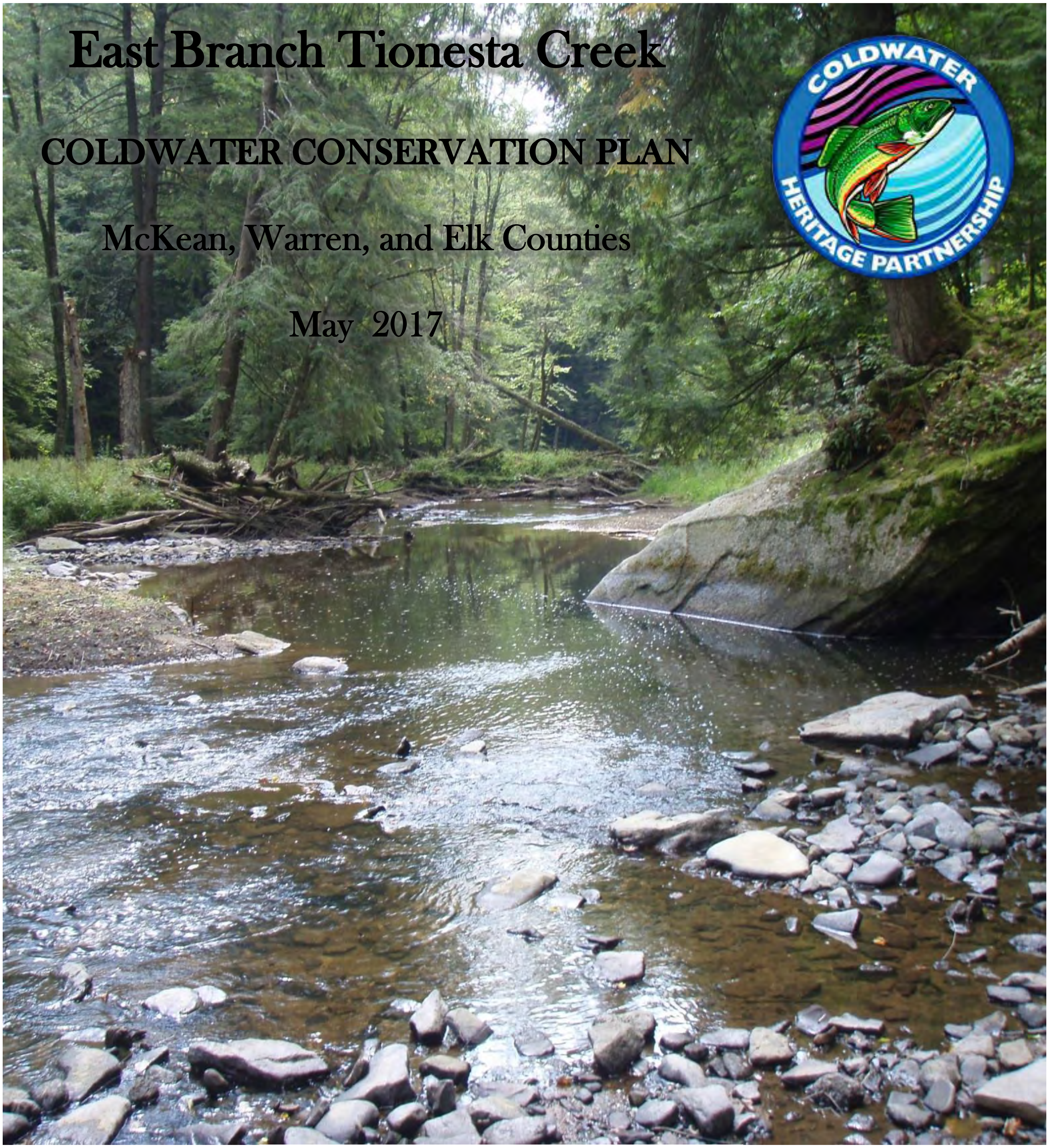
East Branch Tionesta Creek

COLDWATER CONSERVATION PLAN

McKean, Warren, and Elk Counties

May 2017



Western Pennsylvania Conservancy

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Founded in 1932, the Western Pennsylvania Conservancy (WPC) is a non-profit conservation organization that protects and restores exceptional places to provide our region with clean waters and healthy forests, wildlife and natural areas for the benefit of present and future generations. The Conservancy creates green spaces and gardens, contributing to the vitality of our cities and towns, and preserves Fallingwater, a symbol of people living in harmony with nature.

The WPC's Watershed Conservation Program protects and restores rivers, lakes and streams to provide our region with sustainable, clean water supplies that are critical to our quality of life and economy. We provide cost-free, comprehensive assistance to communities and local watershed groups, helping with project selection and prioritization, funding proposals and project management. We also partner with individual landowners and businesses to help them improve water quality and protect the environment on their properties. The Watershed Conservation Program has extensive expertise applying on-the-ground restoration activities since 2001.

Project Funders

This project was funded in part by a grant from the Coldwater Heritage Partnership on behalf of the PA Department of Conservation and Natural Resources, the PA Fish and Boat Commission, the Foundation for Pennsylvania Watersheds and the PA Council of Trout Unlimited. Funding for this project was also provided by the Shell Foundation.

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Watershed Background

The East Branch of Tionesta Creek (EBTC) is a High-Quality Coldwater Fishery in northwestern Pennsylvania. The headwaters originate in Jones and Highland townships in northern Elk County and flow downstream through Wetmore and Hamilton townships in McKean County. At its terminus, EBTC joins another High-Quality Coldwater Fishery—the South Branch of Tionesta Creek—in Sheffield Township, Warren County. Along the more than 17 miles of main stem stream, over 48 miles of tributaries assist in draining this 35-square-mile watershed. Their combined waters flow downstream to the Allegheny River, a tributary of the Ohio River and, ultimately, the Mississippi River system.

East Branch Tionesta Creek is comprised of 38% private land and 62% public land, in the form of the Allegheny National Forest (ANF). The majority of the privately held ground is located in the headwaters of the mainstem and EBTC's largest tributary, West Run. This includes Kane Borough and property of the Collins Companies, as well as surrounding rural residential and agricultural areas. A Land Cover Type map is included in *Appendix 2: Watershed Maps*. Cover Types are shown by acres for the drainage. A tabular form of the legend, including percentages of land cover types, is included in Table 1 in *Appendix 1: Data Tables.*

Kane Borough straddles the watershed divide between East Branch Tionesta Creek, the South Branch of Kinzua Creek and Wilson Run. The South Branch of Kinzua Creek flows north and east to the Allegheny River via the Allegheny Reservoir, while Wilson Run flows south/southeast to the West Branch Clarion River. It is also located at the intersection of US Route 6 and PA Route 66. Before European settlement, the Kane area was used by the Seneca Nation of Indians as part of the Iroquois Trail. The town was founded in the 1850s by Thomas L. Kane, and was known by several different names until a post office was installed in 1864. Early industries included timber, oil, and natural gas, and those industries continue in the area to this day (Kane 2016). The borough was home to approximately 3,610 people in 2015, according to the U. S. Census Bureau (2016).

The Collins Companies, (Collins Pine, Kane Hardwood) own approximately 1,100 acres in the headwaters of the East Branch Tionesta Creek watershed. Their properties and operations are certified to Forestry Stewardship Council standards, with the goal of a sustainable, ecologically and economically working forest now and for future generations. Their values on conserving resources while remaining economically profitable are reflected in their land management strategies, which include cutting edge silviculture techniques, large riparian "no-cut" zones, and biological monitoring. A brief summary of their benthic macroinvertebrate studies on the property is included in the Data Summary section on page 13.

The Allegheny National Forest was established in 1923 and continues to be managed as a "Land of Many Uses." The ANF's goal is for a ". . . healthy, vigorous forest that provides wood products, watershed protection, a variety of wildlife habitats and recreational opportunities – not only for us today, but in a sustainable way so future generations can enjoy these benefits, too." (ANF 2016). To avoid conflicting uses occupying the same land area (i.e. wilderness and ATV usage or commercial timber production), the ANF separates allowable land uses into Management Areas. Specifically in the EBTC watershed, ANF lands are in Management Areas (MA's) 2.1 (Uneven-aged Management), 2.2 (Late Structural Linkages), and 3.0 (Even-aged Management). MA 2.1 promotes a continuously forested scene, with benefits primarily for songbirds and cavity nesting birds and mammals, and limited recreational opportunities. MA 2.2 is geared towards restoring late-structural forest conditions, benefits for forest interior species, and a variety of recreational opportunities. MA 3.0 emphasizes shade intolerant and mid-tolerant tree species, with benefits to white-tailed deer and other early structural species, and increased motorized use, compared with MA's 2.1 and 2.2. Full descriptions of these Management Areas, as well as where they fall within the EBTC Watershed (and across the ANF) can be found in the Forest Plan (ANF 2007).

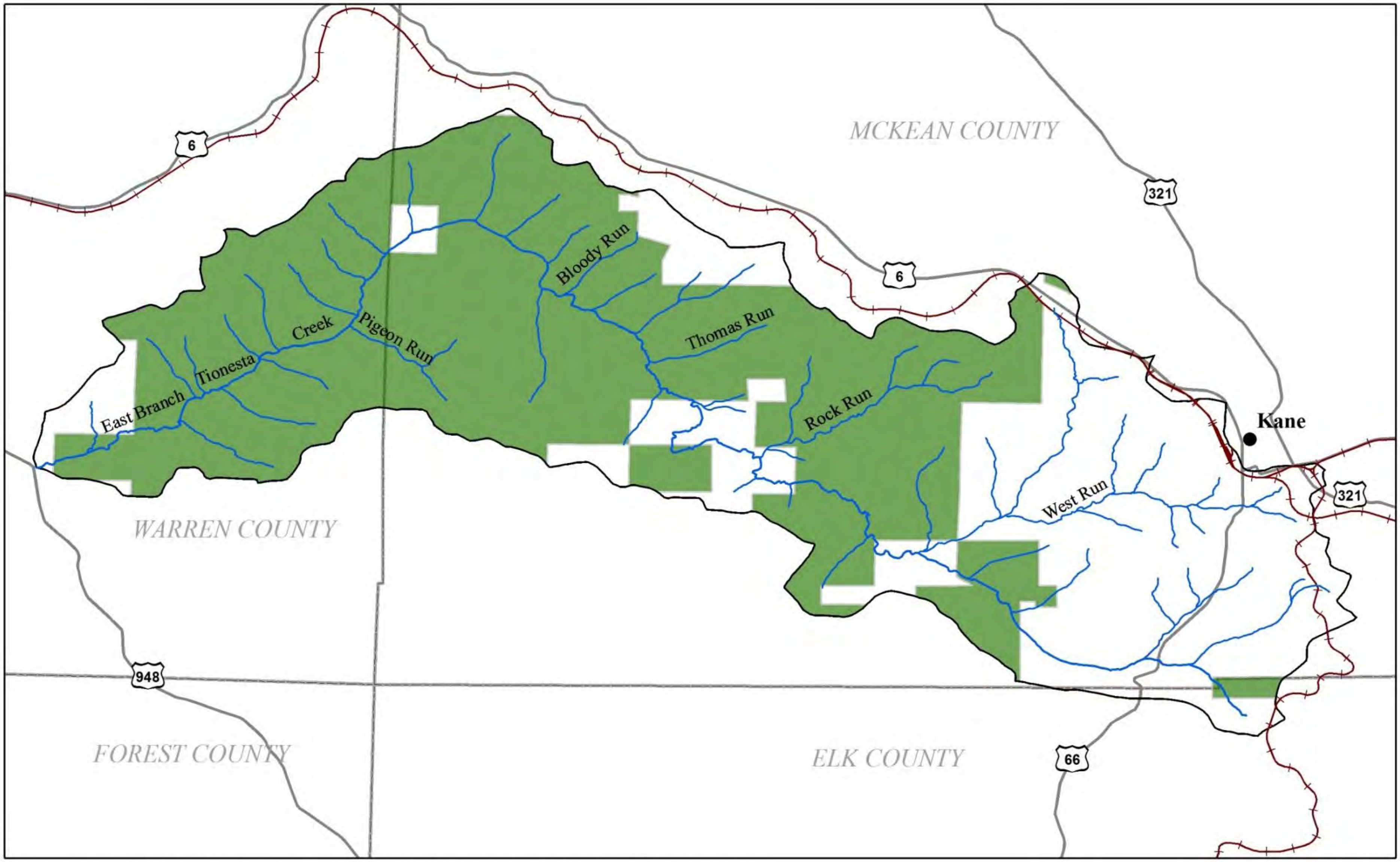
Additionally, on the ANF in EBTC is a portion of the North Country Trail (NCT), as well as a section recommended for inclusion in the National Wilderness Preservation System (FAW 2003). The NCT stretches from North Dakota to New York over 4,600 miles and seven states, and includes 96.3 miles within the ANF. Primarily a hiking trail, approximately five miles of the NCT cross the EBTC watershed near the Warren and McKean county lines. As a testament to the pristine and untrammeled nature of much of the EBTC watershed, approximately the lower third of the drainage has been recommended by the Friends of Allegheny Wilderness' *Citizen's Wilderness Proposal for Pennsylvania's Allegheny National Forest* (2003) to be protected in perpetuity as Wilderness. Specifics on boundaries and regulations associated with Wilderness designation can be found in detail in the *Proposal*.

State Impairment Status

The East Branch of Tionesta Creek watershed is categorized in "List 2: At Least One Use Attained" in Pennsylvania's *2014 Integrated List of All Waters* (CoP 2014). This listing includes the tributary West Run, which at one time was recommended to be placed on the U.S. Environmental Protection Agency's (EPA) *Integrated Waterbody List* (CoP 2010) due to impairments in discharges from Kane Borough's Pine Street Waste Water Treatment Facility (WWTF).

Permitted Discharges

There were two NPDES permitted discharges into the East Branch Tionesta Creek drainage (Appendix 3) at the time of the study, both located in McKean County. Facilities permitted include the Collins Pine Company in Wetmore Township, which discharged to an Unnamed Tributary of West Run (Permit PA0272833). This facility was permitted for 0.00012 MGD (Million Gallons per Day). Kane Boro McKean County was issued permit #PA0023167 for a discharge of up to 1.5 MGD to West Run in Wetmore Township, McKean County.



East Branch Tionesta Creek Watershed - Overview

●	City		Watershed Boundary
	Streams		Allegheny National Forest
	Railroads		County Boundary
	Major Roads		

Watershed Statistics:
35.24 Sq.Miles
65.59 Stream Miles

0 0.5 1 2 3 4 Miles

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Watershed Data

Sampling Methods

Staff and volunteers conducted visual assessments in the field to collect the most accurate data on watershed characteristics. Streams were assessed by examining one "segment" at a time, with each segment being the length of stream between two confluences. These confluences could be at two small tributaries, or a tributary joining the mainstem. Each segment is labeled with a GIS_ID number on the maps in Appendix 2, and it is by those numbers that the segments were referred to during field assessments, as well as in this plan. Due to the scale of the watershed and font/type limitations, it has been separated into 3 separate (overlapping) maps with one each for the West, Northcentral, and Eastern regions of the EBTC watershed.

On every assessment outing, each field team consisted of two to three crew members for safety, as well as, objectivity in sampling. A Western Pennsylvania Conservancy (WPC) staff person lead each assessment team, following the assessment methodology and standards established at an internal visual assessment training in late June, 2015.

The primary assessment protocol was based on the EPA's "Rapid Bioassessment Protocols (RBP) for Streams and Wadeable Rivers-Habitat Assessment and Physicochemical Parameters," (Barbour et. al. 1999) and was augmented with WPC's current standard Visual Assessment Datasheet to more closely align with the goals and concerns of this Coldwater Conservation Plan. Stream reach, width, depth and velocity, as well as canopy cover, proportion of stream morphology types, channelization and obstructions were recorded. Water quality parameters, including temperature, pH, and conductivity, were measured at the upstream and downstream termini of each segment.

In addition to the EPA-based protocol, several segments were surveyed using the U.S. Department of Agriculture (USDA) - Forest Service's "Stream Inventory: Channel Unit Survey." This methodology was developed in the Pacific Northwest, in USDA Forest Service Region 6, and adapted for use on the Allegheny National Forest. Pre-monitoring data provided by this Channel Unit Survey gives an accurate snapshot of existing channel morphology and habitat conditions. Samples of datasheets used in the field assessments are included in *Appendix 3: Standard Data Forms.*

Respecting private property and the landowner's wishes were a top priority while conducting visual assessments. Stream segments having multiple landowners with varying permission statuses were assessed to the best of the field crew's ability, on rare occasions simply via the roadway. Information gathered on private lands was assimilated into the larger dataset per each stream segment to protect those landowners' privacy.

Ten physical habitat parameters (from the EPA protocol) observed during field assessments were combined to provide the most concise, informed snapshot of watershed health. These parameters were independently scored for each stream segment assessed, and then averaged to provide an overall score for that segment. Each parameter was worth a maximum of 20 points for the most ideal habitat condition, and a minimum of 0 points for the least ideal habitat condition. Point awards of 16–20 scored in the Optimal category, 11–15.9 points scored as Suboptimal, 6–10.9 points for Marginal, and 0–5.9 scored in the Poor category.

In addition to parameters based on the EPA's Habitat Assessment Protocol, special attention was given to the amount of Large Woody Material (LWM) in a segment; the presence of Aquatic Organism Passage (AOP) barriers; the impact of Dirt and Gravel Roads (DGR) on the stream; if the habitat could be improved in general; erosion throughout the segment; presence and length of channelization on the segment; if native or wild trout were observed; and any other miscellaneous improvement projects that could benefit the watershed. Descriptions of the methods for each of these categories follow below.

Large Woody Materials (LWM)

During field assessments, segments were classified as having significant, moderate, minimal, or none (not present) amounts of LWM. Guidelines for these categories were somewhat subjective, yet estimates of approximately 120, 80, 40, and zero pieces (respectively) of LWM per mile were used as loose standards for these categories. Minimal and moderately classified segments were further delineated as "Add" LWM segments, if within those reaches a section was obviously lacking this type of habitat, but overall would fall into a higher classification.

Aquatic Organism Passage (AOP)

An Aquatic Organism Passage (AOP) barrier is a structure that impedes the up or downstream movement of fish and other aquatic and riparian species. For the purposes of this study, focus was held on anthropogenic (man-made) AOP barriers, but natural AOP barriers were also noted. AOP barriers included culvert and bridge structures at road-stream crossings, active and defunct dams, and any other man-made structures that would impede passage throughout the reach of the stream segment.

While no formal protocol was used, attributes of each crossing and structure were evaluated and compared with those of the stream. Evaluated attributes included elevation, slope, width, blockage, water depth and velocity, presence of a scour pool, substrate presence and composition, floodplain development, and alignment. Notes and latitude/longitude coordinates were taken for each suspected AOP barrier, and a Yes/No checkbox for "AOP barriers present" was marked on the datasheet. If a potential barrier existed, but the assessor(s) were unsure if it qualified, that distinction was made in the "potentially present" category.

Dirt and Gravel Roads (DGR)

During in-field assessments, dirt and gravel roads were noted when observed within each segment, as well as any obvious issues that may have been associated with them. These issues may have included stream fords, drainage ditches discharging high amounts of sediment to the stream, heavily eroded tire tracks leading to the stream, and changes in streambed substrate composition near the road-stream interaction zone.

Habitat Improvements

Stream segments lacking habitat, but not necessarily suited for LWM treatment or replacement of an AOP barrier were placed into this category. This category was used as a "catch-all" to highlight segments needing habitat improvements that wouldn't fall into one of the other more specific categories. Issues shown in this category typically involve improving habitat diversity and stability.

Erosion

This study categorized the degree of erosion as None, Minimal, Moderate, or Heavy, based on the amount of erosion observed throughout an entire segment. The EPA habitat parameters of Bank Stability and Vegetative Protection were also used, in part, to help make these determinations.

Channelization

The EPA's habitat parameter of Channel Alteration played heavily into the assessment of this specific category. The assessor(s)'s best professional and scientific judgment was used to estimate the length of channelization in a segment. This was done at the time the channelization was observed - usually culverts and bridge crossings, but in some instances a stream was forced to flow below ground.

Native or Wild Trout Observed

If fish were observed and a positive identification of species (trout) could be made, it was noted. This mainly applied to tributaries to EBTC where young of the year trout were observed, as the entire mainstem of EBTC holds wild trout (PFBC 2016).

Miscellaneous Improvement Projects

This category was also used as a "catch-all" to illustrate if a segment was in need of improvements that wouldn't fall into one of the other specific categories. Examples of projects in this category include removing defunct oil and natural gas lines, protecting those that are active, remediating water quality issues, and improving riparian vegetation.

Water Quality Testing

Measurements for pH, conductivity, and temperature were taken in the field with a *Waterproof Oakton PCSTestr 35 Multi-Parameter* multi-meter at the upstream and downstream termini of each assessed segment. The multi-meter was inserted into the water until a stable value was reached for each parameter, which was then recorded on the datasheet.

Macroinvertebrate Sampling

While no macroinvertebrate samples were collected in correlation with this assessment, surveys from the Pennsylvania Department of Environmental Protection (DEP), as well as the Collins Companies, were reviewed. A brief summary of the findings of both studies is included in the Data Summary section, and implications of the findings are reviewed in the Discussion section.

Data Summary

Approximately 94% of the watershed, totaling 61.7 miles, was evaluated via field assessments. The remaining 6% of the watershed was either dry or unable to be assessed, depending on permission and logistics. The entire assessed watershed averaged an overall habitat quality score of 15.6*, putting it just below the Optimal category. The highest average score any singular segment received was 19.7 (near "ideal"- in the high Optimal category), while the lowest average score any segment scored was 10.4 (high Marginal). Most of the individually assessed parameters in the habitat assessment scored a 20 (most ideal) on at least one segment, with the exception of Epifaunal Substrate (fish and macroinvertebrate habitat), which maxed out at 19. Epifaunal Substrate also had the lowest score of any category on at least one segment, with a score of 2, placing it in the Poor category. Predictably, Sediment Deposition (Min. score=3), Channel Flow Status (Min. score=4), Embeddedness (Min. score=5) and Vegetative Protection (Min. score=5) rounded out the lowest scores per category for any singular segment. Table 2 lists all the habitat scores for each segment, with the map in Appendix 2 giving a visual representation of segment scores by location.

**Dry or unassessed segments are not included in these analyses.*

In the instance of Segment 5979, two tributaries to the East Branch Tionesta Creek mainstem (Segments 5978 and 5972) have merged near their mouths, eliminating the beginning and end points of the segment. Due to logistics, these "two" segments

(5979 and 5971) were assessed on different days, several months apart. Upon extensive field investigation, the above geomorphological changes were noted, and scores for 5971 and 5979 were combined. See the map at left for the originally mapped stream channels as well as on the ground observations.

Throughout segments 5979 and 5971, as well as several other locations in the watershed, EBTC mainstem is an anabranching stream (having multiple stable channels), at times having up to five different channels. While this characteristic complicated field assessments, it did show off some of EBTC's great habitat diversity.

Acidity (pH) is the measure of free hydrogen ions in solution. It is measured on a logarithmic scale from 0–14, with a pH of 7.0 as a neutral midpoint. Solutions become 10 times more acidic with each integral drop in pH value (e.g. pH 5 is ten times more acidic than pH 6). Streambed elevation and groundwater interaction with the stream figure heavily into stream pH value. Headwater streams on the Allegheny Plateau tend towards a pH of 4.5–6.0 due to acid precipitation and initial reduced groundwater interaction, while downstream pHs in lower elevations often range from 5.5 to 7.0, with some as high as 8.0. Coldwater fishes on the Allegheny Plateau can survive through a range of acidic solutions, but tend to do best in the pH 6.0–7.0 range. Acidity in the EBTC watershed was not as low as investigators expected, and largely improved as stream elevation dropped. pH readings at the bottom of each stream reach ranged from 5.07 to 8.71, with the majority falling in the range of 6.36–7.85. Top of reach pHs exhibited a larger range, from 4.61–8.88. Details on pH recorded at the bottom of each specific segment can be found on the East Branch Tionesta Creek Watershed-Acidity map in Appendix 2, and overall water quality data can be found in Table 4: Water Quality.

Specific Conductance (or Conductivity) is the ability of water to conduct an electrical current. Pure water is unable to conduct electricity, yet as the amount of dissolved ions in solution increases, water is increasingly able to pass electrons through it. On the Allegheny Plateau, conductivity in streams similar to the East Branch of Tionesta Creek generally range from about 20 to 100 µs/cm, with typical values between 50–70 µs/cm. Like pH, conductivity is also influenced by elevation and groundwater interaction. Since it is a measure of dissolved ions (usually salts, metals, and other conductive materials), conductivity is influenced by human activity within a watershed. Due to these factors, specific conductance was generally predictable in EBTC. All of the elevated measurements (>200µs/cm) were recorded in the most developed sub-watershed, West Run, that drains Kane Borough. Specific conductivities ranged from 795 µs/cm in West Run to 21.6 µs/cm in one of the nearly pristine, forested tributaries to EBTC (Segment 5905). Details on conductivity recorded in each specific segment can be found in Table 4: Water Quality. Highest conductivities observed, as well as those segments whose conductivities changed the most, can be found in those maps in Appendix 2.

