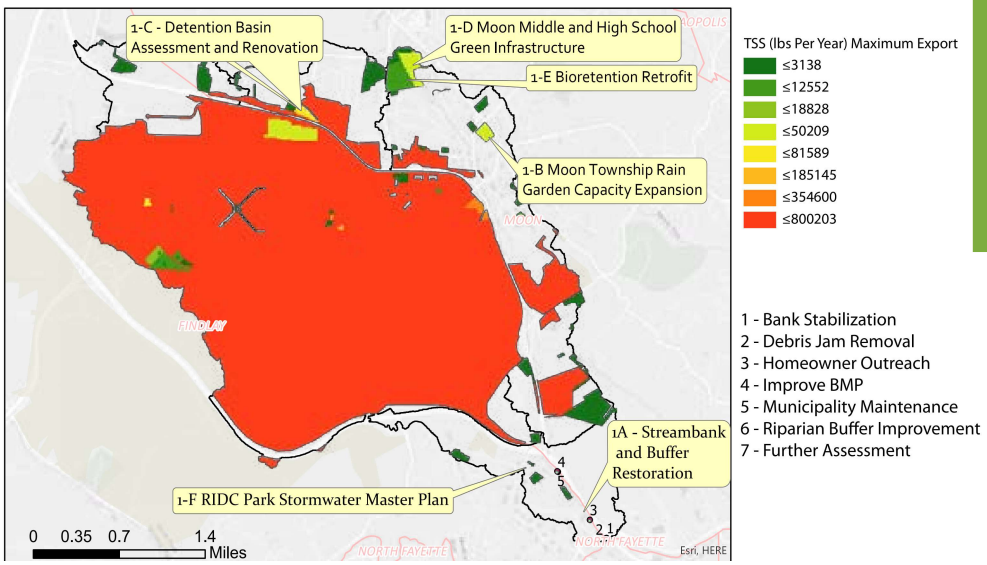

Figure 3.4.1-Priority recommendation sites for Subwatershed Area 1-Airport Area. Sites based on pollution accumulation modeling (TSS shown) and accessibility.

Suggested sites for this sub-watershed group are shown in Figure 3.4.2. Most of the stream miles were inaccessible for the visual assessment on this stretch. Chosen sites were based on pollution accumulation modeling and prioritized by publicly accessible parcels, or parcels owned by municipalities, state or federal government, school districts, parks, churches, etc.

2A: Landscape restoration of the stream bank along the Clinton-Enlow Rd (location, 40.474602, -80.25427). The wide, relatively shallow stream valley with incised stream banks experiences ongoing erosion along Clinton-Enlow Road. Piped drainage directs airport and highway discharge to the stream. The potential for remediation efforts at this site is considered high because:

1. The property is owned by the Pittsburgh Airport Authority, which in the past has spearheaded, donated equipment and in other ways provided support for environmental remediation efforts on airport property.
2. The stream valley is largely undeveloped.
3. The "Montour Connector" bike path, which provides a connection between the Montour Trail, The Great Allegheny Passage trail, and the airport is routed along the rural road boarding the stream. Potential landscape restoration efforts will not impede on the use of this route, and in fact may enhance the visual and ecological quality of the site for trail users.

Proposed BMPs include streambank reinforcement, re-connecting the stream to the floodplain by reducing overbank sediment loading or wetland re-creation, and revegetation of the floodplain and banks to encourage wetland species that can also act as bio-filtration. Concerns about this site that should be taken into consideration include potential complications with the permitting of BMPs in the stream itself, and the possible reintroduction of pollutants from floodplains during high flow conditions. To minimize these complications, mitigate with vegetation on floodplain to help slow water and drop pollutants. This site is slightly under an acre in size, construction costs are estimated around $100,000.

