Plan to Aid Turtle Creek's Health

(PATCH)

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MISSION STATEMENT

The goal of PATCH is to reduce flooding conditions and to reach state standard concentrations in the Turtle Creek Watershed in Southwestern Pennsylvania by the year 2040.

BACKGROUND

Turtle Creek is a 21.1 mile long tributary of the Monongahela River in western Pennsylvania, near Pittsburgh. It drains an area of 147.41 square miles as it travels from its source in Delmont, PA to its mouth at the Monongahela River in Allegheny County. The watershed is dominated by urban communities, but also includes rural areas, agriculture, and abandoned mines. The wide floodplain of Turtle Creek has been topographically altered over the years by human development, including a dam just downstream of the mouth of the creek, along with associated channelization and bank stabilization projects. The watershed contains four coal seams that have been heavily mined, with many of the mines abandoned and contributing to acid mine drainage in the area. There are fourteen species of concern living in the watershed, including five flora and nine fauna. The communities within the watershed include the Allegheny County suburbs of Pittsburgh and communities in Westmoreland County, making up 33 municipalities, including two cities and eight townships, along with 23 boroughs, with the most area being taken up by Murrysville. Fishing occurs along Turtle Creek, but trout stocks have not occured in recent decades due to poor water quality. Several major highways run through the watershed.

HISTORY

The first known inhabitants of the Turtle Creek Watershed appeared over 10,000 years ago and occupied at least 200 sites in the area. These sites show evidence of large villages, swaths of farmland, and seasonal campsites. More recent sites in the watershed are connected to the Monongahela people who lived in the area until the early 17th century when they were displaced by the Haudenosaunee, who were looking for more hunting ground. The Turtle Clan of the Lenae Lenapi eventually made their way into the area in the early 18th century after they were removed from their land by European settlers. It was the Turtle Clan that named the creek “Tulpewisipu”, or “Turtle River”.

The first recorded white settler in the watershed was John Frazier, who built a trading post at the mouth of the creek along the Monongahela River. Frazier’s trading post served as an important landmark for the area and was even frequented by George Washington during his trips to Western Pennsylvania. Turtle Creek became an important site in the fight for European control

of the confluence of the Ohio, Allegheny, and Monongahela Rivers during the French and Indian War. On an expedition to capture the French Fort Duquesne, British general Edward Braddock was ambushed by French troops and was killed in the battle that is now known as “Braddock’s Defeat”.

The Turtle Creek Watershed later played a pivotal role in the native-led Pontiac’s Rebellion. While on their way to fight a siege occuring at Fort Pitt, British general Henry Bouquet’s troops were caught off-guard by Lenape fighters near the Bushy Run Creek and fought in a two-day decisive battle. The British eventually won the battle and secured their rule in Western Pennsylvania.

By the late 19th century, the watershed region was known for its coal mining and natural gas resources. In 1878, the first natural gas well in the United States was drilled next to the Turtle Creek in Murrysville, PA. From there, more wells were installed across the area and many are still in operation today. The watershed region also became known for its many coal mines during the same time period. By the turn of the century, these mines were producing nearly a million tons of coal per year. Because of the flourishing coal industry, railroads were built up into the watershed to transport the coal across the country.

Much like the rest of the Pittsburgh-region, the Turtle Creek Watershed became the site for numerous steel mills. The availability of coal and water transport made it possible for mills to be established in the region. The main steel mill in the watershed was Edgar Thompson Steel Works. Many of the steel mills closed in the 1980s but the Thompson Steel Works still has one plant in operation today.

The main corporation that emerged in the Turtle Creek Watershed, however, was the Westinghouse Corporation. The Westinghouse Air Brake Company (WABCO) was founded by George Westinghouse in 1869 in Pittsburgh, PA and was moved to the watershed in 1889. Westinghouse also founded the Westinghouse Electric Company (later Westinghouse Electric Corporation) in the late 1800s and placed the headquarters in the watershed.

CURRENT POLICIES

The Turtle Creek Watershed Association (TWCA) is an organization founded in 1970 through a joint effort by the Westmoreland County Conservation District, Allegheny County Commissioners, and Westinghouse Electric Corporation. To this day, it serves as the primary line of defense to restore and protect the Turtle Creek Watershed. Since its inception, TWCA has worked with state legislators and other groups in order to develop remediation plans to address the problems of acid mine drainage and other environmental issues in the watershed.