Water temperature is another important factor in the quality of a stream for fish habitat. Though there is some slight variation in temperature thresholds between species; in general, trout can survive in water temperatures near freezing (0°C, 32°F) and begin to experience thermal and oxygen-related stress between 18–21°C (65–70°F). Field investigations were conducted in all four seasons, with stream temperatures ranging from 25.6°C–1.6°C (78.8–34.8°F). To standardize measurements across sampling seasons, the difference in temperature from the top of a segment to the bottom of a segment were used. Data for each segment are available in Table 4: Water Quality, as well as the Temperature Change map in Appendix 2.

The Pennsylvania Department of Environmental Protection has been sampling West Run and the EBTC for benthic macroinvertebrates periodically since 1987. Surveys occurred in 1987, 1997, 2005, and 2009 to assess the impacts of the Kane Borough (Pine Street) Waste Water Treatment Facility (WWTF) to the aquatic community. Data analysis from those surveys was used to develop an Index of Biotic Integrity for each site, which is used to categorize large stream segments as well as determine if the stream is meeting its designated use. Sampling sites were located directly upstream of the WWTF discharge, directly downstream of it, 1.61 miles downstream of the discharge (all three on West Run), and at sites above (upstream) and below (downstream) of West Run's confluence with EBTC. Not all sites were sampled each survey year, and the methodologies changed slightly between surveys. Even so, the general trend of all surveys was that the WWTF was having a negative impact on the biotic community in West Run. Biologic use and conditions returned to approximately those of the upstream site (above the discharge) by the last site on West Run (1.61 miles below discharge). West Run was determined to not have a detrimental effect on EBTC, but was, itself, recommended to be placed on the EPA's Integrated Water Body List as an Aquatic Life Use (ALU) impairment for 1.61 miles below the discharge. The recommendation was for a WWTF compliance issue and expected to meet the aquatic life designated use within a reasonable time period, placing it in Category 4B of the report (CoP 2010). However, as of this plan writing (2017), West Run does not appear on the Category 4B list, but rather under Category 2—waterbodies attaining some uses.

The Collins Companies periodically monitor four sites for benthic macroinvertebrates on their property in the EBTC watershed. This voluntary monitoring is not required by state water quality regulations for timber harvest operations, but is intended to capture land use effects on the aquatic community. Three sites are located on the mainstem of EBTC, with one site on an Unnamed Tributary parallel to State Route 66. Specifically, one site was chosen to pick up influence from an incoming tributary; one site is downstream of all pipeline crossings, another site is just upstream of the pipeline crossings, and the last site is upstream of all timber activity. Sampling occurred in 2001, 2002, and 2013. Fish and macroinvertebrate habitat scores (Based on the DEP and EPA methodology similarly used in our field investigations) stayed fairly consistent over the three sampling years, with all sites scoring Suboptimal to Optimal overall. The two furthest downstream sites (just downstream and a bit upstream of the pipeline crossings) showed slight impairments in their biological scores in 2001 and 2002. These two sites also receive water from several relic impoundments, which may be impacting their function. The 2013 study showed three of the four sites to be slightly impaired based on the score of their Index of Biotic Integrity (IBI Score), but not impaired to the degree of requiring inclusion on the state impairment list. Recommendations that may help improve these scores and conditions can be found in the Recommendations section of the plan.

Invasive species were present to some degree in nearly every portion of the watershed that had regular human interaction, mostly in developed areas or along roads. Multiflora rose (*Rosa multiflora*), Japanese barberry (*Berberis thunbergii*), garlic mustard (*Alliaria petiolata*), and honeysuckles (*Lonicera spp.*) were some of the most common species encountered, with occasional sighting of phragmites (*Phragmites australis*) and Japanese knotweed (*Fallopia japonica*). While a detailed location inventory of invasive species present was slightly outside of the scope of this assessment, species were recorded when observed, and are available upon request from the hardcopy datasheets.

Discussion

Importance of Specific Evaluation categories

Large Woody Materials (LWM)

Trees and forests play an integral role in the protection of coldwater resources. Not only do they shade and cool streams, but branches and entire trunks physically interact with water. Standing trees lessen the impact force of precipitation, reducing soil compaction and erosion, and provide channels along roots for water to seep underground. After they fall, trees on land become natural "water bars" on slopes, slowing and further infiltrating sheet-flow of water into the soil. Trees growing nearer to the water serve an equally vital role. On floodplains fallen trees slow high water en route to downstream communities. Infiltration into floodplain groundwater tables also ensures that summer low-flows have a cool, clean, underground reservoir to draw from. As muddy, debris-filled flood flows are dispersed over the floodplain and their velocity is reduced, their ability to keep particles entrained (mobilized with the flow) is also reduced, forcing them to drop sediment. This nutrient-rich sediment fertilizes the land. Seeds from higher in the watershed are also caught by floodplain vegetation and woody debris, providing a freshly fertilized seedbed in the dropped sediment for the next generation of riparian plants to grow. In this manner, vegetation that has evolved to be in and near streams stays in those environments to provide habitat for aquatic and terrestrial species, and the associated ecosystem services they provide.

Woody materials in the channel help provide habitat for numerous aquatic and terrestrial species while interacting with water in much the same fashion as their upland counterparts. Multiple tree species, age classes, and states and rates of decay provide a diverse substrate for aquatic macroinvertebrates, fungi, and plants that then transfer that energy up the food web. Fish, reptiles, amphibians, birds and mammals all rely on these more "basic" food web pieces, as well as the trees themselves for cover and reproduction. As the volume of water flowing within a channel increases it interacts more forcefully with all substrates present, including LWM. If the individual pieces of LWM or those that they are entangled with are of sufficient size, mass, and shape to not be transported (a "key piece"), they can force the water to scour additional pools, sort gravels, and aggrade, or build, sediment in their slack waters. In this physical role, they help set the grade of the stream, provide areas for nesting, feeding, breeding, and rearing young, as well as refuge from predators.

Aquatic Organism Passage (AOP)

In the course of field assessments, AOP barriers were encountered in a variety of situations. Some were on main highways and paved roads, while others existed on dirt and gravel roads or ATV trails. A small subset of other AOP barriers existed in remote headwater-type areas, with long defunct roads crossing the stream on crushed and rusting culverts, or the remains of logging railroads or dams still hindering natural ecological processes. All encountered structures were evaluated on their ability to keep the aquatic ecosystem connected. A crossing structure that in some way hinders or prevents passage effectively serves as a bottleneck in that entire ecosystem, reducing the flow of nutrients and energy in both directions.

Flood flows can also become problematic for road managers at the road stream intersection as bridges and culverts become blocked by debris or sediment, or are undersized for the watershed they are conveying. Issues can include erosion of the crossing structure and road base, up to and including the whole road itself failing; flooding of low-lying roads posing a safety hazard, and flood debris accumulating in ditches and on the road surface. Crossing structures that are adequately sized to the stream reach and location they are installed on will allow for a floodplain to develop inside, as well as provide passage at multiple flow levels for aquatic and terrestrial species to benefit the entire ecosystem.

Dirt and Gravel Roads (DGR)

Roads and trails surfaced with dirt and/or gravel can provide an economic alternative to impervious surfacing materials like concrete or asphalt. They provide environmental benefits as well, allowing storm water to more readily infiltrate into the ground and slowing the flow of runoff. However, if improperly constructed or maintained they can negatively impact the watersheds they traverse. Sediment that washes off DGR's quickly finds its way into streams, filling the interstitial spaces between cobble and gravel that provide habitat for fish and aquatic macroinvertebrates.

Habitat Improvements

Habitat improvements were included as a special evaluation category separate from *Large Woody Materials* and *Aquatic Organism Passage Barriers* to highlight improvements that wouldn't fit either of those two categories. This will allow a broader suite of conservation tools for stakeholders.

Erosion

While some erosion is natural and necessary in a stream system, it can also have negative consequences for aquatic ecosystems. Similar to the sediment originating from dirt and gravel roads, erosion of a stream's bed and banks can produce sediment. This erosion is most often observed as scalloped, non-vegetated areas on banks, undercutting of the riparian vegetation's roots, and headcutting of the substrate in an upstream direction.

Channelization

Though the EPA parameter of Channel Alteration is used in the determination of habitat scores, we felt it was also necessary to show how much channelization was present in each stream segment. By removing natural bed substrate like boulders, cobbles, gravels, and woody materials from the aquatic ecosystem, the habitat quality as well as energy dissipation abilities of some streams in EBTC have been reduced. Channelization was often observed near road stream crossings, but in some instances smaller streams were culverted and forced underground to accommodate development. Other instances of channelization were observed as relics of historic industrial practices, such as log driving and milling.

Native or Wild Trout Observed

As a state-listed Wild Trout stream (from headwaters to mouth) as well as a High-Quality Coldwater Fishery, the East Branch of Tionesta Creek is protected by some of the most stringent water quality protections in Pennsylvania. Under the *Tributary Linkages* rule of the PA Code, all tributaries to a wild trout stream are also considered to be wild trout streams for "their function as habitat for segments of wild trout populations, including nurseries and refuges, and in sustaining water quality necessary for wild trout." (58 PA Code §57.11). And, since they are associated with a Wild Trout stream, wetlands in the EBTC watershed are protected by even more stringent regulations, which apply to Exceptional Value waters (25 PA Code §105.17).

Though the entirety of the watershed has rigorous water quality protections in place and is considered to contain Wild Trout, staff and volunteers in field investigations were encouraged to record any wild trout they observed, as an informal record for the future. Should climate change or other stochastic events extirpate a portion of the trout population present in the EBTC watershed, locations where trout were observed in this study can serve as source populations or refuge areas for future restoration efforts.

Miscellaneous Improvement Projects

As discussed in the Methodology segment of this plan, this category was included as a space for any improvement project that would improve the water or habitat quality in the East Branch of Tionesta Creek, and did not fit in to the other assessment categories.

Water Quality Measurements

Just as air pollution can make terrestrial habitats inhospitable to human and animal life, so too can water pollution make aquatic habitats toxic. This pollution can be: thermal, often resulting from a "top release" pond with a spillway or overflow pipe draining the warmest water in the pond into the stream; chemical, in the form of acid rain falling on soils with low buffering capacity or road runoff elevating the stream's conductivity; or physical, with a substance (usually sediment) taking up the interstitial spaces that provide habitat for fish and aquatic macroinvertebrates. While the thermal and chemical qualities of water in East Branch Tionesta Creek were measured, sediment in the form of turbidity was not objectively measured, but was subjectively estimated.

Climate Change

Anthropogenic climate change is one of the most diverse and complicated issues facing humanity today. To the non-scientific observer, its effects may seem miniscule and irrelevant, yet numerous and far-reaching climate related impacts have been documented in recent history. These include species' ranges and distributions changing with a warming climate (Chen et. al 2011), as well as, negative impacts on crop yields (IPCC 2014). Effects of climate change specific to coldwater ecosystems can be found in Table 3 below.

Table 3. Climate Change and Coldwater Ecosystems

Climate Change Condition	Effect on Coldwater Ecosystems
Increased drought frequency, intensity, and duration during summer and fall	Habitat fragmentation or loss as streams lose water
	Reduced prey abundance as seasonal wetlands dry before larval amphibians metamorphose and migrate
Warmer average water temperature	Less dissolved oxygen available for aquatic organism respiration
	Habitat loss due to increased temperature
Increased precipitation event frequency, intensity, and duration during winter and spring, mostly as rain	Road-stream crossing structures become undersized as storm events increase in intensity, creating AOP barriers and further fragmenting habitat
	Less snowpack and more precipitation falling as rain means more runoff quicker, resulting in less infiltration to groundwater tables and reduced base flows

Table developed from Woodward et. al. 2010 and Moore et. al. 1997.

Areas of Concern and Opportunity

Numerous areas of concern were found throughout the EBTC watershed. Those concerning the level of LWM in the stream, Dirt and Gravel Roads impacting a segment, length of channelization, observance of wild or native trout, and amount of erosion in a segment are illustrated in their respective maps in Appendix 2. Specific examples are included below, but are not totally inclusive of all projects present in the basin.

Large Woody Materials

5868: Channel spanning log jams were observed sparingly throughout EBTC. Specimens like this on segment 5868 provided natural inspiration and examples of great habitat present. However, this entire reach did not quite have enough pieces of LWM per mile to qualify as "Significant"

6234: Mobile pieces of wood in the channel may pose risks to exposed infrastructure. Note the absence of larger pieces of wood near these concerns.

Dirt and Gravel Roads

5806: Poorly maintained dirt and gravel roads throughout this and other drainages contributed sediment during heavy precipitation or runoff events, at times even preventing accurate assessments (and thus a canceled field day).

Habitat Improvement Opportunities

6099: The riparian area of this segment is periodically used by the local high school to create habitat for small birds and mammals. Incorporating stream habitat into these events to address the entire riparian ecosystem would create greater ecological lift, as well as a more well-rounded learning experience.

Erosion

5868: Eroding bank along East Branch Tionesta Creek mainstem. Note exposed pipeline.

6281: Erosion near the headspring of East Branch Tionesta Creek mainstem. This section is directly below an agricultural area.

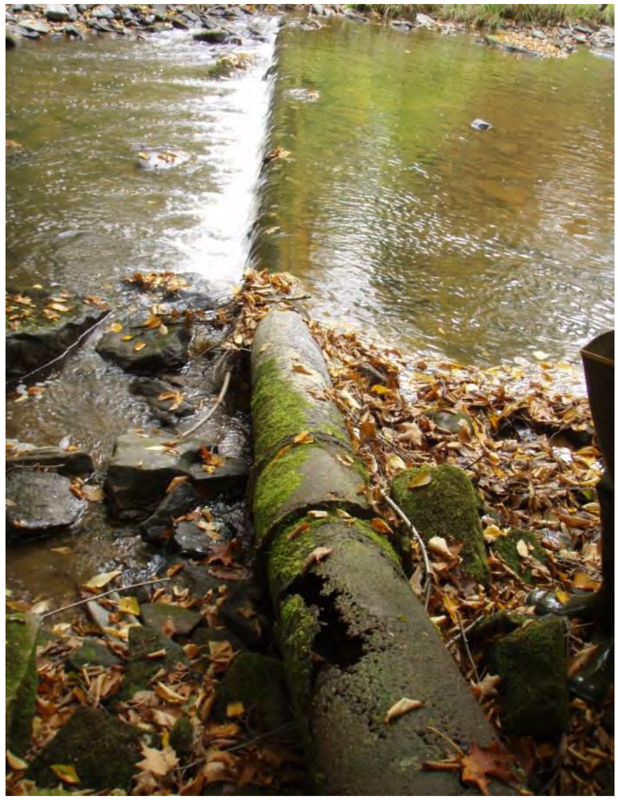
Channelization

6114: Sediment slug upstream of entrance to channelized/underground section of stream.

Wild or Native Trout

5806: Wild brook trout were observed in many stream segments and are considered to inhabit the entire watershed.

Miscellaneous Projects



5963: Old, inactive metal pipe creating a potential AOP barrier, as well as safety hazard.

Water Quality

6090: Checking pH, conductivity, and temperature.

AOP Barriers

Segments with AOP barriers can be found on the "AOP Barriers Present" map in Appendix 2, as well as in Table 5. AOP Barriers and Locations. Photo documentation of most of the AOP barriers is included in the following pages, by stream segment.

5806: Culvert posing an AOP barrier. Culvert lacks suitable substrate for AOP passage.

5816: Culvert inlet (left) and outlet (right) posing an AOP barrier. Culvert is perched and clogged.

5823: Perched culvert outlet, relic undersized pipes, relic log dam (separate locations on 5823).

5853: Culvert lacking substrate the entire length of pipe. Note blockage at visible end.

5869: Perched culverts downstream (left) and upstream (right, near ephemeral point of stream)

5905: Patchy flow near top of stream isolates populations of juveniles. Potential natural AOP barrier.

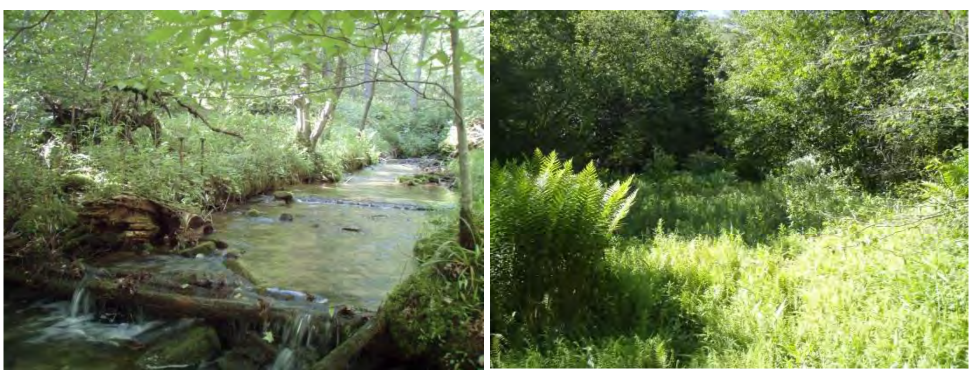

5964: Historic logging railroad (left) impacted original course of stream, potentially leading to seasonal connection through floodplain wetland and sediment (right).


5965: Undersized culvert inlet (left) and outlet with scour pool (right).


5966: Culvert inlet (left) and perched outlet (right) with scour pool.

5978: Perched culvert outlet, 1 of 3 channels on this UNT at this inactive pipeline crossing.

6006: Free flowing segment downstream of relic log RR boiler-fill pond.



6033: A relic mill dam (breached, left photo) and aggraded sediment upstream from it (right) forced the stream to flow subterranean.


6034: Perched culverts on Rock Run (left), with 1 culvert containing an active 2" natural gas line (right).


6035: Culvert perched, lacking substrate.


6041: Several undersized/perched culverts for multiple sinuous DGR crossings. Outlet on the left and clogged inlet on the right.

6045: Bridge causes slight constriction at high flows, but has good floodplain development beneath. Low potential for AOP barrier.

6046: Two relic log dams, reclaimed by nature and posing little threat of being AOP barriers.

6049: Relic bridge abutments and a pipeline form a constriction and low potential AOP barrier.

6052: Recently replaced culvert is perched with substrate falling short of pipe outlet (left). Erosion near inlet (right).

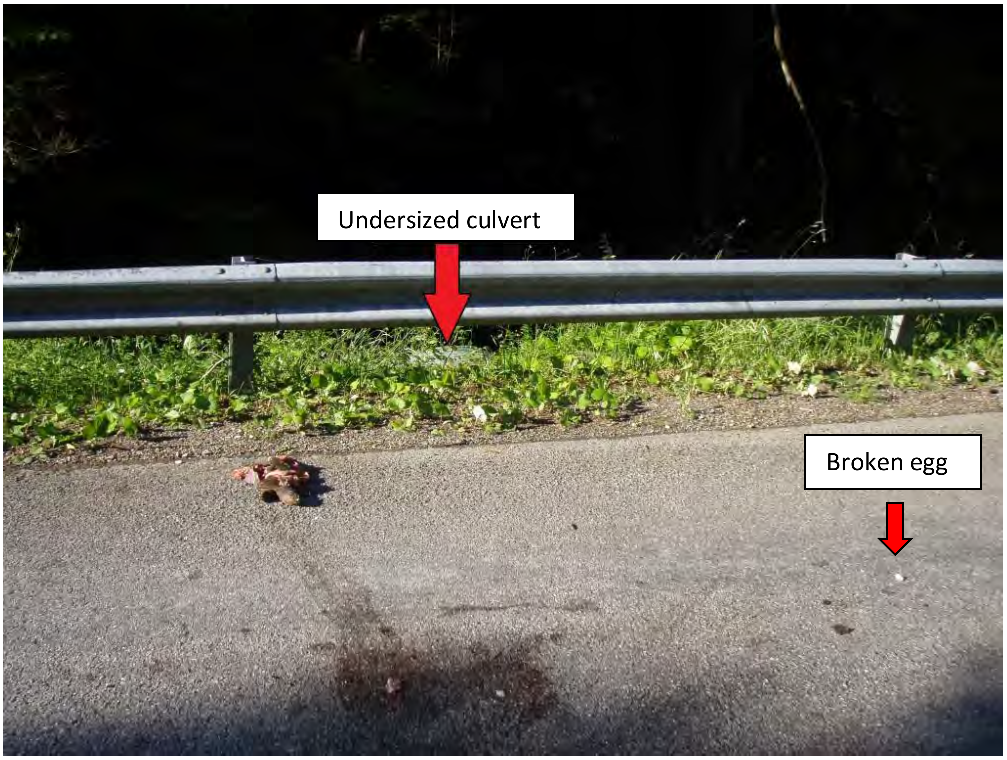
6066: Stream is more floodplain wetland than a stream, but does have a small culvert on it.

6079: One set of double culverts at their outlet. Permission and logistics prevented further survey of the 5+ other AOP barriers on this segment. (Future endeavors may reap different results).

6090: Clockwise from Top Left: Stream enters urban stormwater system from headspring in Evergreen Park; street stormwater grate draining directly to stream; small discolored tributary in Evergreen Park; Stream exits culverted stormwater system, with Japanese knotweed in foreground.

6093: No pictures available, as stream was unfound and suspected subterranean.

6099: Undersized box culvert under State Route 66 (left); old, breached dam (right).

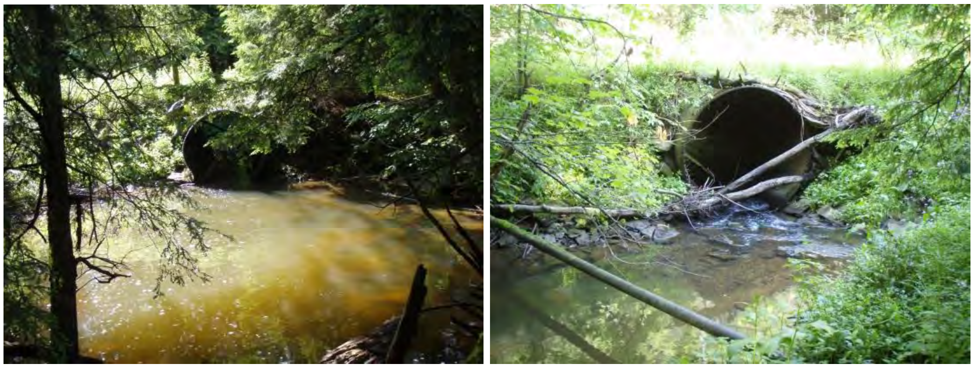


6105: A prime example of an undersized crossing structure impacting aquatic populations. This gravid female snapping turtle was found hit by a vehicle, just above an undersized culvert on West Kane Road.

6105: Relic log dam forms partial AOP barrier (top left), Reigel Road culverts (top right), private road culvert (bottom left).

6110: Undersized culvert at West Kane Road (left); sedimented basin of relic log pond (right).

6114: Clockwise from bottom left: Inlet to underground section; outlet of undersized culvert on Pennsylvania Avenue, three undersized pipes on private gas road crossing.



6115: Outlet (left) and inlet (right) of old oil tank used as culvert on private road/trail. Note log/debris blockage at inlet.

6141: Potential AOP barrier due to narrowness and lack of floodplain beneath bridge.

6142: Undersized culvert on intermittent section of stream in headwaters (left), undersized squash pipe at Forest Road 473 crossing (right).

6164: Undersized culvert on Forest Road 462A.

6175: No picture available for culvert on Highland Road.

6179: Much of stream was inaccessible. Multiple culverts and underground sections observed. No pictures available.

6202: Undersized culvert on private access road.


6203: Perched culvert on private access road (left), three pipes on relic logging road (right).

6230: Undersized culvert on West Wind Road. Picture unavailable due to property access issues.

6231: Clockwise from top left: Relic, breached dam upstream of State Route 66; box culvert on State Route 66-minimal floodplain development inside; Relic, breached dam downstream of State Route 66; another view of the same breached dam downstream of SR 66. These dams are partial/minimal AOP barriers.

7200: Bridge at top of segment constricts flow, no floodplain development underneath.

6234: Clockwise from top left: breached dam, timbers of dam structure, beaver ponds in relic impoundment, secondary breach. This breached dam creates a partial AOP barrier.

7202: Two dilapidated culverts on a gasline right of way.