2B: The Findlay Township Building at the corners of Rte 30 and Clinton Rd. adjoins a community park and includes parking lots and roofs from which the stormwater could

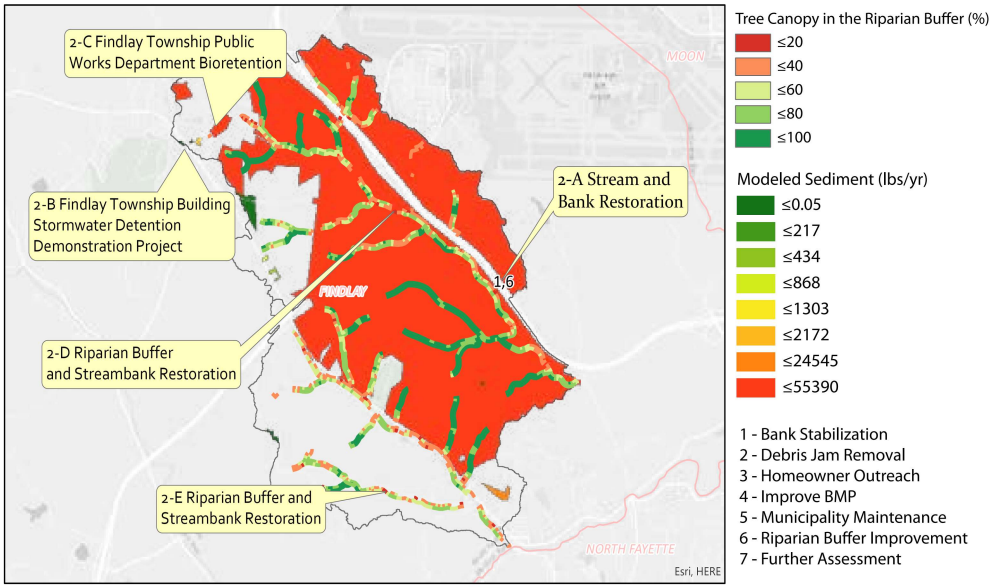

Figure 3.4.2-Priority recommendation sites for Subwatershed Area 2-North Fork and West Enlow. Sites based on pollution accumulation modeling (TSS and Riparian Buffer shown) and accessibility.

be detained. Located in the headwaters of the watershed, valuable benefits would be derived in the form of public education. and improving the adjacent area. A 3,000 square foot rain garden on this site will cost an estimated $174,000.

2C: The Township of Findlay Public Works Department on Clinton Road includes a large parcel with gravel parking lots, expanses of roof, and an existing detention basin. The detention basin should be evaluated for retrofitting to retain water and nutrients. Estimated costs are $80,000.

2D: Restore riparian buffer and stream banks along stream in conjunction with the Airport Authority. The streambanks and near-stream regions would benefit from increased tree cover and natural bank armoring from willow plantings, in particular. Approximately 400 linear feet of riparian buffer plantings along this stretch is estimated to cost $80,000.

2E: Restore riparian buffer and stream banks along Imperial / Burgettstown Road. In particular, the road introduces stormwater runoff directly to the stream. Currently the space between stream and road is scrubby grass. Establishing a more robust riparian buffer along this corridor is estimated to cost $260,000.

Area 3: South Fork Montour Run: The South Fork of Montour Run did not undergo visual assessment because of access issues. Prioritized areas in this sub-watershed group were identified by spatial analysis of the pollution accumulation modeling and examination within publicly accessible parcels.

This sub-watershed group does contain several large industrial properties where GI could help to reduce stormwater runoff. Potential focus partners include:

1. Amazon
2. Imperial Parking Lot retrofits, Findlay Community Center and Agway
3. Lenox Court retention pond retrofit
4. Birchwood Land Pond retrofit
5. West Allegheny School District

Visual assessments began at the confluence of the North and South Fork, and continued along the main stem. Prioritized project areas in this sub-watershed group are focused on stream bank restoration locations based on the visual assessment and publicly accessible parcels (Figure 3.4.3).

3A: Reinforce the riparian buffer through tree plantings and stream restoration efforts on both sides of the stream. These riparian areas are owned by Allegheny County. A visual assessment of this stretch identified 20 individual areas of streambank with visible erosion, no riparian buffer, or was in some way compromised. Reinforcing the buffer in this area would help to decrease erosion and increase resilience. To address 2,000 linear feet of riparian area will cost approximately $200,000.