The state does not have any watershed policies in place stricter than the Clean Water Act's minimum requirement of maintaining "fishable and swimmable" waterways across the nation. However, Pennsylvania is pursuing a complete reclamation of all mines that have been abandoned so the environmental contaminants associated with them can be dealt with.

The Turtle Creek River Watershed Conservation Plan (2002) develops guidelines for managing the floodplain of the area. It calls for groups (both within the TWCA and in the general public) to come together to take inventory of the area's resources and develop an action plan for the streams deemed most susceptible to environmental destruction. What came out of this report was a demand for more stream buffers and riparian zones. However, due to the area's extremely high impervious cover percentage, the efficacy of this approach may not be as strong as once thought.

The Turtle Creek Watershed TMDL (2009) from the PA Department of Environmental Protection lists several new guidelines related to Total Maximum Daily Load (TMDL) discharged into Turtle Creek. This includes a transfer of TMDL limits from point-source to non-point source locations, the removal of some point-source locations, and some changes in land use

Unfortunately, the current policies in place are not proactive in controlling or mitigating the pollution of Turtle Creek. According to a study done by Bickmore, the pH, aluminum, iron, and manganese levels at several points in the stream are far too extreme to sustain aquatic life. It can be inferred that, while several policies address the environmental chemistry and pollutants, not enough is being done from an engineering perspective to ensure that the quality of the Turtle Creek is enough to support aquatic life.

PROBLEMS

PATCH draws attention to and focuses on three main problems that affect the Turtle Creek Watershed, the health of its aquatic inhabitants, and the safety of urban development.

Problem	Description	Causes
P1: Backwater conditions in Lower Turtle Creek	Blocks the natural flow of the Turtle Creek Leads to buildup of toxic chemicals in the Lower Turtle Creek Causes flooding near the mouth of the creek, which leads to erosion concerns	Lock and Dam No. 2 on Monongahela
P2: Low pH and high aluminum and iron levels	High levels of acidity, aluminum, and iron caused by abandoned mines	Acid mine drainage Abandoned mines
P3: Erosion	Increased flooding leads to erosion of hillsides, which destroys microhabitats Eroded stream banks cannot support a natural ecosystem	Urbanization Increased Flooding

PROBLEM 1: BACKWATER CONDITIONS IN LOWER TURTLE CREEK

Lock and Dam No. 2 is located shortly downstream of the mouth of Turtle Creek in the Monongahela River. The dam was constructed in 1902 by the US Army Corps of Engineers in order to control the flow of the Monongahela River and make it more navigable for boats. Lock and Dam No. 2 is one of nine navigational structures built in the Monongahela River from its starting point in West Virginia until its confluence with the Allegheny in downtown Pittsburgh. The dam operates by holding back a certain height of river water and allowing any excess to continue flowing downstream. As the dam disrupts normal river flow, it poses a great concern during heavy rainfall events. When there is an excess of river water, it cannot flow quickly downstream and causes a backup to occur at the mouth of the Turtle Creek. This backup has created flooding concerns in and around the areas of the Lower Turtle Creek

In addition, the backup of water leads to a higher residence time for toxins in the Turtle Creek. Since normal flow is disrupted and river water takes a longer time to flow downstream, toxins linger for a much longer time than in normal river flow. These toxins can harm aquatic life living in the Turtle Creek and those who use the watershed for recreation activities.

Finally, the dam prevents native fish from swimming upstream to lay their eggs in either the Turtle Creek or other tributaries of the Monongahela. Overall, the dam leads to many problems concerning the quality of the Turtle Creek as well as the natural habitats it once held.

GOAL 1

Remove Lock and Dam No. 2 from Monongahela River
Reduce backwater flooding in the Lower Turtle Creek and increase native fish populations in the Turtle Creek and Upper Monongahela.

PROBLEM 2: LOW PH AND HIGH ALUMINUM AND IRON LEVELS

There are many abandoned mines in the Turtle Creek Watershed and acid mine drainage is a persistent issue. Drainage leads decreased pH levels that cannot support fish or other water-based animals. pH samples of the Upper Turtle Creek range from 2.8 - 5.2. According to studies, most streams in Pennsylvania have a pH of at least 6.5 and a pH of 5.0 is thought to be the minimum in which life can be sustained. Acid mine drainage has also led to increased levels of iron and aluminum in the water. Samples taken from the Delmont section have an aluminum concentration of .67 mg/L and an iron concentration of 27.08 mg/L. In order to comply with Pennsylvania regulations, the iron level must decrease by 98%, the aluminum level by 59%, and the acidity level by 93%. In order to combat this problem, there are many solutions that include treating the water itself or reducing mine drainage altogether. Some options include adding alkaline materials to reduce the acidity of the stream as well as removing contaminated soil from the area. Other options include filling abandoned mines with water or other materials to prevent further leakage.