<u>Species of Concern, and other species observed</u>

A number of sensitive species have been observed in this watershed, both during field assessments for this study, and for more broad studies by the Pennsylvania Natural Heritage Program. For more information on what those species might be and protections in place for them, please see http://www.naturalheritage.state.pa.us/ . No new species occurrences or range expansions were found during this study, but several notable species were observed within the drainage. For their protection we are not able to provide exact locations for their occurrences, but their presence in the watershed is a testament to the fine habitat quality already present there. Several photos are provided on the following pages.

Black Bear (*Ursus americanus*)

Comb hericium fungus (*Hericium ramosum (corralloides)*)

American Brook Lamprey (*Lampetra appendix*)

Eastern Brook Trout (*Salvelins fontinalis*)

Recommendations*

Targeted efforts to protect and restore the East Branch of Tionesta Creek should focus on the lowest scoring categories from the habitat assessments. Based on those scores, improvements for coldwater organisms can be accomplished through reductions in sediment, increasing base flows, and habitat improvements. Conductivity should also be addressed in the West Run drainage. Recommendations for specific segments and issues are below.

**Acquire all appropriate State and Federal permits before implementing any recommendations in this plan.*

Large Woody Materials

Restoring the LWM component of habitat to the EBTC watershed can best be implemented by referencing the LWM Present map in Appendix 2, and concentrating on those areas to "add" to, as well as the Minimal and Moderate segments. This method of improving the ecosystem should be used judiciously and be considerate of downstream infrastructure risks. Installation should use primarily on-site materials, and structure designs may be based on those in *Guidance for Stream Restoration and Rehabilitation* (Yochum 2016). The level of complexity of these projects is proportional to the amount of drainage area upstream of the project site, and inversely proportional to the distance to downstream infrastructure. On 1st and 2nd order streams with little risk (or great distance to) downstream infrastructure, simple directional felling techniques can be used to improve habitat. Trees with rootwads still attached can also be uprooted by hand/winch and drug into the stream, or installed by heavy equipment. Rootwads and the amount of winching or need for heavy equipment, as well as engineering and design, increase as EBTC grows into a 3rd and 4th order stream.

As mentioned in the *Retrofit* method of AOP Recommendations and Abbe et. al. (2009), LWM installations can also be used to stabilize and protect infrastructure. This applies widely to the EBTC drainage, as exposed pipelines and/or undersized road-stream crossing structures were found on nearly every stream segment. Specific to pipeline infrastructure, segment 6234 has several exposed pipeline segments that may benefit from wood and boulder grade controls to protect the infrastructure, the environment, and provide enhanced aquatic habitat. If attempting to protect infrastructure in this manner, it is highly recommended that the project partners have the plans professionally engineered and designed, in order to provide the greatest ecological lift along with protections for industry and the environment.

Aquatic Organism Passage Barriers

Barriers to aquatic organism passage should be remediated to allow for full passage of aquatic and terrestrial/riparian species. This suite of species includes fish, mollusks, amphibians, mammals, reptiles, and birds; or any other organism that would use a waterway as a natural travel corridor. Several options are available to accomplish this goal, including:

Replacement

As in the case of segment 6202, a private access road to a large parcel of actively managed timber land is undersized, putting the stream and roadway at risk. This structure should be replaced with a larger one, be it a squashed pipe, bottomless arch, or bridge. Structure type and installation will vary by site based on the stream, landowner, and roadway needs, as well as available funding. The structure should be sized to one hundred and twenty percent (120%) of the stream's current bankfull width that is out of the "zone of influence" of the existing crossing structure. A substrate/bedload mix comparable to that present naturally in the stream channel should be used to simulate it through the crossing. Floodplains should be allowed to develop inside the crossing structure to facilitate higher flows expected to be associated with climate change trends (thus reducing future maintenance), as well as assist non-fish species in utilizing the waterway for travel (see photo of segment 605 on page 32).

Retrofit

The culvert on segment 6052 was replaced in 2011 with a structure properly designed to accommodate AOP. Due to unforeseen circumstances, this culvert is now slightly perched and creating a partial AOP barrier. It may be somewhat unfeasible to remove and replace this structure in the near future, yet a simple solution may be to "retrofit" the structure. By strategically installing large rocks and logs as grade controls on the downstream side, water may be retarded in its seaward journey and increase in depth. The pool backing up into the pipe will allow fish and other aquatic organisms to swim up into and through the crossing, keeping the ecosystem connected. For a retrofit of this nature, it may also be prudent to install a stable "catcher" type LWM structure upstream of the crossing structure that will sequester small, mobile pieces of wood that may cause clogs. This can also work as a "bandage" type of fix for severely undersized crossing structures until they can be replaced.

Removal

The culverts near the top of segment 7202 are clogged and no longer functional. They appear to be installed over a pipeline, with the ROW overgrown with saplings and brush. If the culverts are no longer performing their intended purpose of assisting people in crossing the stream, they should be removed to more fully connect the ecosystem. As this site is fairly remote and the culverts are small, this may be accomplished through a labor crew with a portable cable winch and hand tools. Conversely, if the crossing is still necessary for monitoring of the pipeline, the culverts should be removed and replaced with a properly sized structure.

Removing a structure also applies to the numerous relic dams found throughout EBTC, such as those found on segment 6234. However, this option for relic dams comes with the caveat of historical significance. The heritage of industry and transportation on Pennsylvania's waterways is rich and broadly appreciated; projects that would impact evidence of that heritage should make strong efforts to involve all stakeholders. To facilitate aquatic organism passage, it may be necessary to remove entire structures, yet remnants of abutments or approaches to the structure may be left to preserve the historical integrity of the site. Interpretive signs and preservation of removed materials (i.e. timbers, cut stone, other archaeological evidence) by historical societies or other qualified organizations may be beneficial to include in AOP barrier removal projects from their inception.

While several options to improve aquatic organism passage have been recommended for these specific sites, each one is different, and may require a different approach after conferring with the landowner, subsurface rights owners, natural resource management agencies, and other stakeholders. It is highly recommended that, before attempting any aquatic organism passage project, project partners consult with the above parties. Segments containing AOP barriers can be found in Appendix 2 on the AOP Barriers Present map. Funding to assist with those projects may be available as well, and stakeholders should reference the *Potential Funding Sources* section on pages 52-53.

Dirt and Gravel Roads

Dirt and gravel roads are recommended to be managed to have a minimum impact on aquatic resources and be removed, decommissioned, or at the very least vegetated when they are no longer needed. Proper Best Management Practices (BMPs) should be installed whenever possible, including but not limited to: re-surfacing with Driving Surface Aggregate, grade breaks, and cross drains. While specific segments are not listed here, please see the Dirt and Gravel Road Improvements Recommended map in Appendix 2. Not all Dirt and Gravel Roads were available through GIS mapping, and segments on that map may have improvements recommended for “unmapped” private access roads. Stakeholders seeking to reduce road maintenance and sediment contributions to those stream segments should work with the township or borough, landowner(s) and mineral rights owner(s) for solutions that benefit all. If possible, while working on DGR improvements, AOP barriers should also be removed/replaced/decommissioned within the same project. The USDA Forest Service, Penn State Center for Dirt and Gravel Road Studies, Natural Resources Conservation Service (NRCS), county conservation districts, and Western PA Conservancy are all excellent resources for these types of projects. Recommendations for improvements to a specific section of road can be arranged by contacting them and scheduling a field visit. Find their contact information in the list of Potential Project Partners on pages 48-50.

Habitat Improvements

The Habitat Improvements Recommended map in Appendix 2 should be consulted for reaches within the watershed that would benefit from general habitat improvements, be they of the LWM or more structured designs. Specifically on segment 6099, the reach downhill from Kane High School is used periodically by classes to learn about wildlife habitat and build terrestrial habitat structures. To improve the learning experience of the students, as well as the ecosystem, aquatic habitat improvements should also be included. These can be accomplished by hand (by the students), with the assistance of a sportsman’s group or other partner (WPC, MCCD, TU Chapters, etc.) A plan for habitat improvements could be designed and permitted, and students could complete 1-2 structures per "learning work day" for years. They could move to other stream segments once this initial segment is complete. Opportunities for partnerships with multiple organizations exist for this project, as well as others across the watershed.

Erosion

Coupled with contributions from Dirt and Gravel Roads and stormwater runoff, excessive bank erosion is the primary supplier of stream sedimentation and pollution. Erosion issues can be addressed with "hard" stabilization structures (Lutz 2007, Yochum 2016) in the short term, and vegetatively in the long term. Where feasible, the LWM approach should be used to stabilize eroding banks as it more closely mimics natural conditions and can be more effective at reducing the erosive force of shear stress on channel walls. In more developed areas, such as yards or next to houses, structures like those in the PA Fish and Boat Commission's *Habitat Improvement for Trout Streams* hand book (Lutz 2007) may be used, as they are less intrusive into the stream and the bank. Both approaches abate erosion and help sequester sediment in slackwaters they create. Those structures' longevity is projected to be 20 years, but wood that is completely underwater can often persist for 50–100 years or longer. These approaches can be further augmented by installing soil bioengineering (intensive vegetative plantings) practices along with them.

Soil bioengineering (SBE) is the practice of installing live, dormant plant materials into streambanks in pre-designed configurations for stabilization. Native species, such as willows and dogwoods, have the natural capability to grow roots quickly from dormant cuttings, producing viable adult plants. The resulting network of roots creates a self-healing basket of "root rebar" that stabilizes the bank. A diversity of native species may be used, and harvested on site, if possible. This will simultaneously reduce project costs and keep site specific plant genomes (specifically adapted to that location's climate, photoperiod, and hydrologic cycle) within their native range. For a full list of species and their rooting capabilities for soil bioengineering projects, see NRCS Plant Materials Technical Note No. One (Burgdorf et. al. 2007). This document also lists several additional reference documents, and a brief overview of some of the installation techniques. The most recent U.S. Army Corps of Engineers Wetland Plants List for the Eastern Mountains and Piedmont (Lichvar et. al 2016) may be beneficial to review during a soil bioengineering project to assist in determining planting zones.

SBE would be beneficial at a number of sites in the East Branch Tionesta Creek watershed. Many of these sites are on segments listed in the "Miscellaneous Projects recommended" map in Appendix 2. Some may require the use of heavy equipment, but bank stabilization at other sites can be accomplished with several volunteers on a weekend workday. Specifically on segment 5868, the section with the eroding bank near the pipeline is a great candidate for SBE. This area is on a straight section of stream receiving little erosive force other than parallel shear stress; installed cuttings would be subjected to minimal water velocities, and be able to establish.

One of the simplest methods of preventing bank erosion is to not mow the vegetation on the stream banks. A diverse strip of native plants maintained as a forested riparian buffer approximately 100 feet (30 meters) or more around waterways can be the most cost effective and least maintenance intensive practices for preventing streambank erosion (Sweeney 2014). While EBTC is primarily a forested watershed, efforts can be made in the developed portions of the watershed to enhance and install riparian buffers. By slowing down sheetflow velocity and quantity as it approaches the stream, erosion will be reduced locally as well as downstream.

In addition to forested riparian buffers, BMPs for slowing and reducing the quantity of stormwater in Kane Borough and surrounding impervious areas should be installed. As they do not have one, Kane Borough should develop and implement an ACT 167 Stormwater Management Plan. Until that time, they should adopt and implement recommendations set forth in the McKean County ACT 167 Stormwater Management Plan (2010). Rain barrels, rain gardens, and other green stormwater infrastructure would be beneficial for Kane as well as downstream communities by reducing the quantity of stormwater in already overburdened infrastructure. Reigle Road and JoJo Road are two examples in the McKean Co ACT 167 plan that were also identified as AOP barriers in this plan.

Channelization

Wherever possible, it is recommended to reduce the amount of channelization in the watershed. Future channelization efforts should be reduced or eliminated completely to reduce flooding, erosion, and pollution. Streams should be returned to a natural form and function, dependent on stream order, size, and where they occur within the watershed. For example, restoration of 1st order segment 6090 in Kane Borough would be far different than the restoration that would need to occur on the 3rd order segment 7200 on the mainstem in the Allegheny National Forest. Segment 7200 functions and provides completely different ecosystem services than segment 6090, and each would require their own restoration strategy.

Wild Trout

It is likely that wild brook trout once inhabited the entirety of the EBTC. Usage of a particular section or habitat type was and still is highly dependent on fish size, age, and maturity, as well as seasonal and climatic conditions. To improve conditions for native trout in the EBTC, individuals and organizations may follow the recommendations in this section. Additionally, if the PA Fish and Boat Commission should deem it appropriate, the stocking of non-native trout and hatchery raised brook trout should cease in the EBTC. Competition from these “introduced” fish can reduce the ability of native trout to thrive in the watershed, giving a false impression to anglers and outdoors people of reduced productivity. Seasons, sizes, and creel limits may also need to be adjusted to protect the native trout until their populations reach the desired quality of sport fishery (ideally, Class A).

Miscellaneous Projects

Projects like removing the breached and defunct pipeline on segment 5963 are at a lower priority level than remediating AOP barriers and improving habitat quality. However, when a "higher priority" project is slated to occur on a segment listed for a miscellaneous project, the two should coincide, if possible.

Efforts should also be made to coordinate with numerous partners if the project type allows. For example, if a project to replace an AOP barrier will occur and incorporate various habitat structures using on-site materials, their sourcing may be accomplished in such a way as to improve wild turkey and/or ruffed grouse habitat. It may be beneficial to contact not only the landowner's wildlife biologist (in the case of the ANF or the Collins Companies), but also the PA Game Commission, National Wild Turkey Federation, and the Ruffed Grouse Society.

Water Quality

Low pH on the Allegheny Plateau is typically attributed to acid precipitation and the low buffering capacity of the soils. To prevent acidic precipitation from falling here may not be possible, yet improvements to dirt and gravel roads with limestone DSA and alkalinity basins would help mitigate it once it fell. Our study did not show pHs that were completely outside the range of existence for coldwater organisms, but they could be improved in some areas. If further study should determine that low pH is affecting the resource, a mitigation strategy can be developed at that time.

Conductivity in the West Run drainage should be reduced to improve the resiliency of the ecosystem. Stormwater BMPs and decreased impervious surfaces would help slow the flow of salt- and metal-laden runoff on its way to the stream. Riparian buffers should be included with these stormwater BMPs. Implementing riparian buffers can be as easy as not mowing to the banks of streams and letting native vegetation create the "root rebar" mentioned earlier. If present, invasive species, like Japanese knotweed and Phragmites should be removed, planting a native riparian mix in their stead. Stream corridors thus planted and un-mowed become "natural gardens" of wildflowers and shrubs that are ideal habitat for pollinators and songbirds. This applies to urban environs too, where even a small, un-mowed strip several feet wide can benefit the aquatic resource and attract winged visitors.

Specifically on 6090, which had the highest observed conductivity in the watershed (795µs), measures should be taken to improve the resource. This segment lies in Evergreen Park in Kane Borough, and an educational/edible riparian buffer would benefit the environment and park users. This would reduce maintenance costs as well, shrinking the area staff are required to mow. It is advisable to have soil samples analyzed before planting species with edible products, to prevent contamination by heavy metals or other pollutants that may be present.

Increasing LWM in West Run and headwater areas of EBTC will also help improve conductivity, especially downstream of developed areas (Kane Borough, major roads). By installing

LWM that will help aggrade sediment and force high water to the floodplains, riparian areas are able to fully perform their ecosystem functions of filtering and purifying water, including reducing conductivity. Once again, this approach should be used judiciously and only where the risks to infrastructure can be minimized.

Climate Change

While individuals and small organizations at the local scale can't immediately change the pace of anthropogenic climate change globally, we can act locally to improve the resiliency of our coldwater ecosystems. By following recommendations in this plan, as well as those of the PA Fish and Boat Commission and Trout Unlimited, we can act together to improve the EBTC watershed, impacting the rest of Tionesta Creek, the Allegheny River, and points downstream.

Based on Table 3. Climate Change and Coldwater Ecosystems, recommendations in Table 6 on the following page are provided for mitigating climate change on the local level.

Table 6. Climate Change, Coldwater Ecosystems, and Mitigation Strategies		
Climate Change Condition	**Effect on Coldwater Ecosystems**	**Mitigation Strategies**
Increased drought frequency, intensity, and duration during summer and fall	Habitat fragmentation or loss as streams lose water	-Ensure adequate AOP throughout the watershed, to allow access to water of the proper quality and temperature -Enhance groundwater infiltration from headwaters to mouth, through green stormwater infrastructure, large wood additions, and other BMP's
	Reduced prey abundance as seasonal wetlands dry before larval amphibians metamorphose and migrate	-Provide native riparian tree or shrub plantings to the south of known wetlands to reduce evaporation -Promote beaver usage of the watershed. This can include providing base structures in areas lacking riparian wood, so that upon colonization the beaver structures remain in the system
Warmer average water temperature	Less dissolved oxygen available for aquatic organism respiration	-Safeguard existing forest/shrub riparian areas, as well as plant new areas where needed to shade and cool waters, increasing DO capacity -Diminish or eliminate fishing pressure during hot summer months to reduce physical stress in hypoxic water conditions
	Habitat loss due to increased temperature	-Decrease water temperatures through riparian plantings and increased hyporheic interaction
Increased precipitation event frequency, intensity, and duration during winter and spring, mostly as rain	Road-stream crossing structures become undersized as storm events increase in intensity, creating AOP barriers and further fragmenting habitat	-Ensure adequate AOP throughout the watershed, simultaneously increasing hydraulic capacity of crossing structures -Slow stormwaters upslope and upstream to increase infiltration and reduce quantity of flood flows
	Less snowpack and more precipitation falling as rain means more runoff quicker, resulting in less infiltration to groundwater tables and reduced base flows	-Slow stormwaters upslope and upstream to increase infiltration, install stormwater BMP's -Keep development out of floodplain areas to reduce negative interactions with water table

Potential Project Partners

Allegheny National Forest
United States Department of Agriculture
Forest Supervisor's Office
4 Farm Colony Drive
Warren, PA 16701
814-728-6100

Bradford Ranger District
29 Forest Service Drive
Bradford, PA 16701

Marienville Ranger District
131 Smokey Lane
Marienville, PA 16239
https://www.fs.usda.gov/main/allegheny/home

Allegheny WINs Coalition
Coordinated by Allegheny National Forest Fisheries Biologist Nathan Welker
4 Farm Colony Drive
Warren, PA 16701
814-728-6163
nwelker@fs.fed.us

American Rivers
Mid-Atlantic – Pittsburgh Office
150 Lloyd Ave
Pittsburgh, PA 15218
412-727-6130
https://www.americanrivers.org/

The Collins Companies
P.O. Box 807
95 Hardwood Drive
Kane, PA 16735
814-837-0121
www.CollinsWood.com

Cornplanter Chapter #526 of Trout Unlimited
79 Buena Vista Blvd.
Warren, PA 16365
814-723-3759
https://www.facebook.com/Cornplanter-Chapter-Of-Trout-Unlimited-149820985132939/

Ducks Unlimited
1383 Arcadia Road, Room 8
Lancaster, PA 17601
717-945-5068
www.ducks.org
jfeaga@ducks.org

Elk County Conservation District
850 Washington Street
Saint Marys, PA 15857
814-776-5373
http://www.co.elk.pa.us/index.php/conservation-district-homepage/item/4-about-elk-county-conservation-district
ECCD@countyofelkpa.com

Friends of Allegheny Wilderness
220 Center Street
Warren, PA 16365
814-723-0620
www.pawild.org
info@pawild.org

Hamilton Township, McKean County
PO Box 23
Ludlow PA 16333
814- 945-9613

Highland Township, Elk County
PO Box 505
James City PA 16734
814-837-8762

James Zwald Chapter #314 of Trout Unlimited
418 Center Street
St. Marys, PA 15857
814-834-3472
https://www.facebook.com/JimZwaldTUChapter/

Jones Township, Elk County
320 Faries Street
PO Box 25
Wilcox, PA 15870
814-929-5138
http://www.jonestownship.com/index.html

Kane Borough
112 Bayard Street
Kane, PA 16735
814-837-9240
http://kaneboro.org/

McKean County Conservation District
17137 Route 6
Smethport, PA 16749
814-887-4001
conservation@mckeancountypa.org
http://www.mckeanconservation.com/

National Wild Turkey Federation
Kinzua Valley Chapter
Mount Jewett, PA
Kinzua Allegheny Longbeards Chapter
Sheffield, PA
Contact Skip Motts for either Chapter
570-460-1495
www.nwtf.org
smotts@nwtf.net

North Atlantic Aquatic Connectivity Collaborative
https://streamcontinuity.org/
contact@streamcontinuity.org

Pennsylvania Department of Environmental Protection
Northwest Regional Office
230 Chestnut Street
Meadville, PA 16335-3481
Phone: 814-332-6945
Emergencies: 1-800-373-3398
http://www.dep.pa.gov/Business/Water/Pages/default.aspx

Pennsylvania Fish and Boat Commission
North Central Region Office
595 East Rolling Ridge Drive
Bellefonte, PA 16823
814-359-5250

Northwest Region Office
11528 State Highway 98
Meadville, PA 16335
814-337-0444

Habitat Management Division
450 Robinson Lane
Pleasant Gap, PA 16823
814-359-5100
http://www.fishandboat.com/Pages/default.aspx

Pennsylvania Department of Transportation
PennDOT Engineering District 1-0
255 Elm Street, P.O. Box 398
Oil City, PA 16301
814-678-7085

PennDOT Engineering District 2
70 PennDOT Drive
Clearfield PA 16830
814-765-0400
http://www.penndot.gov/Pages/default.aspx

Seneca Chapter #272 of Trout Unlimited
242 Sartwell Creek Road
Port Allegany, PA 16743
814-598-3449
https://www.facebook.com/SenecaTroutUnlimited/

RuffedGrouse Society
Allegheny Chapter
1016 Long Level Road
Johnsonburg, PA 15845-2402
www.ruffedgrousesociety.org
wlhab@windstream.net

Sheffield Township, Warren County
PO Box 784
Sheffield PA 16347
814-968-3906

Warren County Conservation District
4000 Conewango Ave
Warren, PA 16365
814-726-1441
http://www.wcconservation.net/

Western Pennsylvania Conservancy
Allegheny Regional Office
159 Main Street
Ridgway, PA 15853
814-776-1114
alleghenyproject@paconserve.org
www.waterlandlife.org

Wetmore Township, McKean County
318 Spring Street
Kane PA 16735
814-837-7490

Potential Funding Sources

Colcom Foundation

http://colcomfdn.org/

Coldwater Heritage Partnership

http://www.coldwaterheritage.org/

Commonwealth Financing Authority

http://dced.pa.gov/programs-funding/commonwealth-financing-authority-cfa/#.WGu8Bdjrvcu

Community Foundation of Warren County

http://communityfoundationofwarrencounty.org/grantseekers

Eastern Brook Trout Joint Venture

http://easternbrooktrout.org/

Eastern National Forest Interpretive Association

http://www.enfiamich.org/home.aspx

Foundation for Pennsylvania Watersheds

http://pennsylvaniawatersheds.org/apply-for-a-grant/

National Forest Foundation

https://www.nationalforests.org/grant-programs

North Central Greenways

http://www.ncentralgreenways.com/

Northwest Greenways

http://www.northwestpa.org/greenways-block-grant-program/

Ohio River Basin Fish Habitat Partnership

http://www.fishhabitat.org/the-partnerships/ohio-river-basin-fish-habitat-partnership

PA Department of Conservation and Natural Resources

http://www.dcnr.state.pa.us/brc/grants/

PA Department of Environmental Protection: Growing Greener

http://www.dep.pa.gov/Citizens/GrantsLoansRebates/Growing-Greener/Pages/default.aspx

PA Fish and Boat Commission- Cooperative Habitat Improvement Program

http://www.fishandboat.com/Resource/Habitat/Documents/CHIP-GuidelinesApplication.pdf

Patagonia

http://www.patagonia.com/environmental-grants-and-support.html

Richard King Mellon Foundation

http://fdnweb.org/rkmf/

Seneca Natural Resources Corporation

http://www.natfuel.com/seneca/contact_us.aspx

Shell Foundation

http://www.shellfoundation.org/

Stackpole-Hall Foundation

http://www.stackpolehall.org/

US Department of Agriculture: Natural Resources Conservation Service

https://www.nrcs.usda.gov/wps/portal/nrcs/detail/national/programs/?cid=stelprdb1048817

US Fish and Wildlife Service Fish Passage Program

https://www.fws.gov/fisheries/whatwedo/nfpp/nfpp_faqs.html

List of Resources for BMPs relating to Watershed Conservation

North Atlantic Aquatic Connectivity Collaborative

https://streamcontinuity.org/

Pennsylvania Center for Dirt and Gravel Roads

http://www.dirtandgravel.psu.edu/

PA Department of Environmental Protection

http://www.dep.pa.gov/Business/Water/Waterways/Pages/default.aspx

PA Fish and Boat Commission

http://www.fishandboat.com/Pages/default.aspx

PA State Conservation Commission

http://www.agriculture.pa.gov/PROTECT/STATECONSERVATIONCOMMISSION/Pages/default.aspx