3B: West Allegheny Middle School and High School Campuses. This hilltop complex contains ample grassy parking islands and school property that could be used to detain, infiltrate and filter stormwater runoff from the buildings and parking lots. Projects on this site would also provide tremendous educational opportunities for biology/environmental studies/gardening classes or clubs. Three basins could be explored for retrofitting to increase bioretention and potential habitat (estimated cost, $240,000). Similarly, parking lot runoff could be directed into bioretention swales that could be built on existing grassy areas (estimated cost for 3,000 linear feet approximately $150,000).

3C: Wilson Elementary School grounds rain gardens and bioswales. Grassy parking islands and landscaping provides opportunities to detain, infiltrate, and filter stormwater runoff from the buildings and parking lots. Projects on this site would also provide tremendous educational opportunities for biology/environmental studies/gardening classes or clubs.

3D: Roadside parcels/park along the South Fork of Montour Run between North Star Road. and Santiago Road. These parcels are designated as a public park according to County data. Augmenting the riparian buffer, and repairing deeply incised streambanks could help increase resiliency along this stream corridor.

3E: Findlay Township Community Building Green Infrastructure Demonstration Project. The municipality owned Activity Center serves the surrounding area, not just the township of Imperial. A rain garden at this location would be a highly visible example of Green Infrastructure

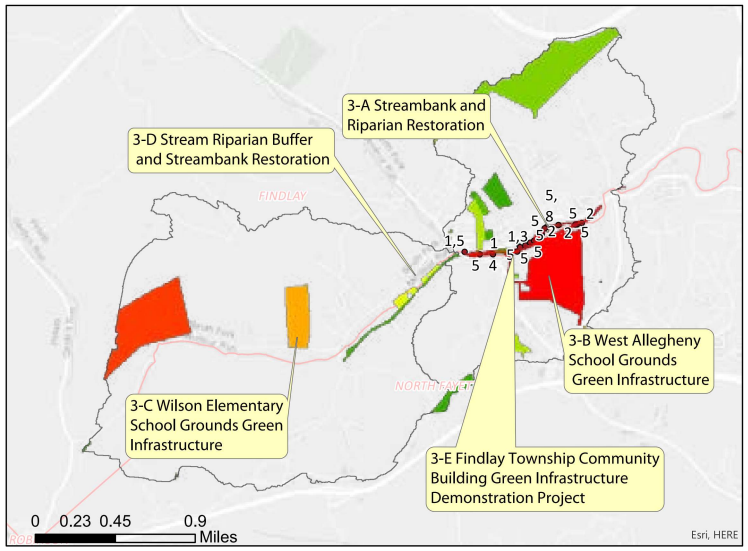

Figure 3.4.3-Priority recommendation sites for Subwatershed Area 3-South Fork Montour Run. Sites based on pollution accumulation modeling (Sediment shown) and accessibility.

for the community. A proposed rain garden design and more detailed estimate of the potential cost and benefits breakdown is included as part of the Conceptual Models produced as part of this WIP.

Area 4: Robinson, Cliff Mine, Beaver Grade: Identified priority projects in this sub-watershed group include streambank restoration projects, bioretention enhancements, and storm basin retrofits (**Figure 3.4.4**).

4A: Streambank along Cliff Mine Road, at the end of Maple Road. Repair storm inlet and outlet from road to Montour Run, and reinforce eroding area around the road. Work with North Fayette Township, as this project will likely support MS4 permit requirements. Approximately 250 linear feet of streambank and infrastructure, $50,000)

4B: Streambank and park (County Property) along McClaren Road. This parcel includes parking for visitors and Montour Trail access. Enhancing the riparian buffer would mitigate stormwater that washes through the parcel from the nearby road (145 linear feetfeet of Riparian Buffer reinforcement, estimated at $29,000).