Figure 2. Abandoned Mines Located within the Turtle Creek Watershed

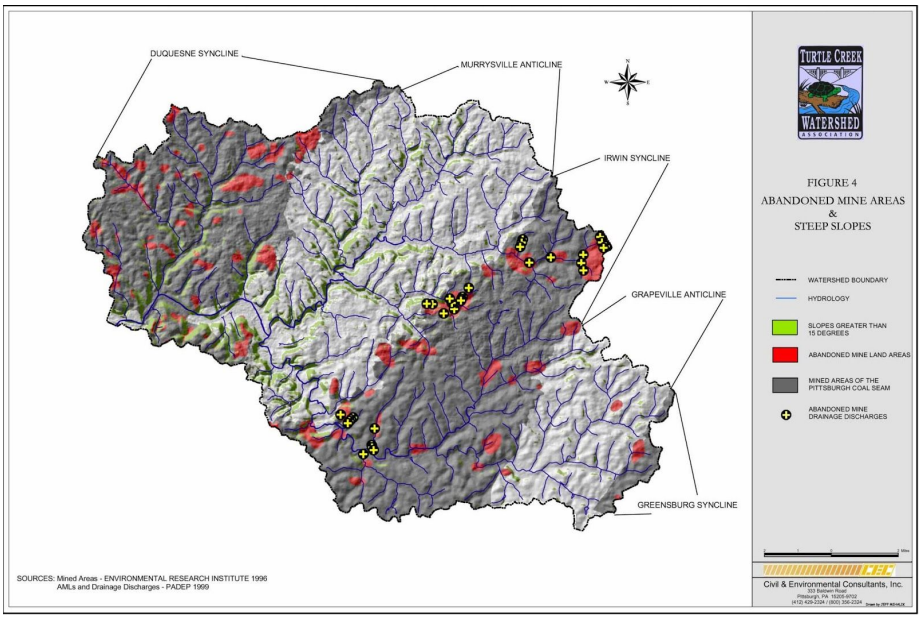
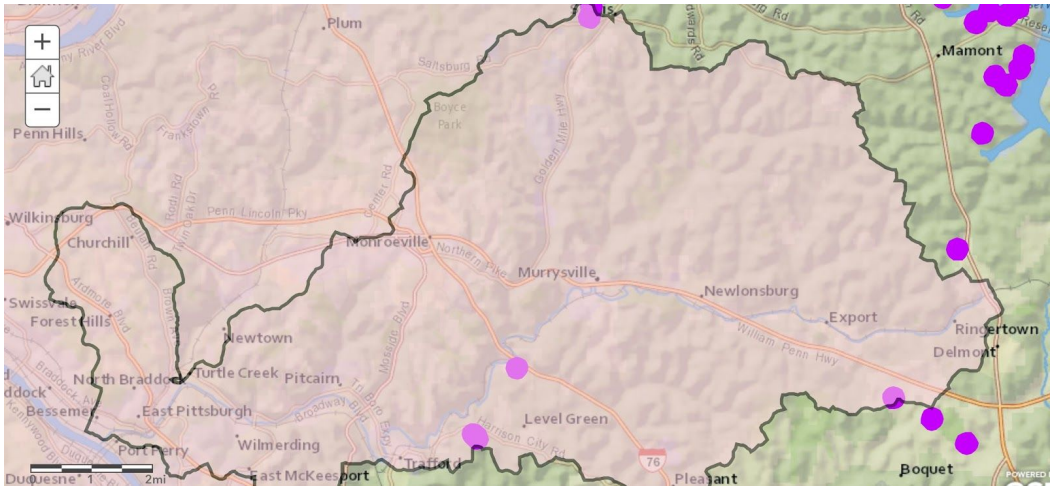