Penn State Extension Service

http://extension.psu.edu/natural-resources/water

Stroud Water Research Center

http://www.stroudcenter.org/

US Department of Agriculture: Natural Resource Conservation Service Field Office Technical Guide (FOTG)

https://efotg.sc.egov.usda.gov/

US Forest Service: Guidance for Stream Restoration and Rehabilitation

https://www.fs.fed.us/biology/nsaec/assets/yochumusfs-nsaec-tn102-2gudncstrmrstrtnrhbltn.pdf

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Appendix 1:

Data Tables

Table 1. Land Cover Types		
Cover Type	**Acres**	**Percent of Watershed**
Developed, Open Space	694	3.08%
Developed, Low Intensity	196	0.87%
Developed, Medium Intensity	60	0.27%
Developed, High Intensity	9	0.04%
Barren Land	67	0.30%
Deciduous Forest	12664	56.16%
Evergreen Forest	1035	4.59%
Mixed Forest	4729	20.97%
Shrub/Scrub	973	4.32%
Grasslands/Herbaceous	197	0.87%
Pasture/Hay	1049	4.65%
Cultivated Crops	366	1.62%
Woody Wetlands	505	2.24%
Emergent Herbaceous Wetlands	4	0.02%
Total	**22548**	**100.00%**

Table 2. Habitat Scores														
GIS_ID	NAME	Segment Length (Feet)	Segment Length (Miles)	Epifa. Subs.	Embed.	Velo. Depth	Sed. Dep.	Chan. FlowSta	Chan. Alt.	Freq. Rif.	Bank Stab.	Veg. Pro.	Rip. Veg.	TotalScore
5806	Trib 55326 To East Branch Tionesta Creek	5750	1.09	19	17	18	14	14	16	18	18	18	17	**16.9**
5815	East Branch Tionesta Creek	2981	0.56	17	14	18	12	13	19	18	16	17	16	**16.0**
5816	Trib 55325 To East Branch Tionesta Creek	4425	0.84	17	13	16	16	15	13	18	18	18	11	**15.5**
5823	Trib 55327 To East Branch Tionesta Creek	3656	0.69	16	15	17	10	10	13	17	15	18	14	**14.5**
5824	East Branch Tionesta Creek	1706	0.32	13	17	16	17	18	15	18	17	18	18	**16.7**
5843	East Branch Tionesta Creek	1785	0.34	14	17	16	15	13	19	16	16	16	17	**15.9**
5844	Trib 55324 To East Branch Tionesta Creek	4255	0.81	18	18	14	15	8	18	18	17	18	18	**16.2**
5853	Trib 55328 To East Branch Tionesta Creek	3069	0.58	12	5	7	3	4	17	6	14	18	18	**10.4**
5854	East Branch Tionesta Creek	2635	0.50	16	18	17	16	16	20	17	18	17	19	**17.4**
5868	East Branch Tionesta Creek	1896	0.36	17	16	17	18	14	17	17	16	18	17	**16.7**
5869	Trib 55323 To East Branch Tionesta Creek	3490	0.66	17	14	12	9	8	11	18	17	18	13	**13.7**
5877	East Branch Tionesta Creek	1706	0.32	17	16	16	15	16	19	17	17	15	20	**16.8**
5881	Bloody Run	5363	1.02	16	15	19	9	10	14	17	9	15	10	**13.4**

5884	East Branch Tionesta Creek	1169	0.22	16	16	19	8	16	19	19	14	18	20	**16.5**
5889	Trib 55332 To East Branch Tionesta Creek	4447	0.84	15	17	17	16	13	20	18	18	20	20	**17.4**
5890	Trib 55333 Of East Branch Tionesta Creek	2237	0.42	7	11	8	16	6	19	15	17	20	20	**13.9**
5901	Trib 55331 To East Branch Tionesta Creek	3713	0.70	17	18	10	19	13	20	17	18	18	20	**17.0**
5902	East Branch Tionesta Creek	2134	0.40	17	18	17	15	17	15	19	14	18	16	**16.6**
5904	East Branch Tionesta Creek	2356	0.45	18	16	16	15	14	19	16	17	17	19	**16.7**
5905	Trib 55322 To East Branch Tionesta Creek	4806	0.91	16	17	16	14	7	14	18	18	20	18	**15.8**
5919	East Branch Tionesta Creek	736	0.14	14	16	10	17	11	20	15	19	19	20	**16.1**
5924	Trib 55332 To East Branch Tionesta Creek	2717	0.51	16	17	16	16	12	20	18	19	20	20	**17.4**
5925	East Branch Tionesta Creek	2665	0.50	17	16	19	16	18	20	18	14	18	20	**17.6**
5932	East Branch Tionesta Creek	3677	0.70	18	17	17	18	14	18	17	18	18	17	**17.2**
5933	Trib 55319 To East Branch Tionesta Creek	5162	0.98	19	18	20	19	20	20	19	20	20	17	**19.2**
5938	East Branch Tionesta Creek	1103	0.21	18	19	19	15	19	20	19	20	18	20	**18.7**
5939	Trib 55318 To East Branch Tionesta Creek	3162	0.60	19	20	19	20	19	20	20	20	20	20	**19.7**
5940	East Branch Tionesta Creek	150	0.03	15	16	16	17	14	20	17	20	20	20	**17.5**

5943	East Branch Tionesta Creek	1897	0.36	11	15	17	16	16	14	12	12	14	20	**14.7**
5947	Thomas Run	6099	1.16	19	16	17	14	13	19	18	18	18	20	**17.2**
5948	Pigeon Run	4364	0.83	18	18	17	15	15	18	19	18	20	19	**17.7**
5949	Trib 55321 To Pigeon Run	2434	0.46	16	13	13	15	17	20	17	19	20	20	**17.0**
5963	East Branch Tionesta Creek	2653	0.50	15	16	17	18	13	18	16	16	20	17	**16.6**
5964	Trib 55317 To East Branch Tionesta Creek	3788	0.72	12	11	12	9	9	16	16	18	18	16	**13.7**
5965	Trib 55350 Of West Run	2073	0.39	13	10	16	15	15	14	11	16	18	18	**14.6**
5966	Trib 55349 To West Run	5194	0.98	7	11	16	11	13	15	10	16	16	16	**13.1**
5967	Trib 55342 Of Rock Run	2609	0.49	17	15	17	16	15	19	18	18	18	19	**17.2**
5970	East Branch Tionesta Creek	1988	0.38	13	15	16	16	16	19	14	19	18	20	**16.6**
5971	East Branch Tionesta Creek	860	0.16	18	17	18	16	17	20	18	19	20	19	**18.2**
5972	Trib 55315 To East Branch Tionesta Creek	3677	0.70	13	16	10	19	17	16	18	20	20	20	**16.9**
5973	Trib 55341 To Rock Run	1667	0.32	17	16	16	16	17	20	19	19	19	20	**17.9**
5974	Rock Run	3279	0.62	Unassessed										**0.0**
5978	Trib 55314 To East Branch Tionesta Creek	4370	0.83	17	17	18	17	17	19	19	20	20	17	**18.1**
5979	East Branch Tionesta Creek	562	0.11	18	17	18	16	17	20	18	19	20	19	**18.2**
5980	Trib 55341 To Rock Run	3983	0.75	16	16	16	14	17	20	18	18	18	20	**17.3**
5982	Pigeon Run	2428	0.46	18	16	17	16	15	16	18	17	17	15	**16.5**

5984	Trib 55329 To East Branch Tionesta Creek	7251	1.37	18	16	18	13	13	16	18	18	18	15	**16.3**
5985	East Branch Tionesta Creek	1999	0.38	16	17	16	17	14	19	18	14	17	20	**16.8**
5991	Trib 55336 To East Branch Tionesta Creek	2048	0.39	15	20	8	19	9	18	17	18	20	19	**16.3**
5992	Trib 55336 To East Branch Tionesta Creek	511	0.10	17	14	15	15	16	18	17	16	16	18	**16.2**
5999	Trib 55337 Of East Branch Tionesta Creek	2099	0.40	Dry										**0.0**
6002	East Branch Tionesta Creek	1701	0.32	16	17	16	18	15	20	16	17	18	20	**17.3**
6006	Trib 55316 To East Branch Tionesta Creek	5219	0.99	16	13	13	11	10	15	16	20	18	17	**14.9**
6033	Trib 55340 To Rock Run	5679	1.08	15	14	18	14	15	14	18	14	16	14	**15.2**
6034	Rock Run	6925	1.31	15	11	17	13	14	15	17	16	18	20	**15.6**
6035	Trib 55335 To East Branch Tionesta Creek	3977	0.75	19	16	16	15	15	15	19	18	18	19	**17.0**
6040	East Branch Tionesta Creek	5731	1.09	17	15	17	15	16	15	18	15	18	18	**16.4**
6041	Trib 55312 To East Branch Tionesta Creek	3424	0.65	12	10	12	11	15	10	16	16	16	14	**13.2**
6043	Rock Run	1012	0.19	15	11	17	15	19	16	16	18	18	16	**16.1**
6045	Rock Run	573	0.11	14	11	16	15	19	14	17	16	19	15	**15.6**
6046	East Branch Tionesta Creek	9724	1.84	15	16	18	16	14	13	17	11	14	17	**15.1**
6048	Trib 55339 To Rock Run	1928	0.37	Dry										**0.0**

6049	East Branch Tionesta Creek	2712	0.51	17	14	18	13	19	15	19	17	16	14	**16.2**
6052	Trib 55313 To East Branch Tionesta Creek	5467	1.04	19	17	18	18	17	14	16	18	18	17	**17.2**
6057	East Branch Tionesta Creek	1544	0.29	15	17	17	16	17	19	18	13	15	20	**16.7**
6064	East Branch Tionesta Creek	1904	0.36	14	15	16	15	17	20	14	15	14	18	**15.8**
6066	Trib 55343 To East Branch Tionesta Creek	1319	0.25	2	10	10	5	15	15	11	20	20	17	**12.5**
6078	Trib 55353 To West Run	3702	0.70	9	10	16	10	15	16	15	14	16	16	**13.7**
6079	Trib 55352 To West Run	5262	1.00	6	12	16	8	11	10	12	12	12	6	**10.5**
6080	West Run	940	0.18	8	8	16	12	15	20	9	10	5	20	**12.3**
6089	Trib 55344 To East Branch Tionesta Creek	1390	0.26	Dry										**0.0**
6090	Trib 55356 To West Run	2118	0.40	6	10	13	8	17	6	7	16	18	6	**10.7**
6092	West Run	502	0.10	10	6	13	11	16	20	9	14	16	20	**13.5**
6093	Trib 55357 To West Run	1880	0.36	Unassessed										**0.0**
6094	West Run	780	0.15	10	6	13	11	16	20	9	14	16	20	**13.5**
6095	West Run	2157	0.41	14	16	18	16	15	15	14	18	13	13	**15.2**
6099	West Run	2663	0.50	10	13	16	7	8	10	15	14	16	14	**12.3**
6100	West Run	2292	0.43	Unassessed										**0.0**
6105	Trib 55349 To West Run	9626	1.82	15	15	17	16	15	13	16	16	18	16	**15.7**
6109	West Run	347	0.07	10	8	16	12	14	17	10	12	18	15	**13.2**
6110	Trib 55348 To West Run	5119	0.97	14	14	16	16	14	12	18	18	16	14	**15.2**
6114	West Run	2372	0.45	11	14	16	14	14	11	15	11	16	13	**13.5**

6115	West Run	3816	0.72	14	10	17	16	15	13	16	11	18	18	**14.8**
6119	Trib 55351 To West Run	3282	0.62	Unassessed										**0.0**
6123	Trib 55355 To West Run	1894	0.36	Dry										**0.0**
6125	East Branch Tionesta Creek	6379	1.21	16	16	17	17	16	18	17	14	12	18	**16.1**
6138	Trib 55354 To West Run	2606	0.49	6	8	16	9	13	16	15	11	16	18	**12.8**
6141	West Run	4272	0.81	14	13	16	15	15	11	15	14	14	13	**14.0**
6142	Trib 55347 To West Run	7156	1.36	16	11	16	10	8	10	13	16	18	18	**13.6**
6143	West Run	261	0.05	17	14	17	14	13	15	17	16	16	20	**15.9**
6145	East Branch Tionesta Creek	4164	0.79	17	13	17	13	11	20	16	14	14	20	**15.5**
6164	Trib 55345 To East Branch Tionesta Creek	3881	0.74	15	14	16	14	15	15	18	16	18	18	**15.9**
6175	Trib 55364 Of East Branch Tionesta Creek	1644	0.31	16	16	16	12	13	15	15	18	18	18	**15.7**
6176	Trib 55363 To East Branch Tionesta Creek	2300	0.44	Dry										**0.0**
6179	Trib 55360 To East Branch Tionesta Creek	3731	0.71	12	11	16	10	14	8	13	16	14	8	**12.2**
6180	Trib 55362 Of East Branch Tionesta Creek	2581	0.49	15	17	15	12	8	20	17	12	14	18	**14.8**
6184	Trib 55359 To East Branch Tionesta Creek	5885	1.11	18	13	17	13	16	18	19	17	17	18	**16.6**
6202	Trib 55360 To East Branch Tionesta Creek	4504	0.85	16	18	18	15	17	15	17	18	18	17	**16.9**

6203	Trib 55361 Of East Branch Tionesta Creek	3249	0.62	15	17	16	14	15	15	18	11	16	16	**15.3**
6229	Trib 55360 To East Branch Tionesta Creek	2596	0.49	15	14	16	14	14	14	16	17	17	19	**15.6**
6230	Trib 55363 To East Branch Tionesta Creek	6486	1.23	15	13	16	10	14	15	17	15	15	16	**14.6**
6231	East Branch Tionesta Creek	2273	0.43	13	13	16	15	16	11	15	11	16	16	**14.2**
6234	East Branch Tionesta Creek	7975	1.51	14	17	16	14	18	13	17	16	18	18	**16.1**
6281	East Branch Tionesta Creek	4248	0.80	15	15	15	14	15	16	17	12	13	11	**14.3**
7200	East Branch Tionesta Creek	3072	0.58	14	15	18	10	14	16	18	17	17	20	**15.9**
7201	East Branch Tionesta Creek	2982	0.56	16	17	16	15	15	13	14	15	15	11	**14.7**
7202	Trib 55358 To East Branch Tionesta Creek	4292	0.81	15	16	13	17	15	16	19	18	18	18	**16.5**
Total		**346302**	**66**											
Mean		**3236**	**0.6**	**14.7**	**14.5**	**15.8**	**14.1**	**14.3**	**16.2**	**16.2**	**16.1**	**17.2**	**17.1**	**15.6**
Maximum		**9724**	**1.84**	**19.0**	**20.0**	**20.0**	**20.0**	**20.0**	**20.0**	**20.0**	**20.0**	**20.0**	**20.0**	**19.7**
Minimum		**150**	**0.03**	**2.0**	**5.0**	**7.0**	**3.0**	**4.0**	**6.0**	**6.0**	**9.0**	**5.0**	**6.0**	**10.4**
Median		**2712**	**0.51**	**15.0**	**15.0**	**16.0**	**15.0**	**15.0**	**16.0**	**17.0**	**16.5**	**18.0**	**18.0**	**16.0**

**Mean, Max., Min., and Median habitat parameter scores in the last rows do not include Dry or Unassessed segment scores in their analysis.*

Table 4. Water Quality

GIS_ID	NAME	Segment Length (Feet)	Segment Length (Miles)	pH ToR	pH BoR	Δ pH From ToR to BoR	Spec. Cond. ToR (µs)	Spec. Cond. BoR (µs)	Δ S.C. From ToR to BoR	Temp. ToR (C)	Temp. BoR (C)	Δ T From ToR to BoR
5806	Trib 55326 To East Branch Tionesta Creek	5750	1.09	5.06	6.75	1.69	29	54.6	25.6	11.2	16.9	5.7
5815	East Branch Tionesta Creek	2981	0.56	7.85	7.07	-0.78	103	102.6	-0.4	21	20.2	-0.8
5816	Trib 55325 To East Branch Tionesta Creek	4425	0.84	5.47	6.59	1.12	28.3	38.7	10.4	16.9	17.1	0.2
5823	Trib 55327 To East Branch Tionesta Creek	3656	0.69	7.45	7.76	0.31	31.1	55.4	24.3	15.1	17.7	2.6
5824	East Branch Tionesta Creek	1706	0.32	7.94	7.74	-0.2	100.4	100.8	0.4	21.6	21.3	-0.3
5843	East Branch Tionesta Creek	1785	0.34	6.62	7.49	0.87	64	100.8	36.8	18.3	20.6	2.3
5844	Trib 55324 To East Branch Tionesta Creek	4255	0.81	4.86	6.38	1.52	28.7	52.9	24.2	16.2	16.4	0.2
5853	Trib 55328 To East Branch Tionesta Creek	3069	0.58	5.95	7.7	1.75	32	38.3	6.3	11.9	15.8	3.9
5854	East Branch Tionesta Creek	2635	0.50	8.05	8.11	0.06	103.9	103.2	-0.7	21.4	21	-0.4
5868	East Branch Tionesta Creek	1896	0.36	7.54	8	0.46	158.4	160.2	1.8	18.7	17.4	-1.3
5869	Trib 55323 To East Branch Tionesta Creek	3490	0.66	5.16	7.57	2.41	29.5	61.8	32.3	15.1	15.7	0.6
5877	East Branch Tionesta Creek	1706	0.32	7.85	8.14	0.29	108.2	103.7	-4.5	20.5	21.2	0.7
5881	Bloody Run	5363	1.02	6.6	7.3	0.7	86.6	73.3	-13.3	16	17.4	1.4
5884	East Branch Tionesta Creek	1169	0.22	7.96	8.41	0.45	93.7	93.6	-0.1	15.3	15	-0.3
5889	Trib 55332 To East Branch Tionesta Creek	4447	0.84	6.81	7.58	0.77	66.5	50	-16.5	16	13.9	-2.1
5890	Trib 55333 Of East Branch Tionesta Creek	2237	0.42	6.98	6.39	-0.59	39.5	37.4	-2.1	15.8	15.3	-0.5
5901	Trib 55331 To East Branch Tionesta Creek	3713	0.70	7.68	7.79	0.11	66.8	58.7	-8.1	9.2	13.5	4.3

5902	East Branch Tionesta Creek	2134	0.40	7.92	7.95	0.03	94.8	94.9	0.1	16.3	15.7	-0.6
5904	East Branch Tionesta Creek	2356	0.45	7.87	7.91	0.04	160.5	160.1	-0.4	19.7	19.1	-0.6
5905	Trib 55322 To East Branch Tionesta Creek	4806	0.91	7.75	7.13	-0.62	21.6	31.2	9.6	12.4	12.7	0.3
5919	East Branch Tionesta Creek	736	0.14	7.61	8.11	0.5	111.7	150	38.3	14.4	13.8	-0.6
5924	Trib 55332 To East Branch Tionesta Creek	2717	0.51	6.93	7.4	0.47	44.1	50.3	6.2	16	13.9	-2.1
5925	East Branch Tionesta Creek	2665	0.50	8.01	7.85	-0.16	95.6	94.4	-1.2	18.6	17.5	-1.1
5932	East Branch Tionesta Creek	3677	0.70	8.23	8.11	-0.12	147.8	142.5	-5.3	13.9	14.4	0.5
5933	Trib 55319 To East Branch Tionesta Creek	5162	0.98	5.6	7.43	1.83	31.4	41.9	10.5	9.4	11.3	1.9
5939	Trib 55318 To East Branch Tionesta Creek	3162	0.60	6.09	5.86	-0.23	27.4	25.2	-2.2	12	12.2	0.2
5940	East Branch Tionesta Creek	150	0.03	8.03	7.62	-0.41	145.3	144.9	-0.4	12	11.9	-0.1
5943	East Branch Tionesta Creek	1897	0.36	7.64	8.07	0.43	97.2	92	-5.2	16.1	19.1	3
5947	Thomas Run	6099	1.16	6.05	7.01	0.96	29.1	35.3	6.2	8.6	12.7	4.1
5948	Pigeon Run	4364	0.83	8.88	8.71	-0.17	37.1	31.3	-5.8	11.7	13.3	1.6
5949	Trib 55321 To Pigeon Run	2434	0.46	6.01	8.12	2.11	29.3	27.5	-1.8	8.1	12.7	4.6
5963	East Branch Tionesta Creek	2653	0.50	7.79	8.18	0.39	132.3	142.2	9.9	11.9	12.3	0.4
5964	Trib 55317 To East Branch Tionesta Creek	3788	0.72	6.35	7.57	1.22	29.1	42.1	13	12	11.5	-0.5
5965	Trib 55350 Of West Run	2073	0.39	7.41	6.68	-0.73	88.7	173	84.3	18	25.1	7.1
5966	Trib 55349 To West Run	5194	0.98	7.34	6.75	-0.59	301	102.8	-198.2	18.8	22.1	3.3
5967	Trib 55342 Of Rock Run	2609	0.49	5.17	5.07	-0.1	22.7	22.4	-0.3	15.7	14.8	-0.9

5970	East Branch Tionesta Creek	1988	0.38	7.97	7.74	-0.23	98.7	90.8	-7.9	17.9	16	-1.9
5971	East Branch Tionesta Creek	860	0.16	7.71	7.39	-0.32	66.8	66.2	-0.6	10.1	10.1	0
5972	Trib 55315 To East Branch Tionesta Creek	3677	0.70	6.35	7.19	0.84	34.2	49	14.8	9.5	10.5	1
5973	Trib 55341 To Rock Run	1667	0.32	5.08	5.08	0	25.7	24.2	-1.5	14	13.7	-0.3
5978	Trib 55314 To East Branch Tionesta Creek	4370	0.83	5.5	7.03	1.53	26.5	42.6	16.1	8.1	8.5	0.4
5980	Trib 55341 To Rock Run	3983	0.75	4.8	5.18	0.38	27.9	27.9	0	17.5	14.5	-3
5984	Trib 55329 To East Branch Tionesta Creek	7251	1.37	6.9	7.45	0.55	35.4	31.3	-4.1	13.1	18.8	5.7
5985	East Branch Tionesta Creek	1999	0.38	8.03	7.96	-0.07	124.2	124.4	0.2	19.3	19.5	0.2
5991	Trib 55336 To East Branch Tionesta Creek	2048	0.39	6.1	7.6	1.5	29.3	29.6	0.3	8.6	13.3	4.7
5992	Trib 55336 To East Branch Tionesta Creek	511	0.10	7.58	8.28	0.7	29.7	27.8	-1.9	13.4	17.9	4.5
6002	East Branch Tionesta Creek	1701	0.32	7.12	7.35	0.23	42.4	71.3	28.9	8.5	8.9	0.4
6006	Trib 55316 To East Branch Tionesta Creek	5219	0.99	7.04	7.56	0.52	44.1	61.2	17.1	10.7	12.1	1.4
6034	Rock Run	6925	1.31	5.04	6.58	1.54	24	25.9	1.9	14	16.4	2.4
6035	Trib 55335 To East Branch Tionesta Creek	3977	0.75	6.8	7.77	0.97	32.8	45.8	13	14	15.3	1.3
6040	East Branch Tionesta Creek	5731	1.09	7.84	7.28	-0.56	54.8	64.5	9.7	4	5.1	1.1
6041	Trib 55312 To East Branch Tionesta Creek	3424	0.65	7.3	7.14	-0.16	38.4	38	-0.4	6.7	6.9	0.2
6046	East Branch Tionesta Creek	9724	1.84	7.62	7.59	-0.03	138	129	-9	15.9	18.3	2.4
6049	East Branch Tionesta Creek	2712	0.51	7.2	7.25	0.05	67	65.8	-1.2	5.1	5.3	0.2