4C: Address erosion, reinforce riparian buffer, and evaluate for stormwater runoff sources along the stretch of Montour Run north of Cliff Mine Road between McClaren and RIDC Park Drive South. This parcel is owned by Allegheny County. Interested stakeholders should include the County as well as the Montour Run Watershed Association and the Montour Trail Association. The visual assessment estimated approximately 534 cumulative feet of streambank erosion along this section of stream in disparate areas. This would require approximately $106,800 to address bank erosion along this 1 mile long stream section.

4D: Bioswales and bank reinforcement along Montour Run Road. This parcel, part of the Montour Trail park system, receives stormwater runoff from nearby roads and parcels. Sections where the trail crosses the stream show evidence of erosion; streambanks in these areas should be reinforced. Addressing approximately 160 linear feet of bank erosion will cost an estimated $32,000 to $64,000, depending on severity.

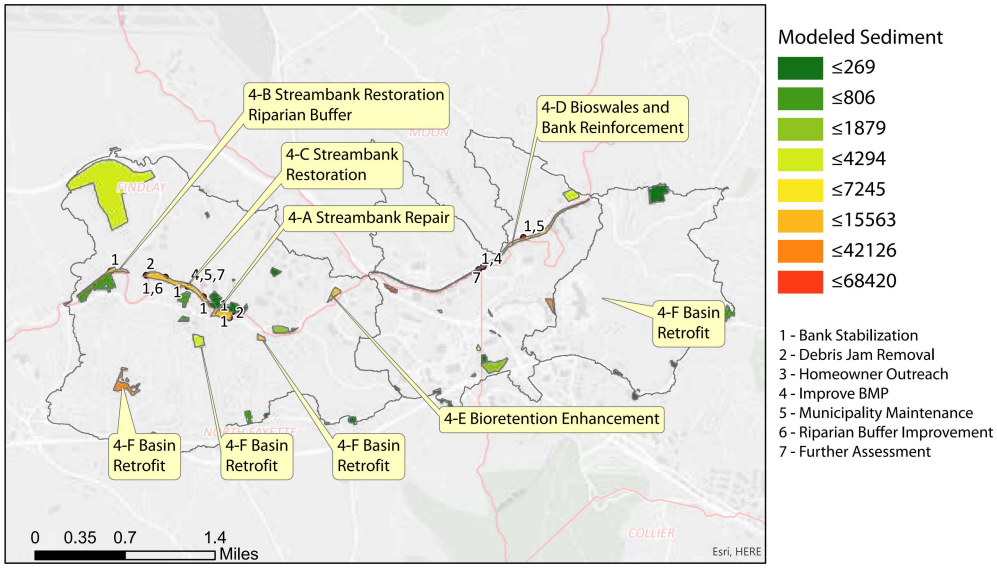

Figure 3.4.4-Priority recommendation sites for Subwatershed Area 4-Robinson, Cliff Mine, Beaver Grade. Sites based on pollution accumulation modeling (Sediment shown in lb/year) and accessibility.

4E: The Association of Theological Schools is a non-profit with property that borders on Montour Run and Cliff Mine Road. An existing stormwater detention basin could be enhanced with plantings and bioretention soil. Stormwater from the parking lots and nearby streets could be directed to this area, where the water would be detained and filtered before it enters Montour Run. Potential stakeholders include the Association of Theological Schools and the local municipality of North Fayette. This basin retrofit is projected to cost $80,000.

4F: Storm basin retrofits. This subwatershed group contains multiple detention basins that could be enhanced through various methods to slow stormwater, reduce contamination through biofiltration and provide a more scenic landscape through the introduction of native plants. Potential stakeholders in this effort include the private property owners or homeowner's association, as well as the municipalities who need to reduce reduce stormwater inputs to the stream for their respective MS4 permits. Each retrofit can cost between $80,000 to $195,000, so each should be evaluated individually to determine the most cost effective sediment and nutrient removal. Potential basin retrofit locations:

- Bioswales and rain gardens, and enhanced detention basin at the recreation area for Walden Woods housing plan.
- Oak Moss Drive Detention Basin.
- Green Meadow Drive.