Figure 3. Active Mines Located Within the Turtle Creek Watershed



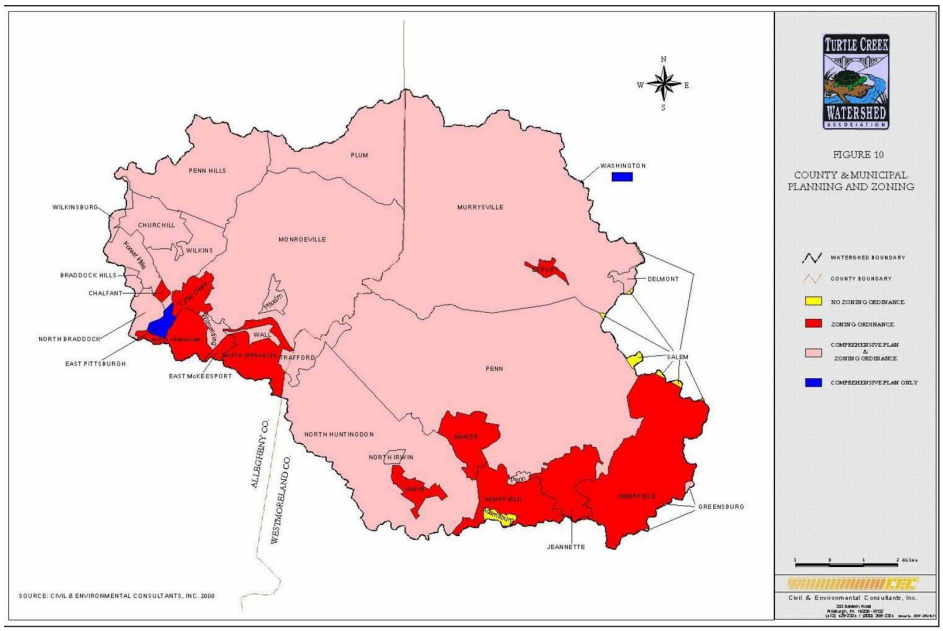
GOAL 2

Bring Acidity, Aluminum, and Iron Concentrations to Pennsylvania Standards
Reduce acidity concentration by 93%, reduce aluminum concentration by 59%, and reduce iron concentrations by 98%.

PROBLEM 3: EROSION

The Turtle Creek Watershed is registered as an impacted stream, which means that there is impervious cover over 11-25% of the land in the land it encompasses. The watershed area has become the site of growing residential and commercial zones. The construction of houses and industrial buildings has led to an increase in impervious cover and much more of the rainwater flows directly to streams and not into the ground. This increase in impervious cover has led to severe erosion and degradation of streambanks. As of this report, steep slopes makeup 6.2% of the watershed area and host numerous microhabitats essential for ecological diversity. The increase in erosion has damaged many of these steep slopes and destroyed numerous microecosystems. It is vital that these slopes be protected via local and state governments. The two best ways to protect these slopes are through zoning laws and best management practices. Much of the watershed is zoned for residential and commercial usage. Those zones that are not intended for impervious cover, however, can be petitioned to change zones to allow for construction. The forest zones must be upheld in order to protect the banks of the Turtle Creek. The other method is to encourage residents to use Best Management Practices. BMPs can reduce the amount of pollutants going into a stream and overland flow into the stream.

Figure 4. Zoning of the Turtle Creek Watershed



GOAL 3

Preserve and Protect Steep Hillsides

Create zoning laws that protect vulnerable hillside ecosystems and encourage the use of BMPs.

PATCH SUMMARY OF GOALS

PATCH is focused on resolving the problems discussed in this report. In order to protect the health of the watershed, we propose that the following goals be met:

G1: Remove Lock and Dam No. 2 from Monongahela River

Reduce backwater flooding in the Lower Turtle Creek and increase native fish populations in the Turtle Creek and Upper Monongahela.

G2: Bring Acidity, Aluminum, and Iron Concentrations to Pennsylvania Standards

Reduce acidity concentration by 93%, reduce aluminum concentration by 59%, and reduce iron concentrations by 98%.

G3: Preserve and Protect Steep Hillsides

Create zoning laws that protect vulnerable hillside ecosystems and encourage the use of BMPs.

REFERENCES

Turtle Creek Watershed River Conservation Plan, Volume 1: The Plan. Prepared by CEC Civil & Environmental Engineering Consultants, April 30, 2002.

Bickmore, Travis. *Determination of Acidity, Aluminum, Calcium, Iron, and Manganese Concentrations in Turtle Creek, Westmoreland and Allegheny Counties, PA.* University of Pittsburgh at Greensburg, 2016.

Turtle Creek Watershed TDML: Allegheny and Westmoreland Counties. Prepared by Pennsylvania Department of Environmental Protection, June 29, 2009.