6052	Trib 55313 To East Branch Tionesta Creek	5467	1.04	4.61	5.48	0.87	32.6	27.3	-5.3	9.3	8.7	-0.6
6057	East Branch Tionesta Creek	1544	0.29	8.6	8.33	-0.27	127.5	134.7	7.2	22.3	21.3	-1
6064	East Branch Tionesta Creek	1904	0.36	7.5	7.75	0.25	121.8	120.9	-0.9	15.1	15.7	0.6
6066	Trib 55343 To East Branch Tionesta Creek	1319	0.25	6.75	6.5	-0.25	37.2	44.5	7.3	10.5	13.8	3.3
6078	Trib 55353 To West Run	3702	0.70	7.5	7.42	-0.08	279	304	25	18.7	19.2	0.5
6079	Trib 55352 To West Run	5262	1.00	6.91	6.96	0.05	139.4	145.4	6	19.1	19	-0.1
6080	West Run	940	0.18	7.32	7.25	-0.07	388	369	-19	18.1	18.4	0.3
6090	Trib 55356 To West Run	2118	0.40	4.74	6.47	1.73	83	795	712	9.9	10.8	0.9
6092	West Run	502	0.10	8.05	7.66	-0.39	304	256	-48	14.4	22.1	7.7
6094	West Run	780	0.15	6.89	6.92	0.03	256	257	1	22.1	25.6	3.5
6095	West Run	2157	0.41	7.66	7.54	-0.12	233	252	19	19.6	17.5	-2.1
6099	West Run	2663	0.50	7.75	8.05	0.3	282	304	22	14.2	14.4	0.2
6105	Trib 55349 To West Run	9626	1.82	6.77	7.27	0.5	125	132.8	7.8	22.6	15.2	-7.4
6109	West Run	347	0.07	7.13	7.41	0.28	162	196	34	15.1	15	-0.1
6110	Trib 55348 To West Run	5119	0.97	6.06	6.47	0.41	25.9	29.6	3.7	12.2	15.5	3.3
6114	West Run	2372	0.45	7.79	7.96	0.17	158.5	286	127.5	15.9	14.5	-1.4
6115	West Run	3816	0.72	7.29	7.4	0.11	228	233	5	14.8	14.6	-0.2
6125	East Branch Tionesta Creek	6379	1.21	6.84	7.5	0.66	129.7	121.8	-7.9	13.2	15.1	1.9
6138	Trib 55354 To West Run	2606	0.49	6.3	6.73	0.43	58	82.5	24.5	16.1	18.5	2.4
6141	West Run	4272	0.81	7.69	7.15	-0.54	156.5	156.6	0.1	15.6	12.1	-3.5
6142	Trib 55347 To West Run	7156	1.36	5.95	6.8	0.85	24.1	30.6	6.5	9.9	10.1	0.2
6143	West Run	261	0.05	7.16	7.67	0.51	123.9	157.5	33.6	12	12.3	0.3

6145	East Branch Tionesta Creek	4164	0.79	7.8	7.38	-0.42	111.8	123.5	11.7	12.5	13.5	1
6164	Trib 55345 To East Branch Tionesta Creek	3881	0.74	6.18	6.86	0.68	25.8	30.5	4.7	11.8	10.9	-0.9
6175	Trib 55364 Of East Branch Tionesta Creek	1644	0.31	7.34	7.3	-0.04	97.5	93.9	-3.6	19.8	18.8	-1
6180	Trib 55362 Of East Branch Tionesta Creek	2581	0.49	6.97	6.79	-0.18	198.2	77.3	-120.9	7.5	7.9	0.4
6184	Trib 55359 To East Branch Tionesta Creek	5885	1.11	7.67	8.3	0.63	80.5	72	-8.5	4.1	2.1	-2
6202	Trib 55360 To East Branch Tionesta Creek	4504	0.85	7.29	6.75	-0.54	109.5	98.7	-10.8	8.7	8.1	-0.6
6203	Trib 55361 Of East Branch Tionesta Creek	3249	0.62	6.32	6.36	0.04	80	39.3	-40.7	8.8	7.5	-1.3
6229	Trib 55360 To East Branch Tionesta Creek	2596	0.49	7.29	7.03	-0.26	85.8	76.4	-9.4	3.8	5.3	1.5
6230	Trib 55363 To East Branch Tionesta Creek	6486	1.23	7.16	7.01	-0.15	64.6	61.1	-3.5	8.9	8.3	-0.6
6231	East Branch Tionesta Creek	2273	0.43	7.04	7.41	0.37	36.7	53	16.3	8.7	10.4	1.7
6234	East Branch Tionesta Creek	7975	1.51	7.9	6.98	-0.92	68.7	78.9	10.2	3.1	3.2	0.1
6281	East Branch Tionesta Creek	4248	0.80	5.58	6.84	1.26	53.1	36.5	-16.6	9.4	8.7	-0.7
7200	East Branch Tionesta Creek	3072	0.58	8.6	7.99	-0.61	101.9	100.9	-1	1.6	1.7	0.1
7201	East Branch Tionesta Creek	2982	0.56	7.5	7.66	0.16	88.1	99.7	11.6	16.2	12.9	-3.3
7202	Trib 55358 To East Branch Tionesta Creek	4292	0.81	5.65	7.2	1.55	26.2	40.8	14.6	3.1	3.1	0
Mean		**3416.15**	**0.65**	**6.97**	**7.30**	**0.33**	**92.96**	**103.56**	**10.60**	**13.46**	**14.13**	**0.66**
Maximum		**9724.00**	**1.84**	**8.88**	**8.71**	**2.41**	**388.00**	**795.00**	**712.00**	**22.60**	**25.60**	**7.70**
Minimum		**150.00**	**0.03**	**4.61**	**5.07**	**-0.92**	**21.60**	**22.40**	**-198.20**	**1.60**	**1.70**	**-7.40**
Median		**3069.00**	**0.58**	**7.20**	**7.40**	**0.23**	**80.00**	**76.40**	**0.40**	**14.00**	**14.50**	**0.20**
Range		**9574.00**	**1.81**	**4.27**	**3.64**	**3.33**	**366.40**	**772.60**	**910.20**	**21.00**	**23.90**	**15.10**

Segments excluded from Analysis

GIS_ID	NAME	Segment Length (Feet)	Segment Length (Miles)	Reason for exclusion from analysis.
6179	Trib 55360 To East Branch Tionesta Creek	3731	0.71	Technical difficulties with equipment or permission/access issues prevented accurate measurement of these parameters during field investigations.
6119	Trib 55351 To West Run	3282	0.62	Segment Unassessed.
6100	West Run	2292	0.43	Segment Unassessed.
6093	Trib 55357 To West Run	1880	0.36	Stream inaccessible and underground.
6045	Rock Run	573	0.11	Technical difficulties with equipment or permission/access issues prevented accurate measurement of these parameters during field investigations.
6043	Rock Run	1012	0.19	Technical difficulties with equipment or permission/access issues prevented accurate measurement of these parameters during field investigations.
6033	Trib 55340 To Rock Run	5679	1.08	Technical difficulties with equipment or permission/access issues prevented accurate measurement of these parameters during field investigations.
5982	Pigeon Run	2428	0.46	Technical difficulties with equipment or permission/access issues prevented accurate measurement of these parameters during field investigations.
5979	East Branch Tionesta Creek	562	0.11	Included as segment 5971.
5974	Rock Run	3279	0.62	Segment Unassessed.

5938	East Branch Tionesta Creek	1103	0.21	Technical difficulties with equipment or permission/access issues prevented accurate measurement of these parameters during field investigations.
6176	Trib 55363 To East Branch Tionesta Creek	2300	0.44	Dry Segment
6123	Trib 55355 To West Run	1894	0.36	Dry Segment
6089	Trib 55344 To East Branch Tionesta Creek	1390	0.26	Dry Segment
6048	Trib 55339 To Rock Run	1928	0.37	Dry Segment
5999	Trib 55337 Of East Branch Tionesta Creek	2099	0.40	Dry Segment

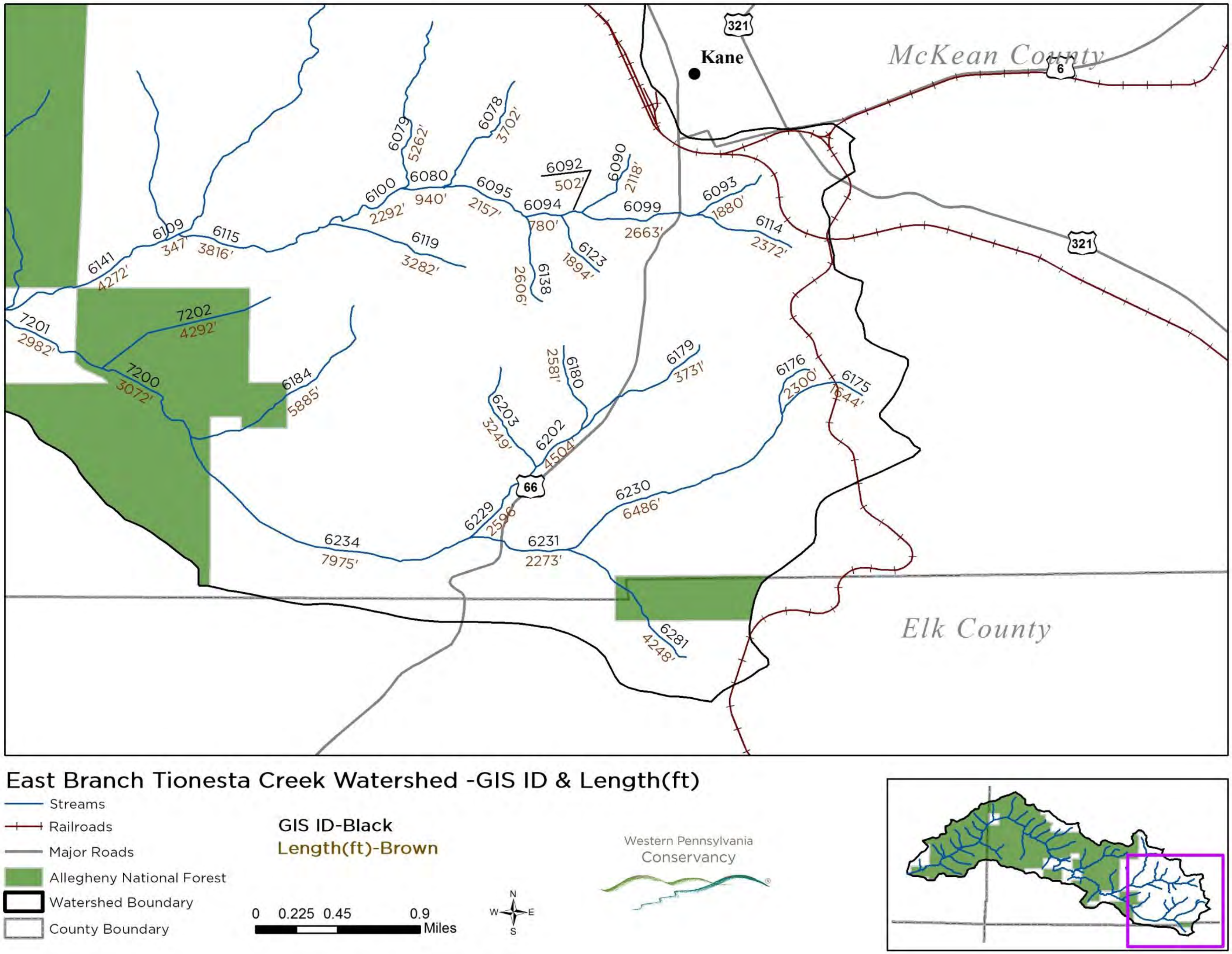
Table 5. Aop Barriers and Locations				
GIS ID	**Name**	**AOP Barrier Type**	**Latitude**	**Longitude**
5806	Trib 55326 To East Branch Tionesta Creek	Culvert lacking substrate	41.71025	-78.93678
5816	Trib 55325 To East Branch Tionesta Creek	Clogged/perched culvert	41.701038	-78.950162
5823	Trib 55327 To East Branch Tionesta Creek	Clogged/perched culvert	41.89852	-78.93383
		Undersized relic pipes	41.70476	-78.92431
		Log Dam (Relic)	41.69835	-78.93404
5844	Trib 55324 To East Branch Tionesta Creek	Boulder plunge pools (multiple)	41.695286	-78.954689
5853	Trib 55328 To East Branch Tionesta Creek	Culvert lacking substrate	41.695209	-78.925322
5869	Trib 55323 To East Branch Tionesta Creek	Perched culvert	41.692719	-78.961957
		Perched culvert	41.696431	-78.964205
5905	Trib 55322 To East Branch Tionesta Creek	Patchy flow near top	41.696967	-78.973877
5964	Trib 55317 To East Branch Tionesta Creek	Stream seasonally connected to EBTC main, potentially due to historic RR/logging practices.	41.67742	-78.97339
5965	Trib 55350 Of West Run	Perched culvert	41.677677	-78.8397
5966	Trib 55349 To West Run	Perched culvert	41.674339	-78.933681
5978	Trib 55314 To East Branch Tionesta Creek	Perched pipes, multiple channels	41.67589	-78.989942
6006	Trib 55316 To East Branch Tionesta Creek	Large boulders in stream near relic log RR	41.6673	-78.97032
6033	Trib 55340 To Rock Run	Breached, relic mill dam has legacy sediment behind it. Stream flows subterranean through wet meadow	41.67532	-78.88369
6034	Rock Run	Perched culverts, high priority to replace	41.67075	-78.8719
6035	Trib 55335 To East Branch Tionesta Creek	Perched culvert, lacking substrate	41.66875	-78.91083
6041	Trib 55312 To East Branch Tionesta Creek	Several undersized culverts, road sinuous near stream	41.664922	-79.002786
6045	Rock Run	Bridge causes constriction	41.661623	-78.89157
6046	East Branch Tionesta Creek	Two relic log dams	N/A	N/A

6049	East Branch Tionesta Creek	Relic bridge abutments	41.659578	-79.012726
6052	Trib 55313 To East Branch Tionesta Creek	Perched culvert	41.666828	-78.987781
6066	Trib 55343 To East Branch Tionesta Creek	Perched culvert	41.657769	-78.891823
6079	Trib 55352 To West Run	Double culverts	41.662524	-78.832884
		Numerous (5+) other culverts for driveways and small private dam	N/A	N/A
6090	Trib 55356 To West Run	Stream mostly subterranean due to urban environment	N/A	N/A
6093	Trib 55357 To West Run	Stream is suspected to be totally subterranean	N/A	N/A
6099	West Run	Undersized box culvert, no substrate inside	41.653305	-78.811121
		Old, partially breached dam	41.653178	-78.811915
6105	Trib 55349 To West Run	Undersized culvert-Dead snapping turtle present. West Kane Road.	41.652681	-78.84975
		Relic log dam	N/A	N/A
		Three undersized culverts-Intersection with Reigel Road.	41.663133	-78.841378
		Private ATV trail culvert (undersized)	N/A	N/A
6110	Trib 55348 To West Run	Undersized Culvert-West Kane Road	41.652075	-78.851699
		Relic log dam	N/A	N/A
6114	West Run	Private gas road	N/A	N/A
		Pennsylvania Avenue Culvert	41.650782	-78.80236
		Underground (culverted) stream section	N/A	N/A
6115	West Run	Large oil tank-perched. Private trail/road.	N/A	N/A
6141	West Run	Bridge lacking floodplain development underneath	41.647377	-78.859017
6142	Trib 55347 To West Run	Undersized culvert	41.659932	-78.863981
		Undersized culvert-FR 473	41.65232	-78.863745
6164	Trib 55345 To East Branch Tionesta Creek	Undersized Culvert-FR 462A	41.64036	-78.881119
6175	Trib 55364 Of East Branch Tionesta Creek	Culvert- Highland Road	41.639575	-78.798299

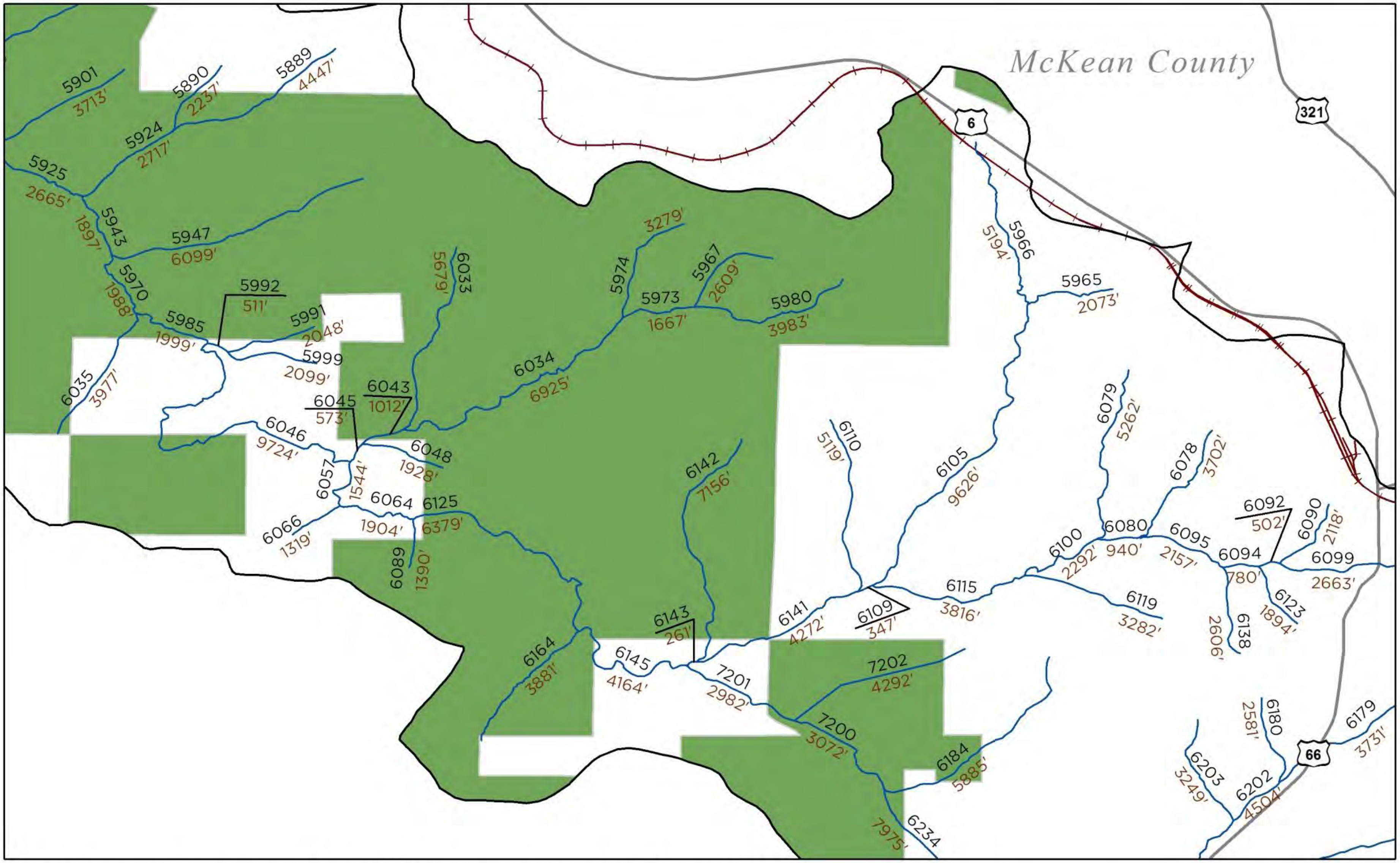
6179	Trib 55360 To East Branch Tionesta Creek	Stream Underground	N/A	N/A
6202	Trib 55360 To East Branch Tionesta Creek	Undersized culvert on main access road	41.635633	-78.819887
6203	Trib 55361 Of East Branch Tionesta Creek	Perched culvert	41.636118	-78.824975
		Three undersized culverts on relic log road	41.639142	-78.826411
6230	Trib 55363 To East Branch Tionesta Creek	Undersized Culvert on West Wind Road	41.634634	-78.804739
6231	East Branch Tionesta Creek	Relic, breached dam upstream of State Route 66	41.626841	-78.822778
		State Route 66 box culvert	41.627335	-78.825173
		Relic, breached dam downstream of State Route 66	41.627924	-78.826347
6234	East Branch Tionesta Creek	Large relic dam, partially breached	41.626335	-78.835001
7200	East Branch Tionesta Creek	JoJo Road Bridge constricts flow	41.63609	-78.85041
7202	Trib 55358 To East Branch Tionesta Creek	Two relic culverts on gasline right of way	41.641159	-78.852304

Appendix 2:

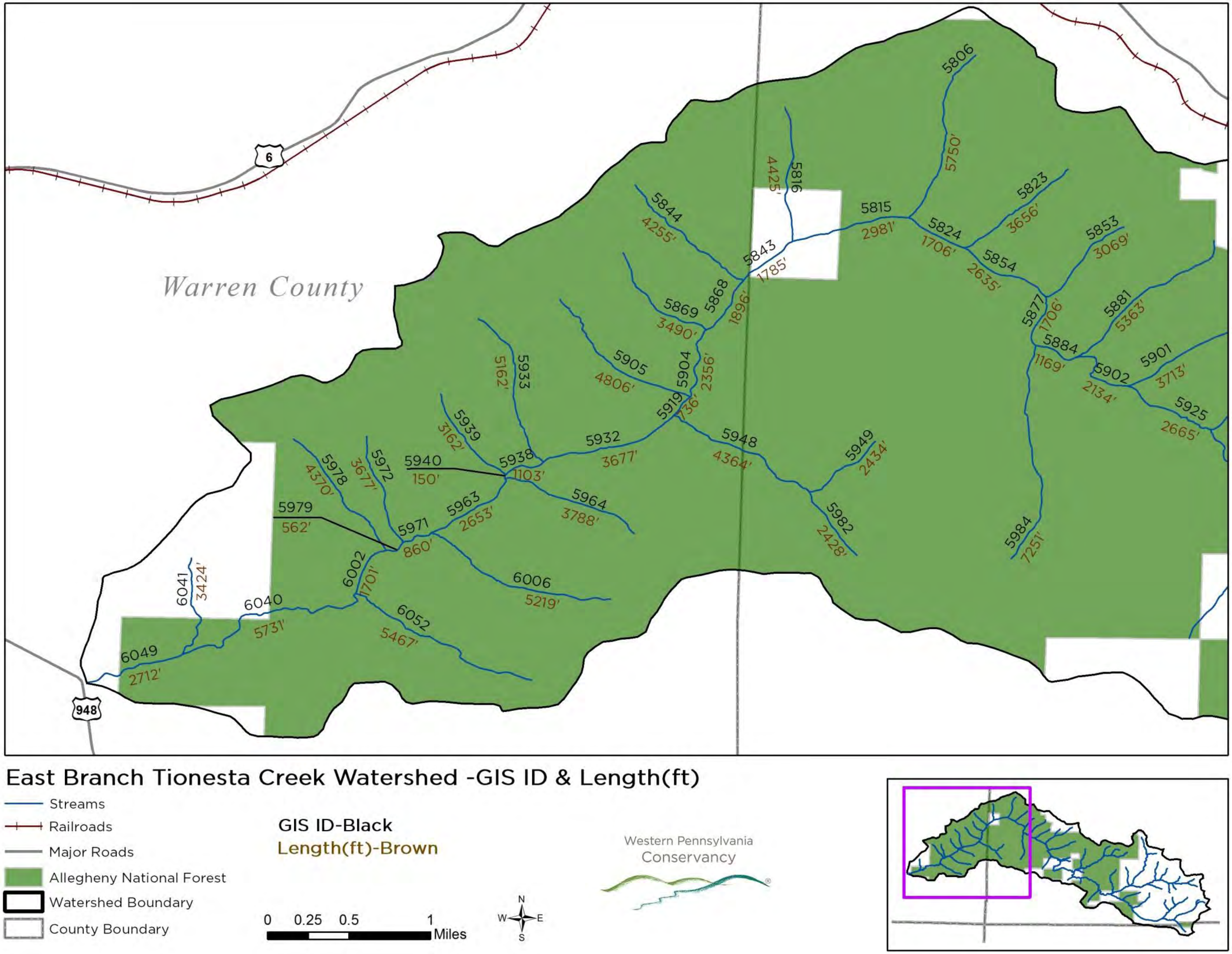
Watershed Maps

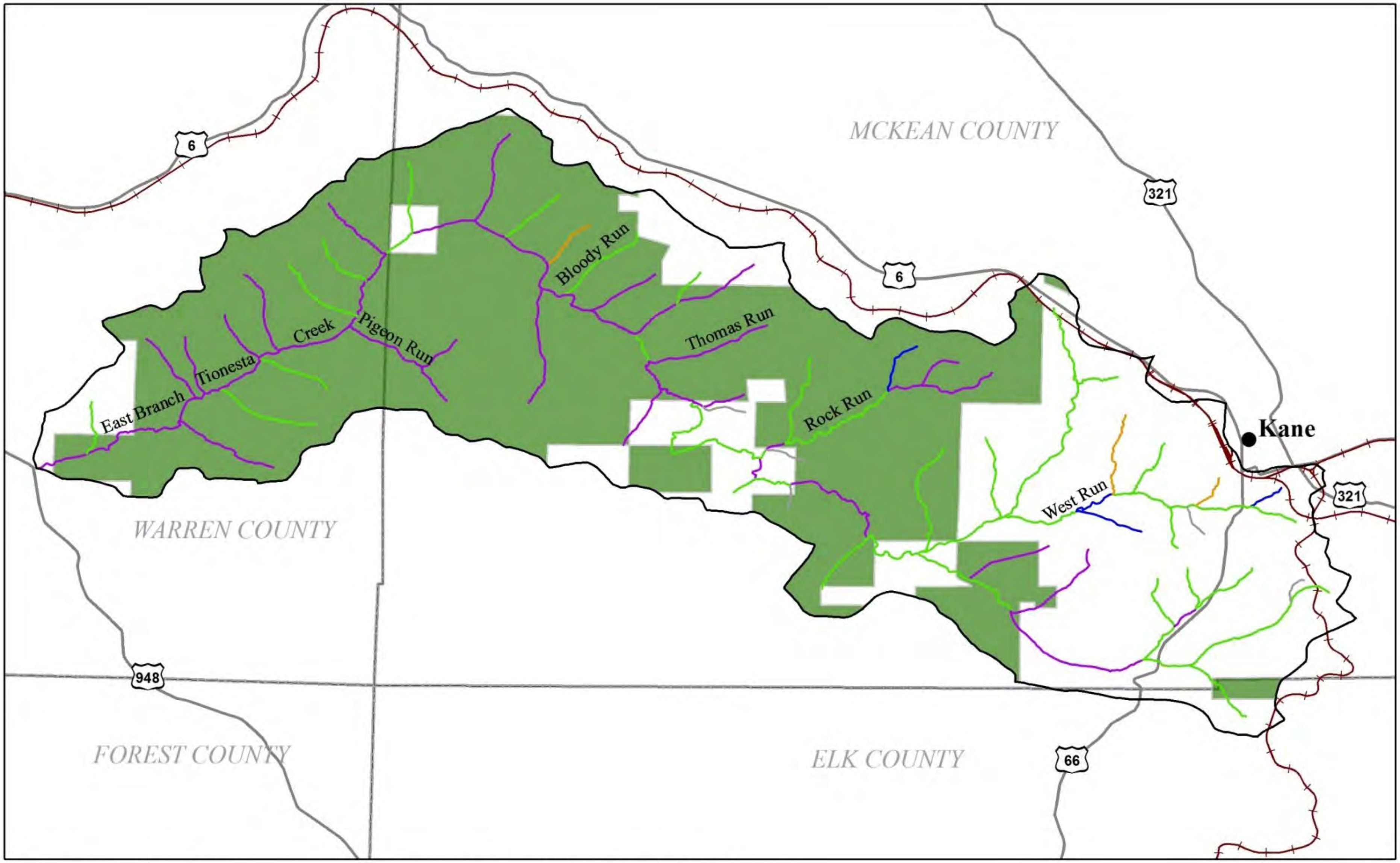


East Branch Tionesta Creek Watershed -GIS ID & Length(ft)