An example detention basin retrofit and more detailed estimate of the potential cost breakdown is included is included in the Conceptual Models produced as part of this WIP.

Area 5, Meeks, Trout , and Salamander's Head: The recommended strategy for this sub-basin group is to maintain, as much as possible, the landscape as it is. Water flows downhill from the headwaters located on the golf course and through the 300 acre Montour Woods Conservation Area, owned by the Hollow Oak Land Trust. Trails lead throughout the Conservation Area and connect upstream to Moon Park, downstream to the Montour Trail, and across the watershed divide to the Trout Run Conservation Area. This conservation area represents a significant amount of preserved landscape. Large portions of this area have erosion-prone steep slopes that are protected from development. Increasing conservation holdings, particularly in areas with steep slopes as identified by the "Greenways" data set, will help to maintain the water quality (**Figure 3.4.5**).

5A: Address bank stabilization and debris jams that cause erosion on the upper reaches of Meeks Run. In addition, address upstream erosion points that are de-stabilizing stream banks. The estimated cost to restore 2,000 linear feet of streambank is approximately $400,000.

5B: Landscape-based pollution loading modeling suggests that non-point source pollution may be coming from the upper Meeks Run areas, possibly sourced from Moon Park and the Golf Course. This is also the area with the least tree canopy in the riparian buffer. Opportunities include planted buffers along the playing fields (up to 1,000 linear feet of buffer, at estimated $80 per foot for $80,000 worth of improvements) and retrofitting an existing stormwater detention pond ($80,000 to $195,000). Runoff from this site in particular enters the headwaters of Meeks Run, a relatively clean stream. The township, which has a vested interest in reducing the effects of stormwater pollution, owns the property.

5C: The parking lots for the church at the corner of Hookstown Grade Road and McCormick Road drain directly to the headwaters of Trout Run. Bioswales between the parking lots and stream would detain and filter this water, helping to mitigate stormwater runoff from these lots. Estimated cost of ~500 foot of bioswale is $50,000.

5D: The land along either side of Montour Run, including the Montour Trail, has opportunities for increased riparian buffers. The visual survey and modeling results confirm that the streambanks in this area are eroded. Recent efforts in the Montour Run Watershed included riparian buffer restoration work along this area. Work to further augment this buffer and stream bank, about 500 ft, could cost up to $100,000.

Area 6-Lower Montour Run to Ohio River: This area of the watershed is affected by all the pollutant inputs upstream of it, and the streetscape of Coraopolis and Robinson townships. Although little can be done to remove pollutants from Montour Run from upstream sources, the recommended strategy here is to coordinate efforts with local authorities to reduce localized stormwater inputs as much as possible (**Figure 3.4.6**).

Sewage treatment for Moon and Coraopolis is processed by the Coraopolis Water and Sewer Authority (CWSA). The CWSA developed a stormwater fee system in order to raise funds specifically to address pollutant reduction as part of their MS4 Permit requirements. The CWSA stormwater fee will charge $7/month per ERU, with an ERU equivalent to 1,900 square feet of impervious area. The fee was projected to begin in first quarter of 2019. Credits for this program are offered for educational efforts and involvement around stormwater management (up to 10%