East Branch Tionesta Creek Watershed -GIS ID & Length(ft)


Warren County
6
948
5806
5750'
5816
4425'
5815
2981'
5823
3656'
5824
1706'
5844
4255'
5843
1785'
5853
3069'
5854
2635'
5869
3490'
5868
1896'
5877
1706'
5881
5363'
5884
1169'
5901
3713'
5902
2134'
5925
2665'
5905
4806'
5904
2356'
5919
736'
5933
5162'
5939
3162'
5932
3677'
5948
4364'
5949
2434'
5940
150'
5938
1103'
5978
4370'
5972
3677'
5964
3788'
5982
2428'
5984
7251'
5979
562'
5971
860'
5963
2653'
6006
5219'
6002
1701'
6041
3424'
6040
5731'
6052
5467'
6049
2712'
East Branch Tionesta Creek Watershed -GIS ID & Length(ft)
Streams
Railroads
Major Roads
Allegheny National Forest
Watershed Boundary
County Boundary
GIS ID-Black
Length(ft)-Brown
0 0.25 0.5 1 Miles
N
W
E
S
Western Pennsylvania
Conservancy



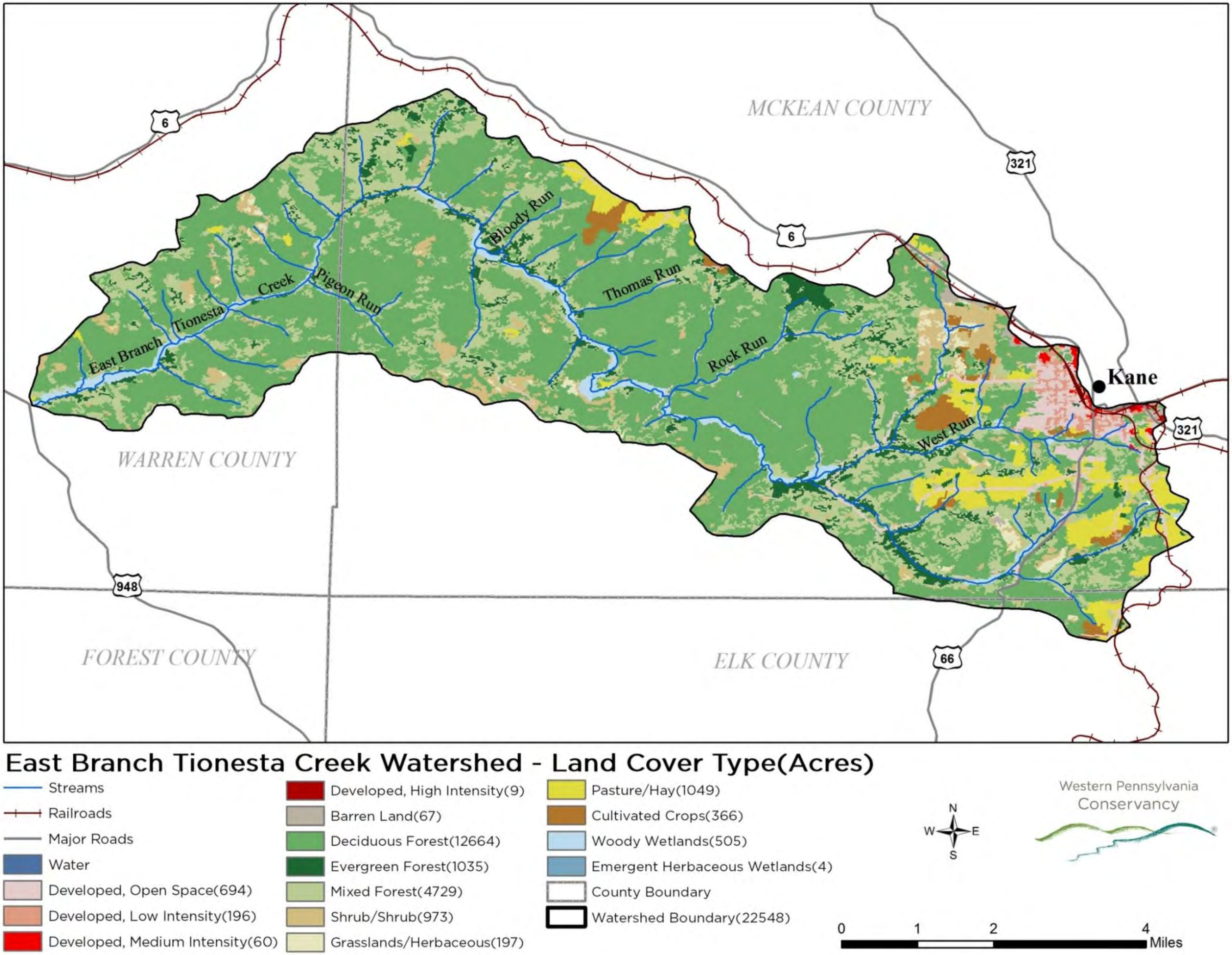
East Branch Tionesta Creek Watershed - Total Habitat Scores

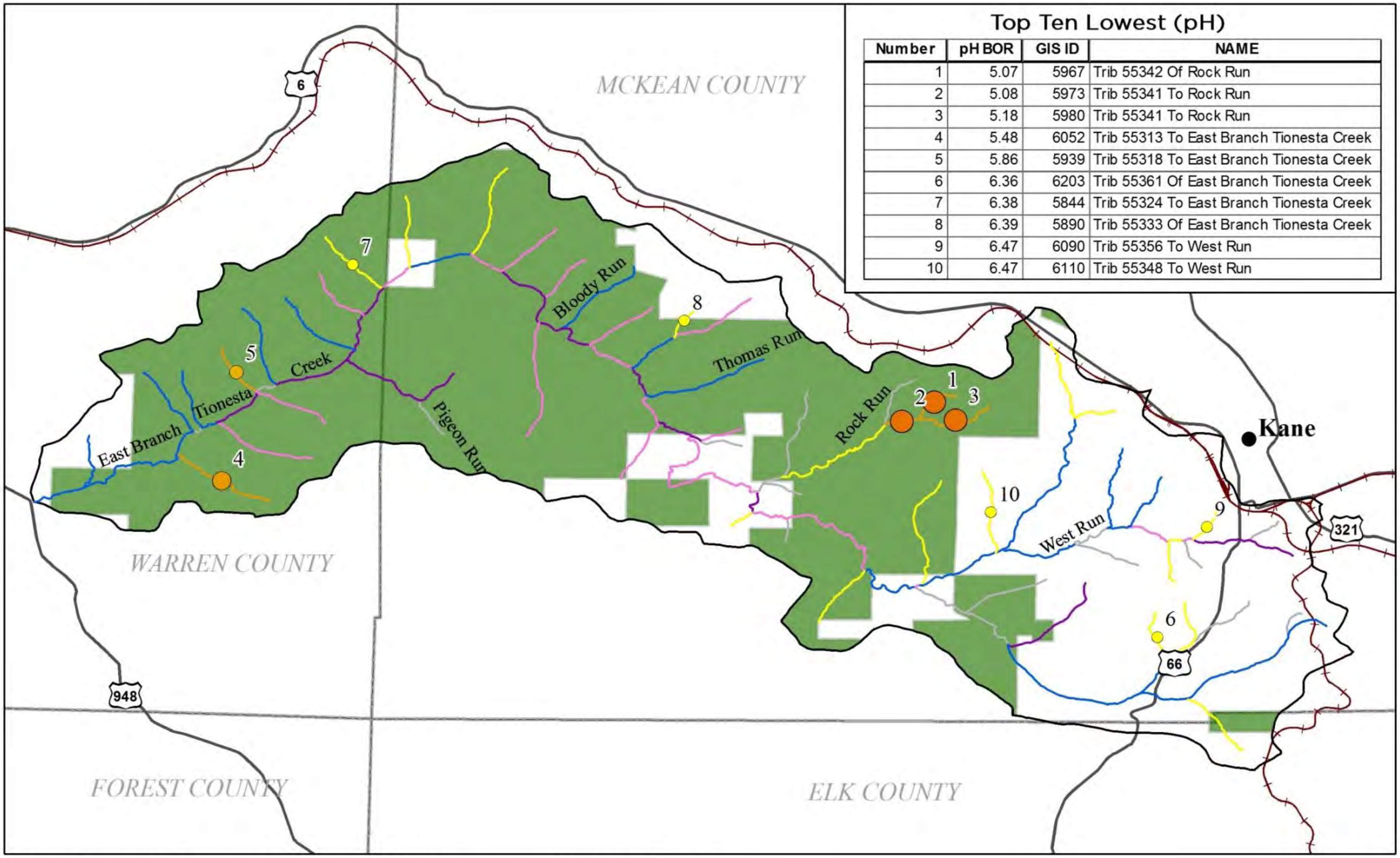
Optimal 16-20
Suboptimal 11-15
Marginal 6-10
Unassessed (See Notes)
Dry
Railroads
Major Roads
Allegheny National Forest
Watershed Boundary
County Boundary

N W E S

0 0.5 1 2 3 4 Miles

Western Pennsylvania Conservancy


MCKEAN COUNTY
WARREN COUNTY
FOREST COUNTY
ELK COUNTY
Kane
6
321
948
66
East Branch Tionesta Creek
Pigeon Run
Bloody Run
Thomas Run
Rock Run
West Run
East Branch Tionesta Creek Watershed - Land Cover Type(Acres)
Streams
Railroads
Major Roads
Water
Developed, Open Space(694)
Developed, Low Intensity(196)
Developed, Medium Intensity(60)
Developed, High Intensity(9)
Barren Land(67)
Deciduous Forest(12664)
Evergreen Forest(1035)
Mixed Forest(4729)
Shrub/Shrub(973)
Grasslands/Herbaceous(197)
Pasture/Hay(1049)
Cultivated Crops(366)
Woody Wetlands(505)
Emergent Herbaceous Wetlands(4)
County Boundary
Watershed Boundary(22548)
N
W
E
S
Western Pennsylvania
Conservancy
0
1
2
4
Miles



Top Ten Lowest (pH)

Number	pH BOR	GIS ID	NAME
1	5.07	5967	Trib 55342 Of Rock Run
2	5.08	5973	Trib 55341 To Rock Run
3	5.18	5980	Trib 55341 To Rock Run
4	5.48	6052	Trib 55313 To East Branch Tionesta Creek
5	5.86	5939	Trib 55318 To East Branch Tionesta Creek
6	6.36	6203	Trib 55361 Of East Branch Tionesta Creek
7	6.38	5844	Trib 55324 To East Branch Tionesta Creek
8	6.39	5890	Trib 55333 Of East Branch Tionesta Creek
9	6.47	6090	Trib 55356 To West Run
10	6.47	6110	Trib 55348 To West Run

East Branch Tionesta Creek Watershed - Acidity (pH)

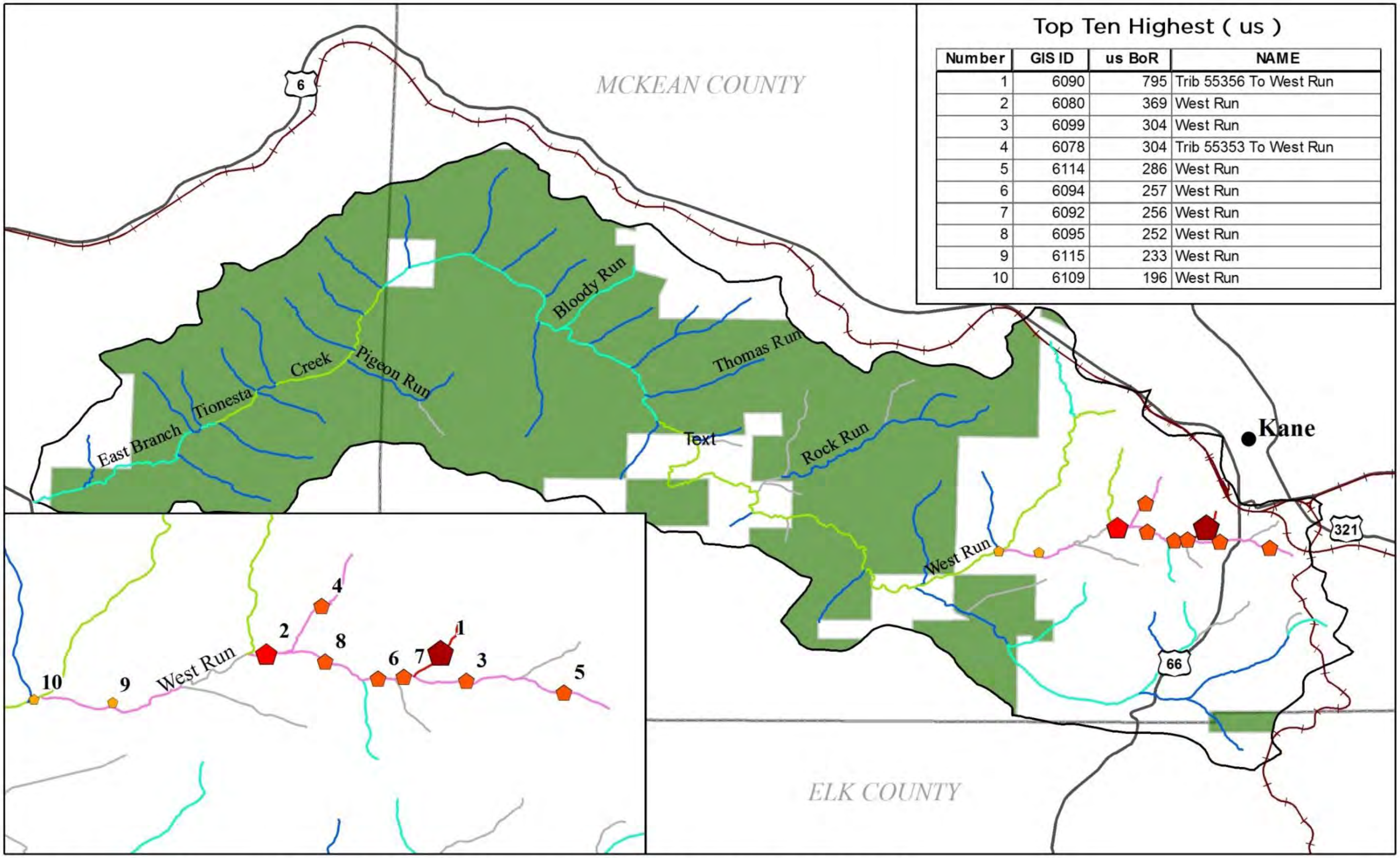
(pH) Level at BoR

- 5.07 - 5.86 (5)
- 6.36 - 6.92 (18)
- 6.96 - 7.43 (26)
- 7.45 - 7.85 (20)
- 7.91 - 8.71 (19)
- NA (See Notes)
- Railroads
- Major Roads
- Watershed Boundary
- Allegheny National Forest
- County Boundary

N W E S

0 0.5 1 2 3 4 Miles

Western Pennsylvania Conservancy



Top Ten Highest (us)

Number	GIS ID	us BoR	NAME
1	6090	795	Trib 55356 To West Run
2	6080	369	West Run
3	6099	304	West Run
4	6078	304	Trib 55353 To West Run
5	6114	286	West Run
6	6094	257	West Run
7	6092	256	West Run
8	6095	252	West Run
9	6115	233	West Run
10	6109	196	West Run

East Branch Tionesta Creek Watershed - Specific Conductivity (us)

(us) from BoR

- 22.40 - 61.80 (38)
- 64.50 - 103.70 (23)
- 120.90 - 196.00 (18)
- 233.00 - 369.00 (8)
- 795.00 (1)

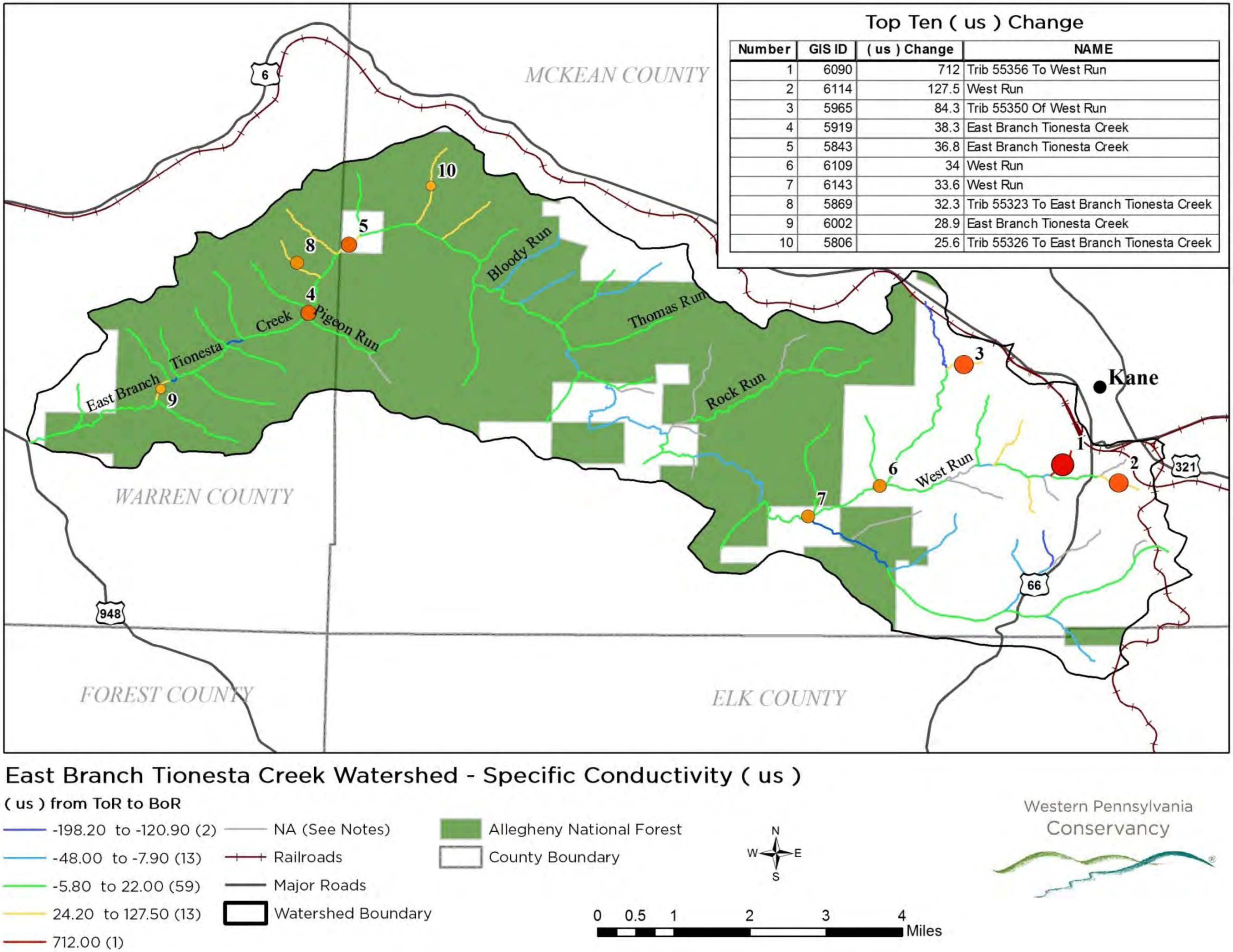
- NA (See Notes)
- Railroads
- Major Roads
- Watershed Boundary

- Allegheny National Forest
- County Boundary

N W E S

0 0.5 1 2 3 4 Miles

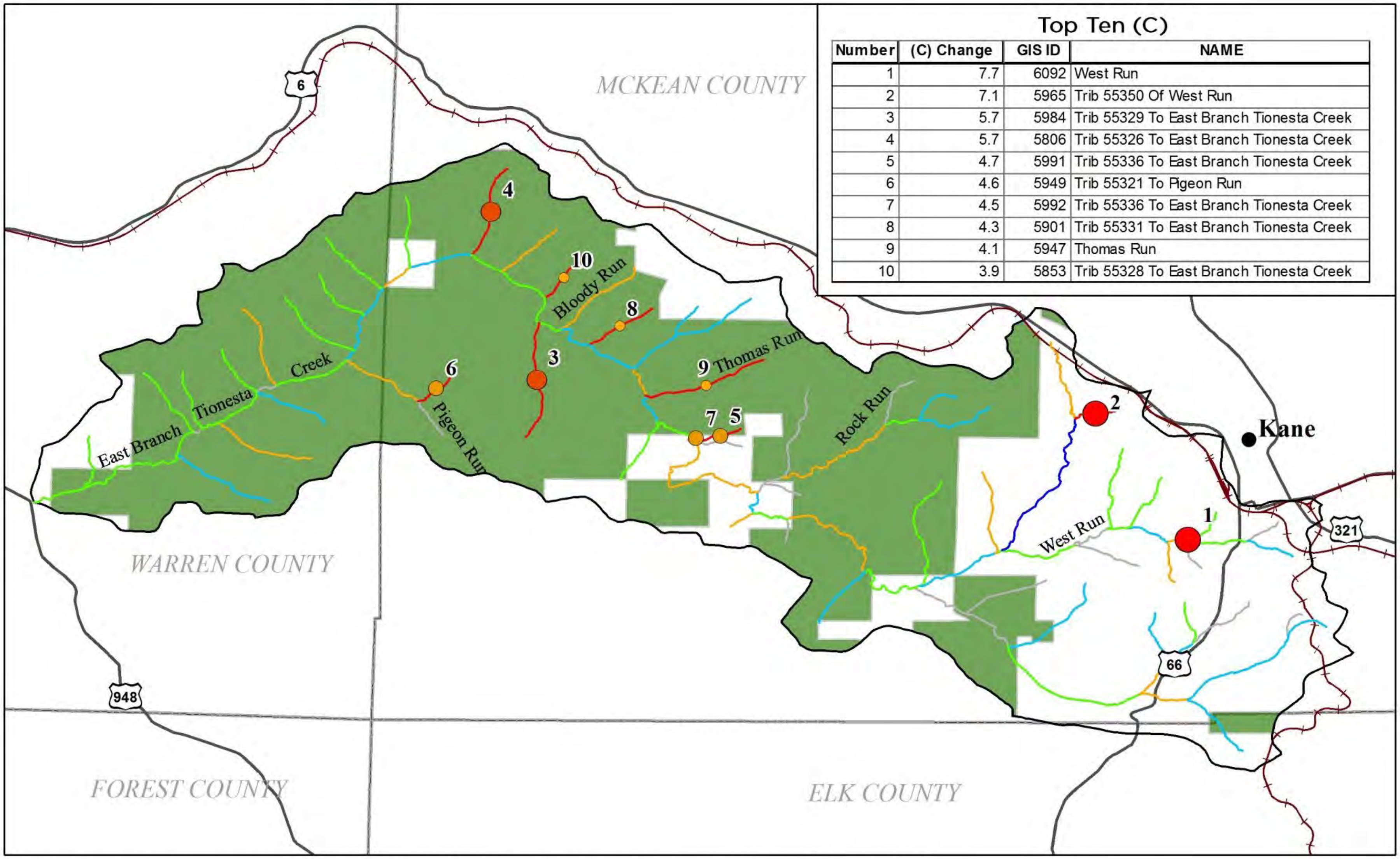
Western Pennsylvania Conservancy



Top Ten (us) Change

Number	GIS ID	(us) Change	NAME
1	6090	712	Trib 55356 To West Run
2	6114	127.5	West Run
3	5965	84.3	Trib 55350 Of West Run
4	5919	38.3	East Branch Tionesta Creek
5	5843	36.8	East Branch Tionesta Creek
6	6109	34	West Run
7	6143	33.6	West Run
8	5869	32.3	Trib 55323 To East Branch Tionesta Creek
9	6002	28.9	East Branch Tionesta Creek
10	5806	25.6	Trib 55326 To East Branch Tionesta Creek

East Branch Tionesta Creek Watershed - Specific Conductivity (us)



Top Ten (C)

Number	(C) Change	GIS ID	NAME
1	7.7	6092	West Run
2	7.1	5965	Trib 55350 Of West Run
3	5.7	5984	Trib 55329 To East Branch Tionesta Creek
4	5.7	5806	Trib 55326 To East Branch Tionesta Creek
5	4.7	5991	Trib 55336 To East Branch Tionesta Creek
6	4.6	5949	Trib 55321 To Pigeon Run
7	4.5	5992	Trib 55336 To East Branch Tionesta Creek
8	4.3	5901	Trib 55331 To East Branch Tionesta Creek
9	4.1	5947	Thomas Run
10	3.9	5853	Trib 55328 To East Branch Tionesta Creek

East Branch Tionesta Creek Watershed - Water Temperture Change (C)

(C) Change from ToR to BoR

-7.4 (1)
-7.39 to -0.50 (25)
-0.49 to - 1.30 (35)
-1.30 to 3.50 (17)
3.51 to 7.70 (10)

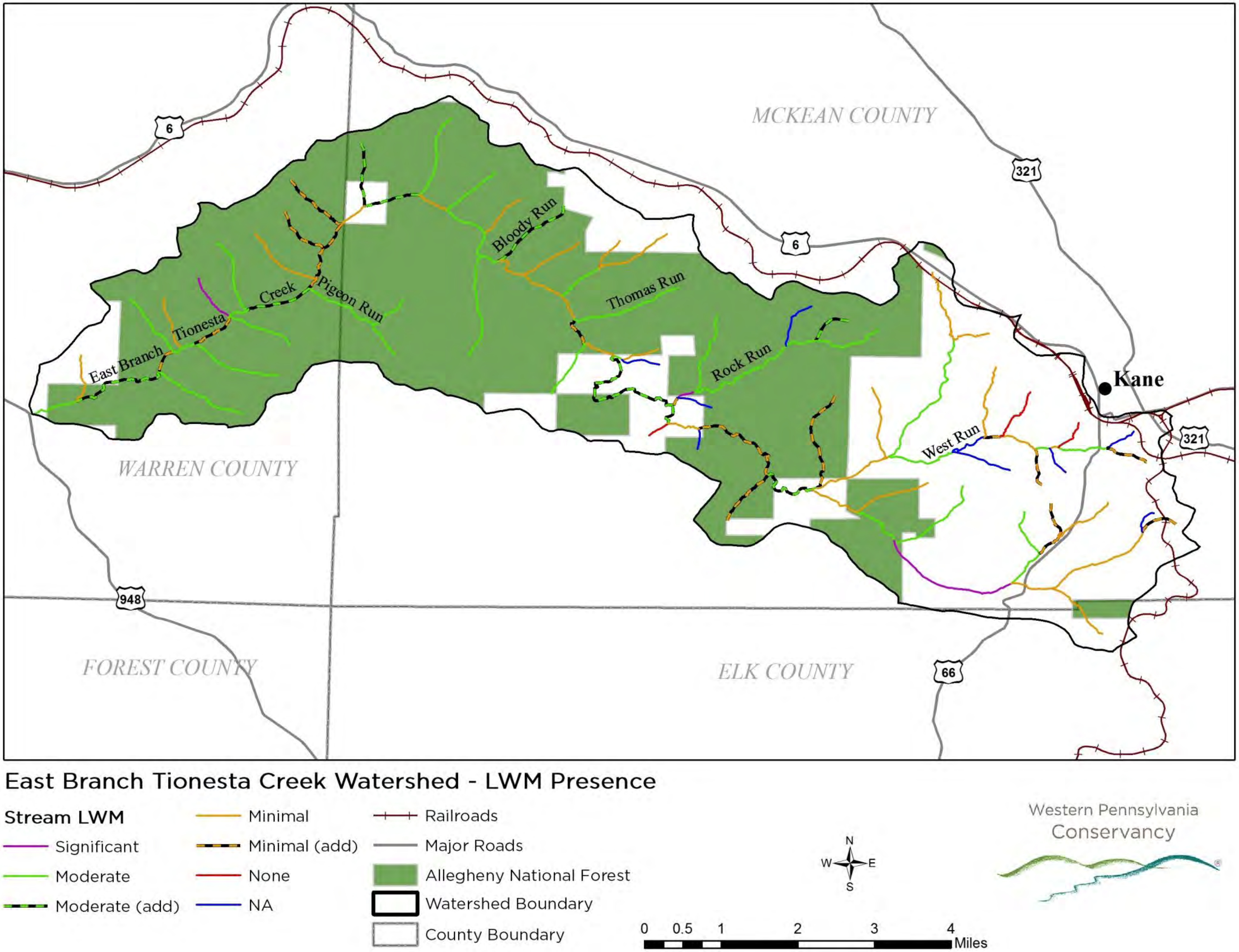
NA (See Notes)
Railroads
Major Roads
Watershed Boundary

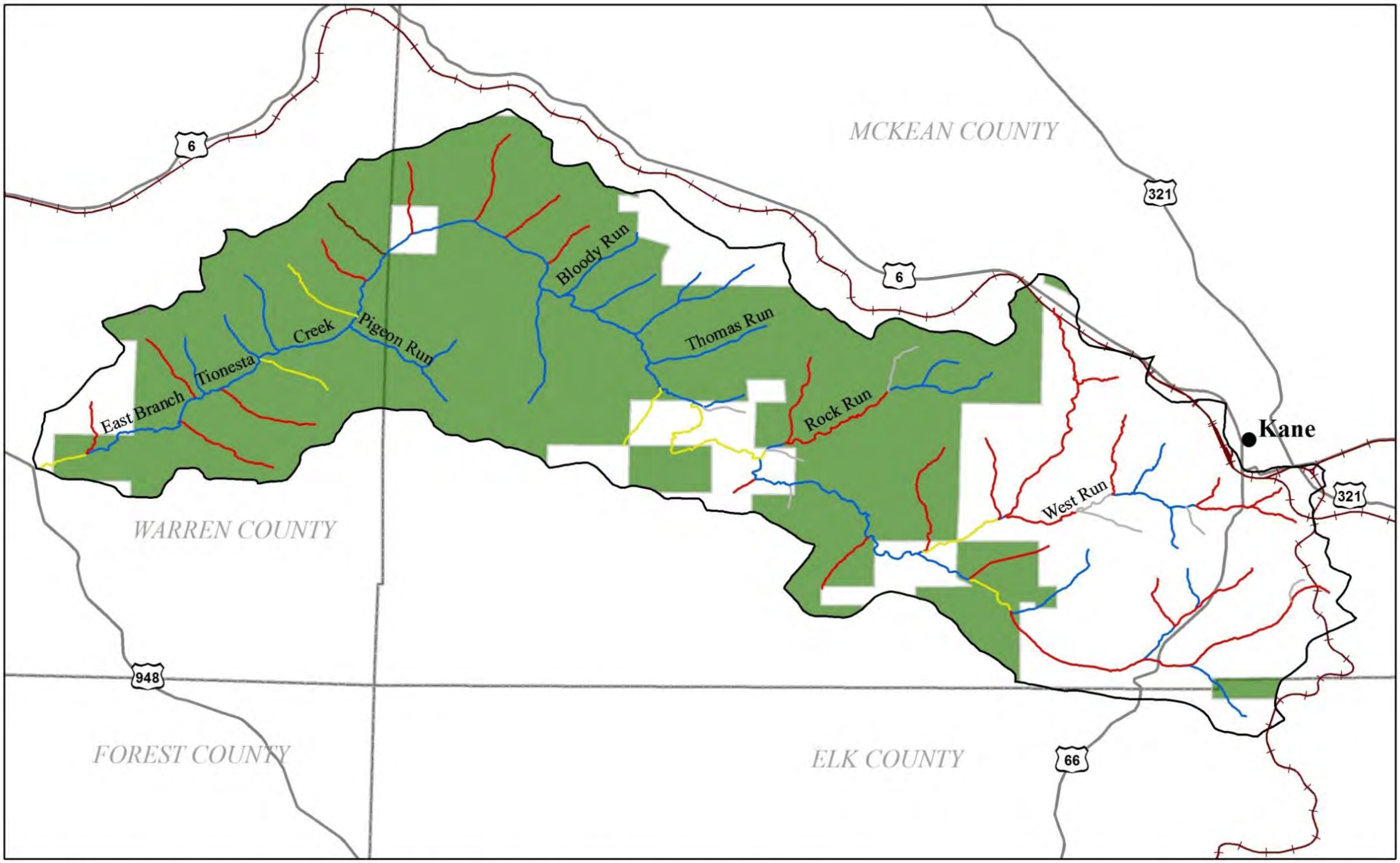
Allegheny National Forest
County Boundary

N
W E
S

0 0.5 1 2 3 4 Miles

Western Pennsylvania Conservancy


MCKEAN COUNTY
WARREN COUNTY
FOREST COUNTY
ELK COUNTY
Kane
East Branch
Tionesta
Creek
Pigeon Run
Bloody Run
Thomas Run
Rock Run
West Run
6
321
948
66
East Branch Tionesta Creek Watershed - LWM Presence
Stream LWM
Significant
Moderate
Moderate (add)
Minimal
Minimal (add)
None
NA
Railroads
Major Roads
Allegheny National Forest
Watershed Boundary
County Boundary
N
W
E
S
0
0.5
1
2
3
4
Miles
Western Pennsylvania Conservancy



East Branch Tionesta Creek Watershed - AOP Barriers Present

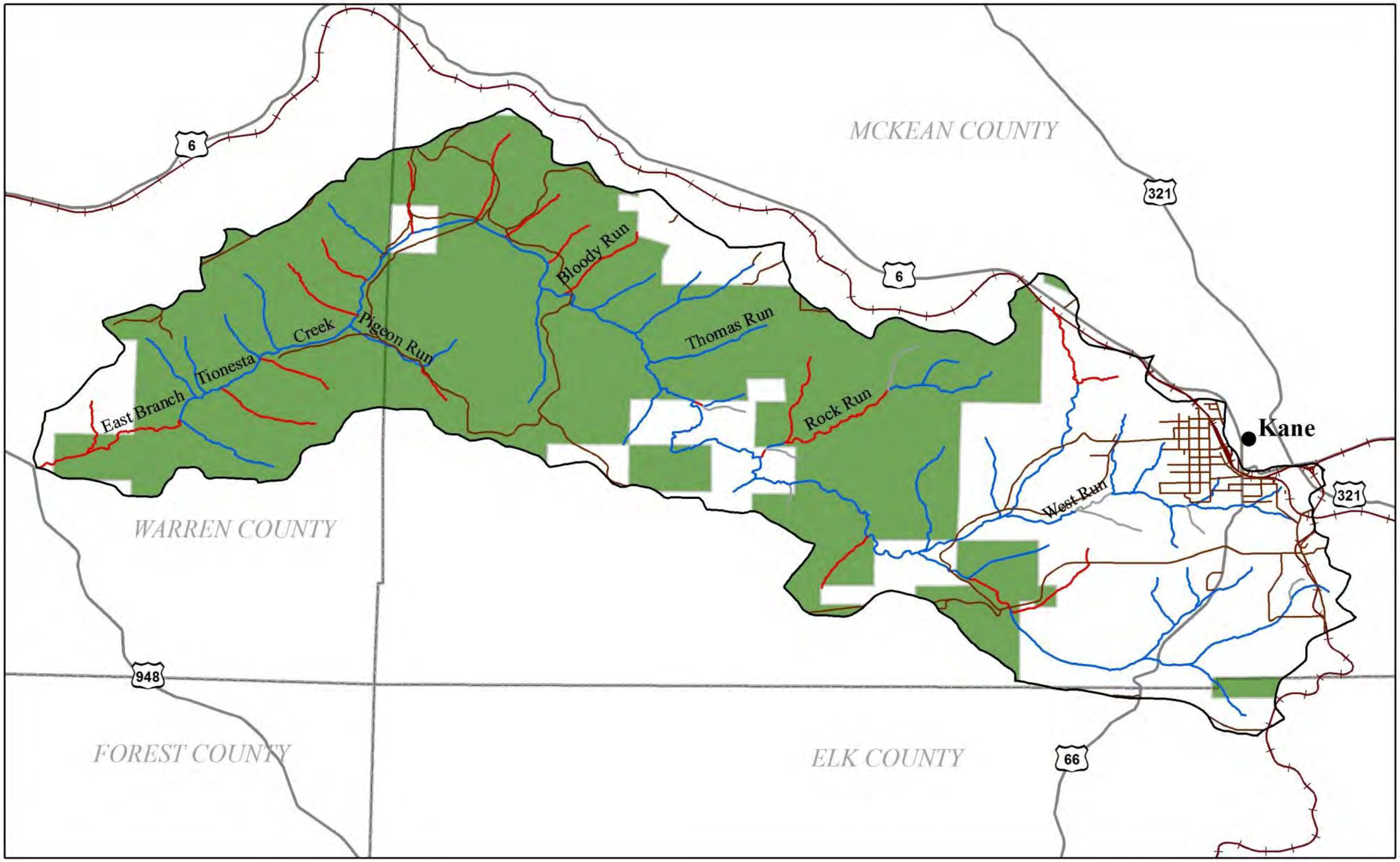
AOP Barrier

- Yes
- Potentially
- No
- Natural
- NA (See Notes)
- Railroads
- Major Roads
- Allegheny National Forest
- Watershed Boundary
- County Boundary

N W E S

0 0.5 1 2 3 4 Miles

Western Pennsylvania Conservancy



East Branch Tionesta Creek Watershed - DGR Improvements Recommended

Improvements Recommended

Yes
No
NA (See Notes)