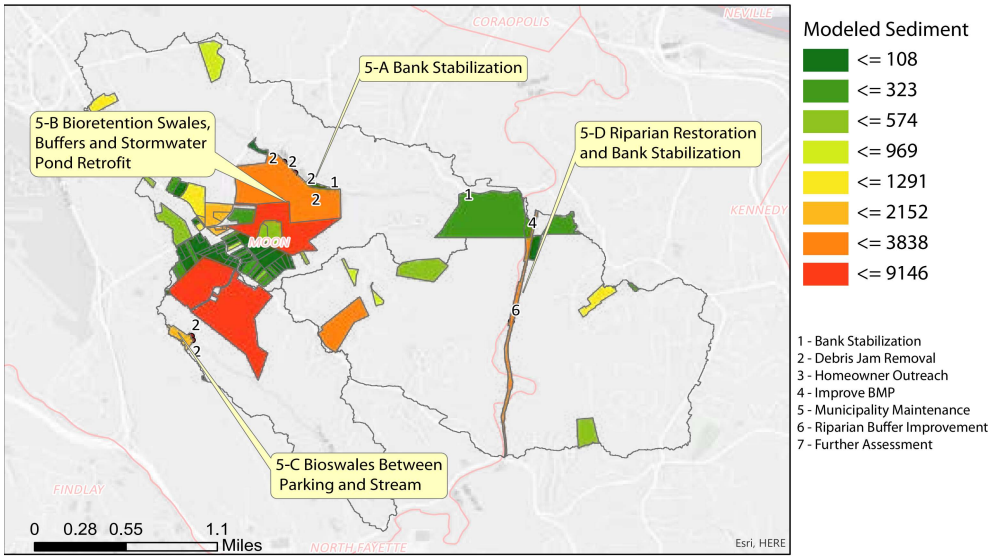

Figure 3.4.5-Priority recommendation sites for Subwatershed Area 5-Meeks, Trout and Salamander's Head. Sites based on pollution accumulation modeling (Sediment shown in lb/year) and accessibility.

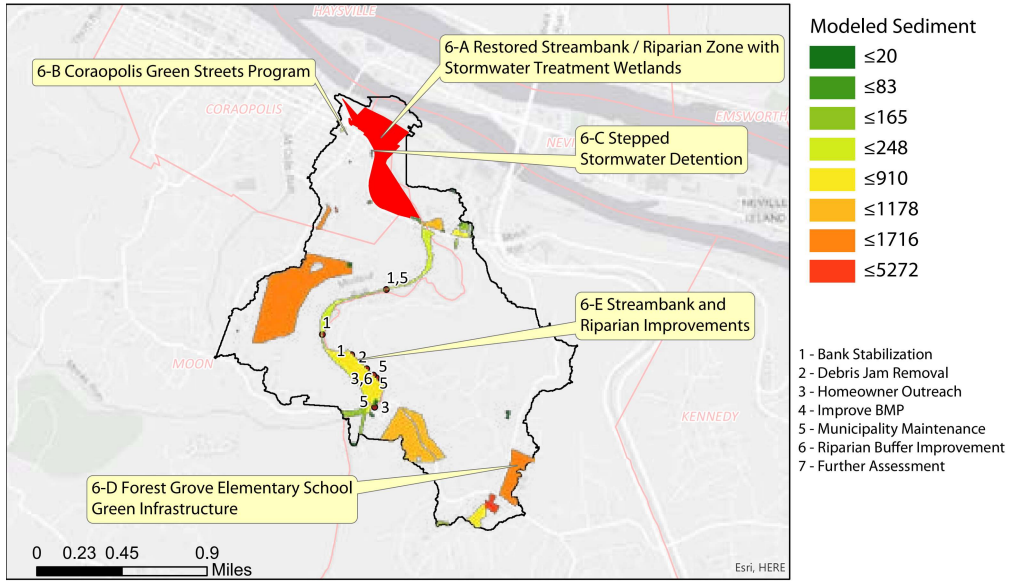

Figure 3.4.6-Priority recommendation sites for Subwatershed Area 6-Lower Montour Run to Ohio River. Sites based on pollution accumulation modeling (Sediment shown in lb/year) and accessibility.

credit on fee) and on-site implementation of post-construction stormwater best management practices. As in North Fayette Township, this fee and credit system could be leveraged for the Coraopolis region, by encouraging landowners to remove stormwater from the system with rain barrels or rain gardens, when possible.

6A: Restore streambank and wetlands with trail system in the lower Montour Run watershed before it reaches the Ohio River. Currently, this 54+ acre parcel is owned by the Redevelopment Authority of Allegheny County. Streambanks within the parcel boundaries are severely eroded and inset. Restoration of the stream course within this parcel could be configured to include treatment wetlands for stormwater inputs and create more opportunity for interaction with stream and floodplain. The Montour Trail, which currently ends south of this point, can be extended through this parcel, and the site could also increase opportunities for wildlife habitat. This wetland plan is explored in more detail as part of the Coraopolis Green Streets Conceptual Model plan. Projected costs are $400,000.

6B: Implement Green Street Program in Coraopolis. Planning can begin to develop partnerships with the Coraopolis Municipal Authority to manage stormwater on streets via a Greenstreet construction program. The stormwater could be directed to a treatment wetland system built in the large parcel owned by the Redevelopment Authority of Allegheny County at the bottom of the river. This Green Streets Plan is explored in more detail as part of the Coraopolis Green Streets Conceptual Model plan. This is an infrastructure-heavy plan, that could be phased in over time, with a total projected cost of $3,054,000.

6C: Stormwater detention at the bottom of Ridge Avenue. This site has been identified by the Municipality as a location that experiences flooding. The bottom section of Ridge Avenue, where it intersects with Route 51, has been closed to traffic. This is an opportunity to de-pave this section of street and install stormwater detention structures to manage flooding. This proposal is detailed as part of the Coraopolis Green Streets Conceptual Model plan, with an estimated cost of $91,800.

6D: Bioswale and rain garden at the entrance to the Forest Grove Elementary School. Currently, two mown sections of lawn exist on either side of the entrance to the school. These could be re-configured as a series of bioswales on grade and a rain garden to provide infiltration and evaporation opportunities for stormwater runoff from the parking lots and roof areas.

6E: Streambank and Riparian Improvements: The land along either side of Montour run, including the Montour Trail, has opportunity for bank stabilization efforts and coordinated work with homeowners and municipalities. Work to further augment this buffer and stream bank, about 500 ft, could cost up to $100,000.

Resources

Technical and Financial Assistance: This section provides a brief outline of potential sources of funding to implement project recommendations in the plan. This is by no means an all encompassing list, but suggestions of funding sources commonly sought for the types of projects outlined in this plan.

Growing Greener Grants: Programs potentially enacted as a result of this WIP would be eligible for grants from the Growing Greener Watershed Restoration and Protection Program and the Abandoned Mine Drainage (AMD) Set-Aside program. Growing Greener helps to address non- point source pollution throughout Pennsylvania. The AMD Set-Aside Program utilizes funds from current mining operations to address issues of abandone mine discharges.

EPA Section 319 Nonpoint Source Management Grants: The Nonpoint Source Pollution Management Program (PA DEP and EPA funded) works to implement watershed-based strategies throughout PA in order to mitigate nonpoint pollution. A section of this program also provides mini-grants for Conservation Districts and other local partners to implement local awareness of water quality issues and encourage local participation in solutions.

Foundation for Pennsylvania Watersheds: The Foundation for Pennsylvania Watersheds provides grants to citizen groups, including watershed associations and conservation districts, working to protect and clean PA waterways. Grant awards vary from $500 to $25,000. These grants are recommended for projects such as riparian buffer plantings or simple erosion remediation efforts, where engineering and design services are not necessary to complete the work.

Stormwater Fee System for BMPs: The communities that make up most of the Montour Watershed have plans to establish stormwater fees to help fund their MS 4 pollution reduction plans. Most stormwater fee systems allow some credit for property owners that enact stormwater BMPs on their property, such as rain gardens. This credit system provides incentive for all property owners, but in particular large property owners such as development owners, to install township-approved BMPs. For example, North Fayette Township created a stormwater fee in 2016 of $3.50 per ERU, or Equivalent Runoff Unit. For commercial properties, a certain amount of impervious cover is assumed to equal 1 ERU. North Fayette's stormwater fee allows a 25% credit for BMPs that reduce stormwater. While this credit system provides incentives for all property owners, greater cost savings wwould be incurred by large property owners such as development owners to install township-approved BMPs. With conservative assumptions, an estimate can be generated of the annual savings for large property owners in the Montour Run Watershed. Savings can be used to install and maintain approved BMPs. Assumptions:

- 1 ERU is equivalent to approximately 3500 square feet of impervious surface.
- GIS data shows approximately 906 acres of commercial properties in the Montour Run portion of North Fayette Township.
- If it is assumed that each acre is 60% impervious, that means there is approximately 6,765 ERU's of commercial property in the relevant portion of the watershed (906 acres * 0.6 impervious surface ratio * 43560 ft2 per acre / 3500 ft2 per ERU)
- Working with property owners to establish and maintain appropriate BMPs would generate approximately $71,032 in savings per year for commercial property owners, after the BMP was paid for and installed. (6,765 ERUs * $3.50 per ERU * 0.25 (25% credit) * 12 months).

Stakeholder Resources:

- Township Coordination and Communication - The Western Area Stormwater Awareness Group (WASAG) is made up of local municipalities - North Fayette Township, Findlay Township, Moon Township, Oakdale Borough, Coraopolis Borough, and Crescent Township along with the Montour Run Watershed Association and assistance from the Allegheny County Conservation District. All but Oakdale Borough and Crescent Township are located in, or stakeholders in, the Montour Run Watershed. The group works to educate and engage stakeholders on the impacts of stormwater. This group is a powerful resource for coordinating with the Municipalities as each individual governing body works to enact it's own MS4 requirements. This group should be used in a coordinated effort to target areas of the Montour Run Watershed that will undergo enhancements – such as detention basins – for enhancement.
- Allegheny County Conservation District
- Montour Run Watershed Association
- Montour Trail Council
- Hollow Oak Land Trust

ii. Track Progress

Evaluation of Progress

Define criteria to be tracked:

- Project specifics and the expected outcome of the project will be tracked and recorded. In particular, the number of projects and the area affected will be part of these numbers.
- Area that has been forested or riparian buffer that has been restored.
- Expected gallons of water detained.
- Expected reductions in dediment, nitrogen, and phosphorus as a result of the intervention.

Who will track it?

- Stakeholders who undertake work will be responsible for quantifying and reporting the result. Both that the work was conducted (e.g., planted trees) and the extent of the work (e.g., x square yards of riparian cover enhanced as a result.)
- Progress will be reported to the stakeholders as well as the Allegheny County Conservation District Watershed Specialist for tracking and accounting.

Progress to date:

- The first Public Meeting was held on February 6 to present the WIP to the community. Participants were invited to provide input on their own observations of the problem. A one-page executive summary was developed for this meeting and for use as a future handout. This executive summary outlines simple strategic goals, sample projects, and points interested parties towards the complete WIP online.
- Stormwater fees have been planned by the MS4 communities. Some of these communities have implemented the stormwater fee, others are planning the implementation for the near future.
- The Montour Run Watershed contains a number of existing rain gardens and demonstration projects, for example the Moon Township Municipal Offices and Police Station rain gardens. However, the resulting water detained or pollution removal is not consistently tracked.

Implementation Schedule and Milestones

Every effort was made to ensure that the work proposed here was both implementable and effective. The watershed stakeholders will take the lead on administrating implementation grants.

2021-2025

- Educate and inform stakeholders about the plan and opportunities.
- Engage volunteers to implement "low hanging fruit" projects, with focus on municipal opportunities, riparian buffer and streambank restorations. These need minimal engineering / professional effort, and therefore are more shovel-ready than more intensive infrastructure modifications.
- Develop plans to fund and design the projects that require professional design and construction implementation.
- Begin conversation now with municipalities to try to coordinate efforts for next round of MS4 permits.

2025-2028 Project Implementation and Progress Tracking

- Expand education efforts particularly to schools and large development landowners.
- Begin construction of second round of projects, and continue planning
- Record each project and reductions due to the intervention.
- Plan next round of implementation in coordination with municipalities for MS4 permit pollution reduction plans.

2028-2030 Revision Strategy

- Evaluate progress by summing reductions.
- Revisit priorities list and progress areas to determine which need to be completed yet.
- Revisit modeling and maps to determine which new projects should be prioritized next. Modeled TSS and nutrient data in particular can be used to site new projects.