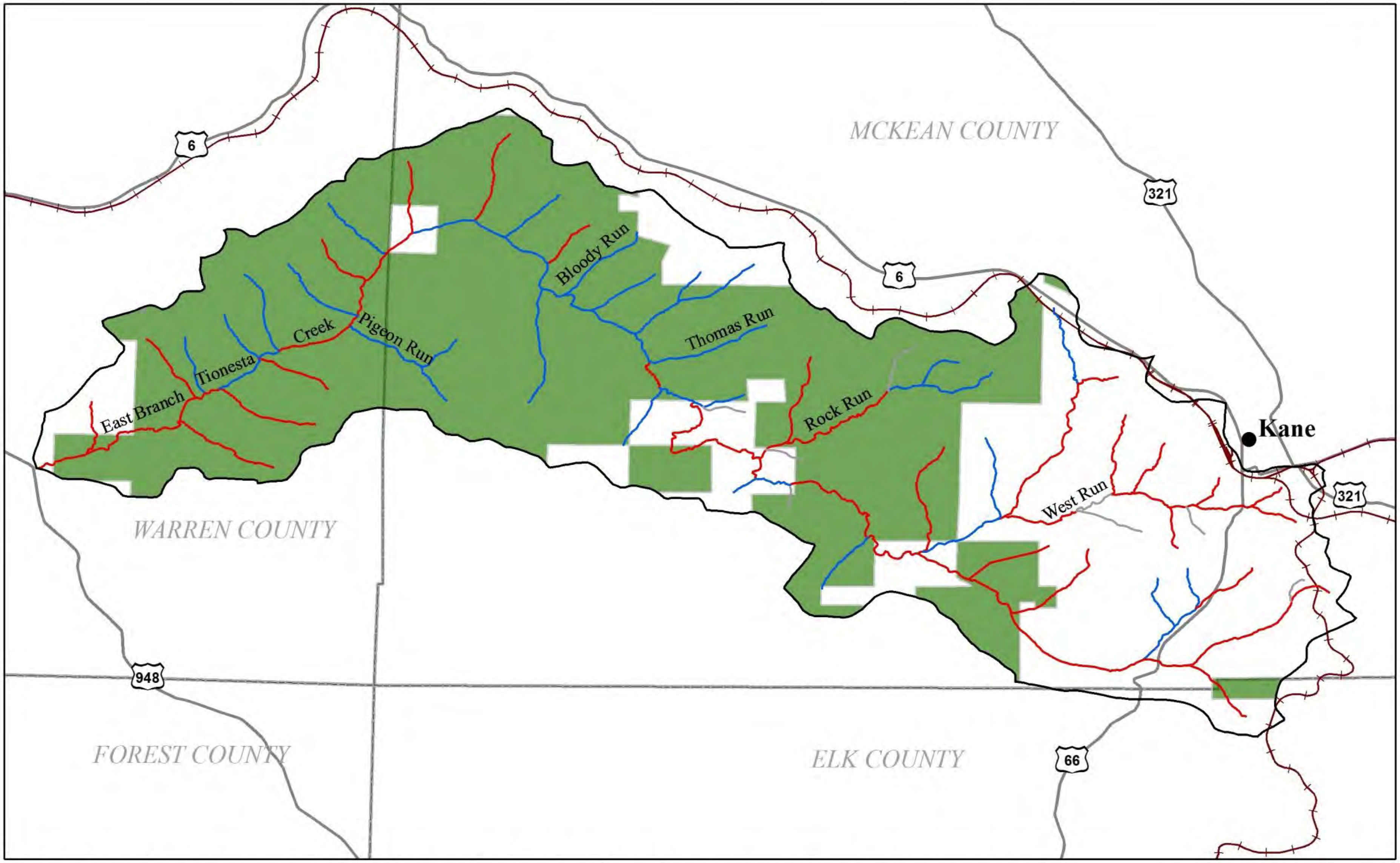
Railroads
Local Roads
Major Roads

Allegheny National Forest
Watershed Boundary
County Boundary

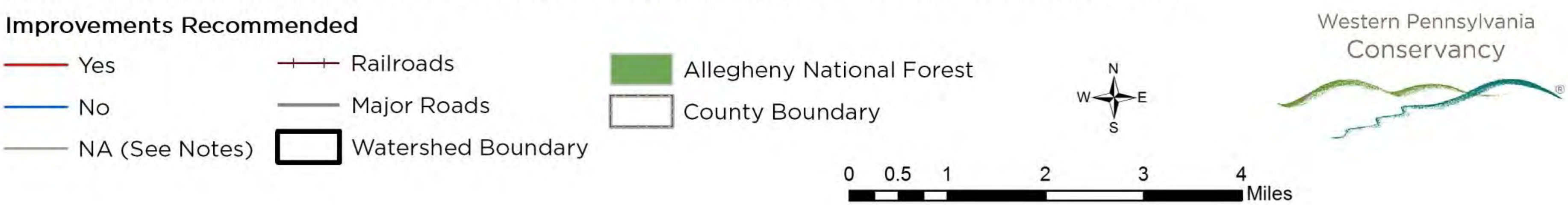
N W E S

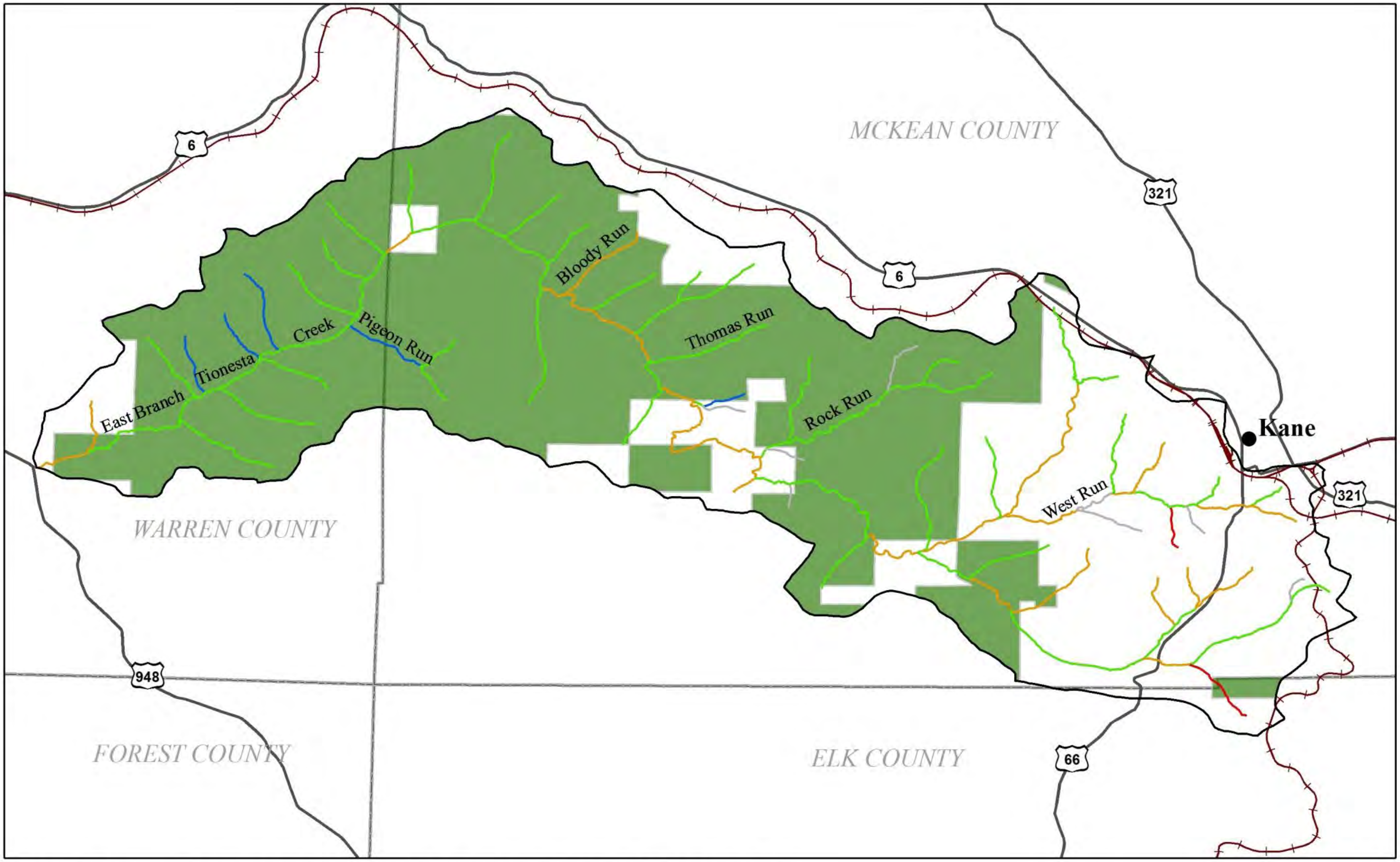
0 0.5 1 2 3 4 Miles

Western Pennsylvania Conservancy

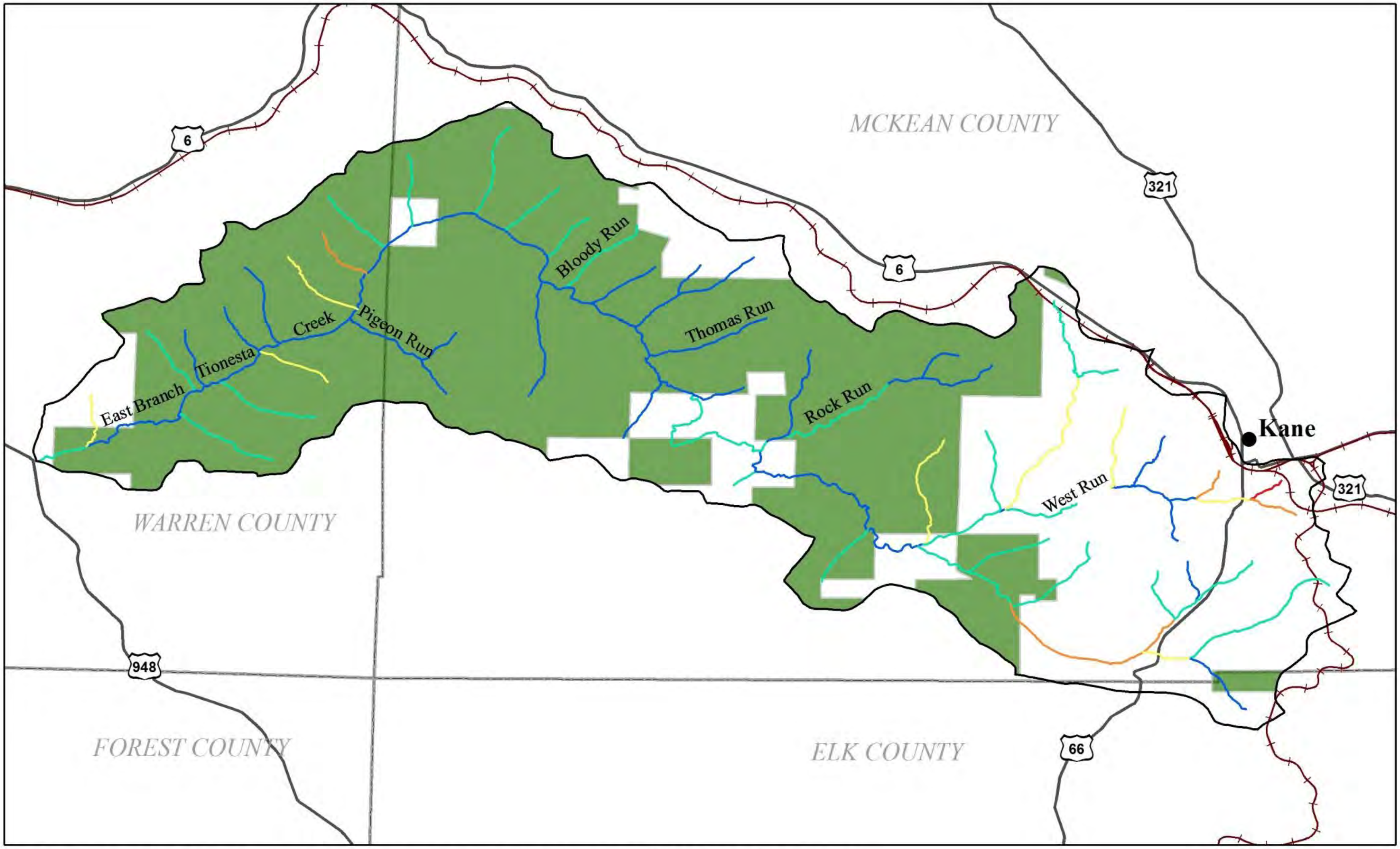


East Branch Tionesta Creek Watershed - Habitat Improvements Recommended





East Branch Tionesta Creek Watershed - Erosion Presence



East Branch Tionesta Creek Watershed - Channelization Present

Channelization

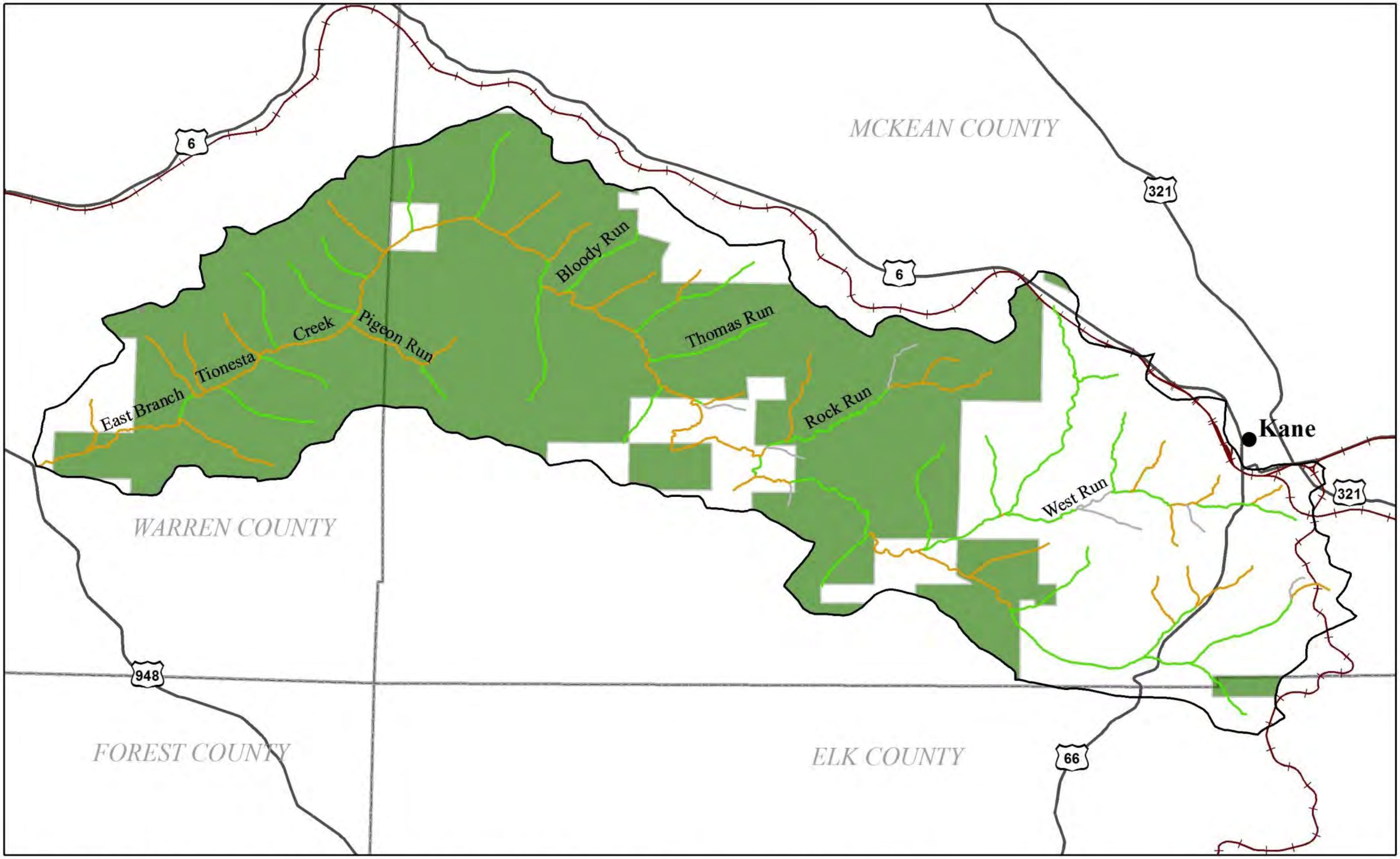
- 0-15ft
- 15-70ft
- 70-200ft
- 200-600ft
- 600-1800ft

- Railroads
- Major Roads
- Watershed Boundary
- Allegheny National Forest
- County Boundary

N W E S

0 0.5 1 2 3 4 Miles

Western Pennsylvania Conservancy



East Branch Tionesta Creek Watershed - Native/Wild Trout Observed

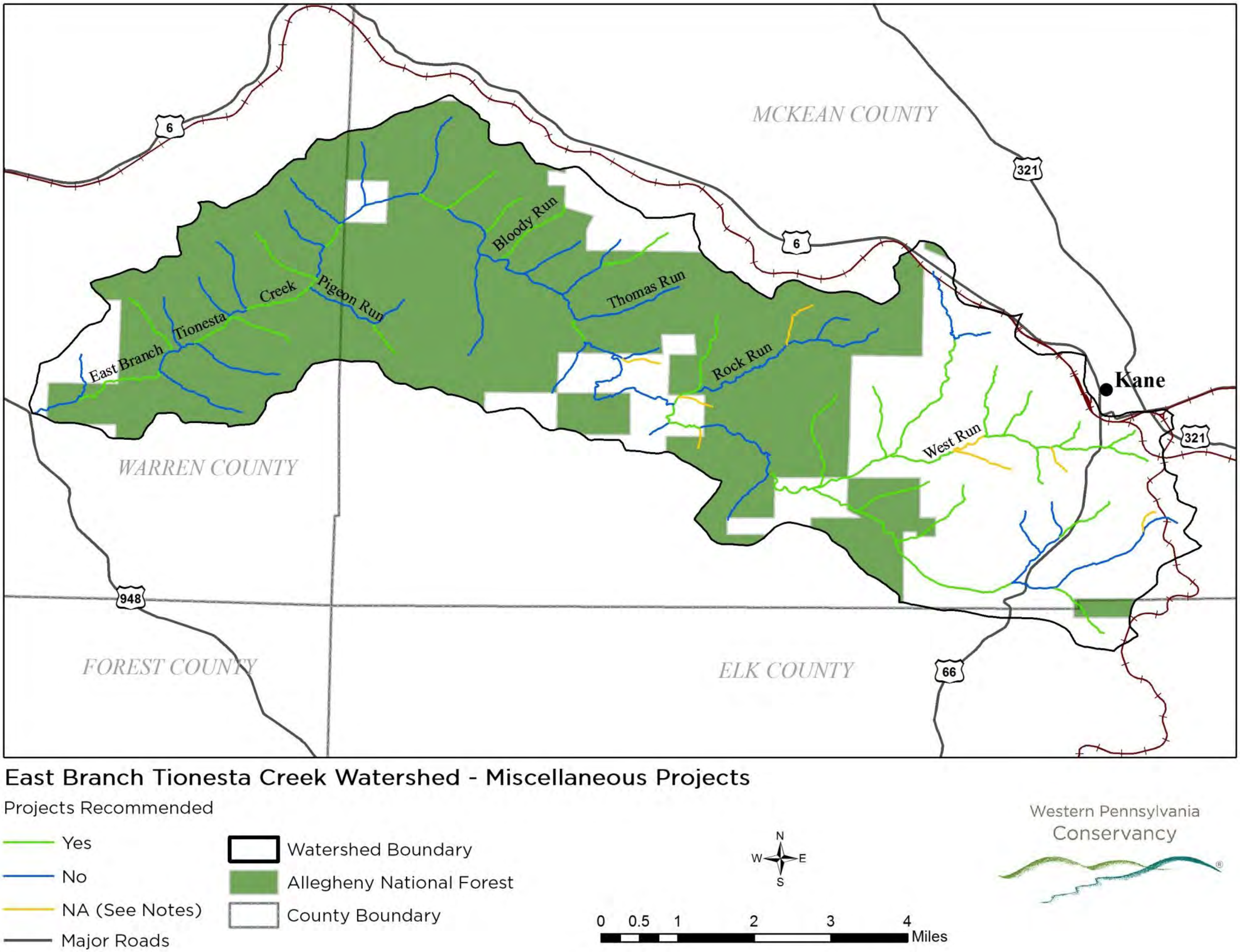
Observed

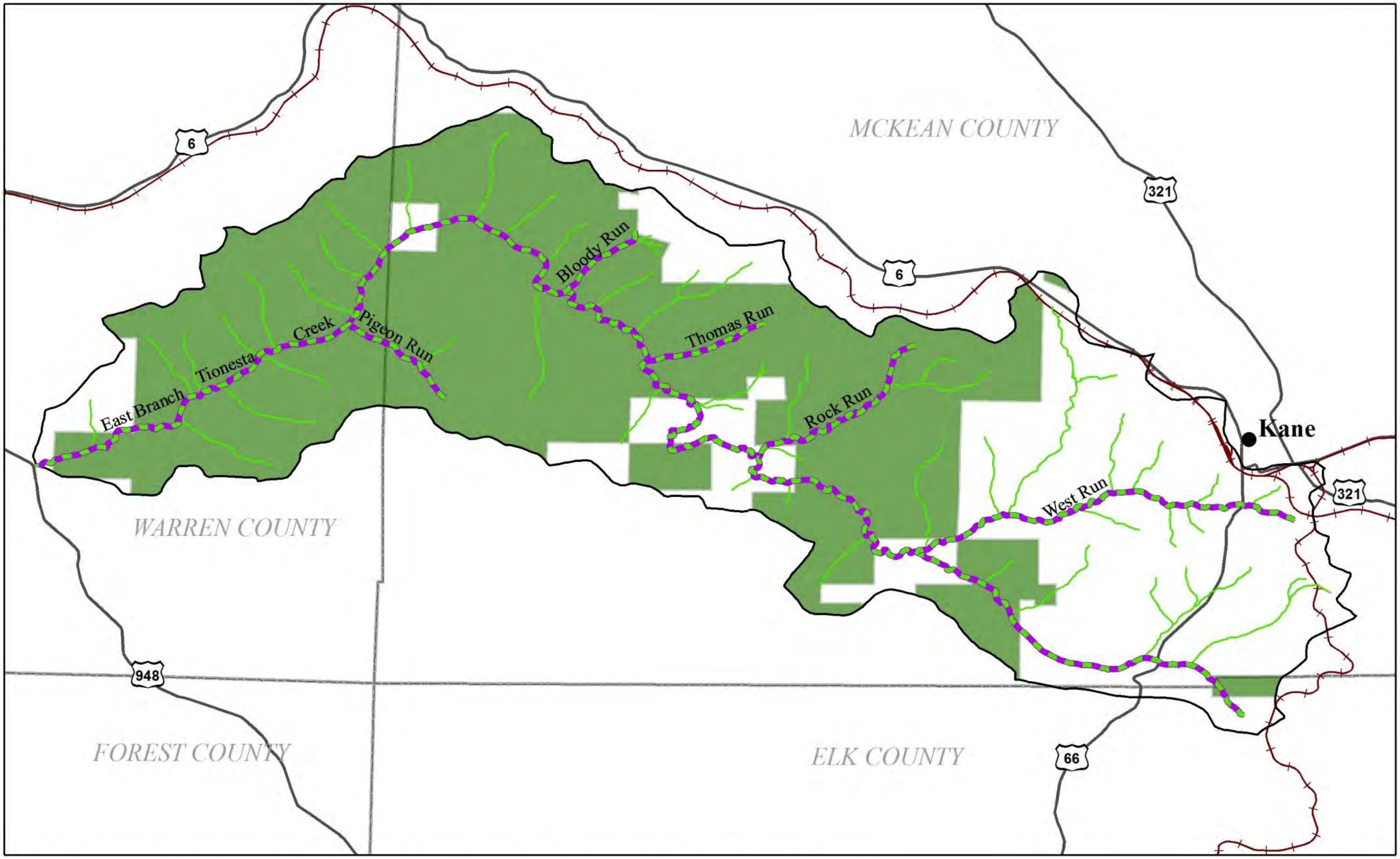
- Yes
- No
- NA (See Notes)
- Railroads
- Major Roads
- Watershed Boundary
- Allegheny National Forest
- County Boundary

N W E S

0 0.5 1 2 3 4 Miles

Western Pennsylvania Conservancy


MCKEAN COUNTY
WARREN COUNTY
FOREST COUNTY
ELK COUNTY
Kane
6
321
948
66
East Branch
Tionesta
Creek
Pigeon Run
Bloody Run
Thomas Run
Rock Run
West Run
East Branch Tionesta Creek Watershed - Miscellaneous Projects
Projects Recommended
Yes
No
NA (See Notes)
Major Roads
Watershed Boundary
Allegheny National Forest
County Boundary
N
W
E
S
0 0.5 1 2 3 4
Miles
Western Pennsylvania
Conservancy



East Branch Tionesta Creek Watershed - Chapter 93 Designations

Trout Natural Reproduction/HQCF
High Quality Coldwater Fishes(HQCF)
Railroads
Major Roads
Watershed Boundary
Allegheny National Forest
County Boundary

N W E S

0 0.5 1 2 3 4 Miles

Western Pennsylvania Conservancy

Appendix 3:

Standard Data Forms

PHYSICAL CHARACTERIZATION/WATER QUALITY FIELD DATA SHEET (FRONT)

STREAM NAME	**SEGMENT ID**
GIS ID # __________	**STREAM CLASS**
LAT ______________ **LONG** ______________	**RIVER BASIN**
STORET # N/A	**AGENCY** Western Pennsylvania Conservancy
INVESTIGATORS	

FORM COMPLETED BY	**DATE** ___________________ **TIME** __________ **AM PM**	**REASON FOR SURVEY**

WEATHER CONDITIONS

Now
- ☐ clear/sunny
- ☐ storm (heavy rain)
- ☐ rain (steady rain)
- ☐ showers (intermittent)
- ☐ % cloud cover (circle %)

25% - 50 % - 75% - 100%

Past 24 hours
- ☐ clear/sunny
- ☐ storm (heavy rain)
- ☐ rain (steady rain)
- ☐ showers (intermittent)
- ☐ % cloud cover (circle %)

25% - 50 % - 75% - 100%

Has there been a heavy rain in the last 7 days?
☐ Yes ☐ No

Air Temperature _____ °F

Other________________________________

FEATURES of NOTE:

Describe significant features and/or impacts seen in section. Include GPS points when applicable

Latitude (North)	Longitude (West)

☐ Check box if stream is dry and record any significant info about section.

HABITAT IMPROVEMENT OPPORTUNITIES:

☐ Segment has need for improvement project(s)

Describe:

Recommendation(s):

Segment Accessibility:

☐ Excellent ☐ Good ☐ Poor ☐ In-Accessible – Describe:____

STREAM CHARACTERIZATION

Stream Subsystem
☐ Perennial ☐ Intermittent

Stream Type
- ☐ Main Stem
- ☐ Unnamed Tributary
- ☐ Headwater UNT
- ☐ Named Tributary
- ☐
- ☐ Other ________

Stream Type
☐ Coldwater ☐ Warmwater

WATERSHED FEATURES (with in 30 meter buffer)	**Predominant Surrounding Land-Use** (Must = 100%) ☐ Forest ____% ☐ Field/Pasture ____% ☐ Agricultural ____% ☐ Open space (i.e., parks/golf courses) ____% ☐ Commercial/Industrial ____% ☐ Residential ____% ☐ Paved Roads ____% ☐ Dirt and Gravel Roads ____% (TWP, Gas & Logging) ☐ Rail Line ____% ☐ Wetland ____% ☐ Other _______________ ____%	**Stormwater Inputs** ☐ None ☐ Tile Drain ☐ Road Ditch ☐ Urban Stormwater Pipe ☐ Field Ditch ☐ Overland Flow **D&GR Sediment Contribution (Runoff)**: ☐ None ☐ Minimal ☐ Moderate ☐ Heavy **Bank revetments:** ☐ None ☐ Rip-rap ☐ Gabion ☐ Concrete ☐ Other ________
VEGETATION INFORMATION **NOTE: Bank side determined when facing DOWN Stream**	**Riparian Zone Width** **Riparian Zone Encroachment** ☐ Yes ☐ No Right Bank: ☐ 0 – 15 feet ☐ 16 – 50 feet ☐ 51 – 150 feet ☐ 150 – 300 feet ☐ Greater than 300 feet Left Bank: ☐ 0 – 15 feet ☐ 16 – 50 feet ☐ 51 – 150 feet ☐ 150 – 300 feet ☐ Greater than 300 feet **Indicate dominant vegetation type within riparian zone (~18 meter buffer),and record dominant species present:** ☐ Trees ☐ Shrubs ☐ Grasses ☐ Herbaceous ☐ Invasive - Dominant species present:____________________________ **Bank Canopy Vegetation:** Left Bank ☐ 100% (Shaded) ☐ 75% ☐ 50% ☐ 25% ☐ 0% (No Cover) Right Bank ☐ 100% (Shaded) ☐ 75% ☐ 50% ☐ 25% ☐ 0% (No Cover) **Channel Canopy:** ☐ Open ☐ Closed **Presence of Large Woody Debris (LWD):** ☐ Significant ☐ Moderate ☐ Minimal ☐ None **Presence of aquatic vegetation:** ☐ None ☐ Normal ☐ Excessive - Describe:______________________________	
INSTREAM FEATURES	**Average Stream Width** _________ ft **Active Streambank Erosion for Segment** ☐ None ☐ Minimal ☐ Moderate ☐ Heavy **Surface Velocity:** ☐ Slow ☐ Moderate ☐ Fast **Flow Status:** ☐ Low ☐ Moderate ☐ High **Springs/Seeps:** ☐ Abundant ☐ Minimal ☐ None **Adjacent Wetlands:** ☐ Abundant ☐ Minimal ☐ None **Proportion of Stream Morphology Types** ☐ Riffle_______% ☐ Run_______% ☐ Pool_______% **Average Number of Riffles in section** _______________	**Channelization** ☐ No ☐ Yes: Length of Straitening ____ft **Dam Present (Beaver or Human)** ☐ Yes ☐ No **Constrictions Present :** ☐ None ☐ Culvert ☐ Bridge ☐ Old Abutment ☐ Bedrock Outcrop ☐ Other _________ **Stream Ford or Animal Crossing Present** ☐ Yes ☐ No **Debris Jam Present** ☐ Yes ☐ No **Connectivity to Flood Plain** (Zero percent equals not connected to flood plain) Right Bank: ☐ 100% ☐ 75% ☐ 50% ☐ 25% ☐ 0% Left Bank: ☐ 100% ☐ 75% ☐ 50% ☐ 25% ☐ 0%
WATER QUALITY **(During visual assessment use pH and conductivity meters to take reading.)** **WQ Instrument(s) Used** _______________ _______________	**pH _______ (Top of section) H2O Temp _______(Top)** **pH________(Bottom of section) °F or C ________(Bot.)** **Specific Conductance (Top)________ (Bottom)________** **Turbidity (if not measured)** ☐ Clear ☐ Slightly turbid ☐ Turbid ☐ Opaque ☐ Stained ☐ Other______ **Water Odors** ☐ Normal/None ☐ Sewage ☐ Petroleum ☐ Chemical ☐ Fishy ☐ Other___________	**Water Surface Oils** ☐ Slick ☐ Sheen ☐ Globs ☐ Flecks ☐ None ☐ Other________________________ **Overall Water Quality** ☐ Excellent ☐ Good ☐ Fair ☐ Poor **Primary source(s) of water quality impact** ☐ Agriculture ☐ Active Pasture ☐ AMD ☐ Gas Wells ☐ Development ☐ Sewage ☐ Bank Erosion ☐ Sedimentation

INORGANIC SUBSTRATE COMPONENTS (should add up to 100%)		
Substrate Type	**Diameter**	**% Composition in Sampling Reach**
Bedrock		
Boulder	> 256 mm (10")	
Cobble	64-256 mm (2.5"-10")	
Gravel	2-64 mm (0.1"-2.5")	
Sand	0.06-2mm (gritty)	
Silt	0.004-0.06 mm	
Clay	< 0.004 mm (slick)	

Additional Notes

WT Observed? Y or N **Coord. of Obs.:**

HABITAT ASSESSMENT FIELD DATA SHEET – HIGH GRADIENT STREAMS (FRONT)

STREAM NAME	GIS ID # _________
SEGMENT ID	STREAM CLASS
LAT _____________ LONG _____________	RIVER BASIN
STORET # N/A	AGENCY Western Pennsylvania Conservancy
INVESTIGATORS	

FORM COMPLETED BY	DATE __________________ TIME _________ AM PM	REASON FOR SURVEY Visual Assessment

Habitat Parameter	Condition Category			
	Optimal	Suboptimal	Marginal	Poor
1. Epifaunal Substrate & Available Cover	Greater than 70% (50% for low gradient streams) of substrate favorable for epifaunal colonization and fish cover; mix of snags, submerged logs, undercut banks, cobble or other stable habitat and at stage to allow full colonization potential (i.e., logs/snags that are not new fall and not transient).	40-70% (30-50% for low gradient streams) mix of stable habitat; well-suited for full colonization potential; adequate habitat for maintenance of populations; presence of additional substrate in the form of newfall, but not yet prepared for colonization (may rate at high end of scale).	20-40% (10-30% for low gradient streams) mix of stable habitat; habitat availability less than desirable; substrate frequently disturbed or removed.	Less than 20% (10% for low gradient streams) stable habitat; lack of habitat is obvious; substrate unstable or lacking.
SCORE ___	20 19 18 17 16	15 14 13 12 11	10 9 8 7 6	5 4 3 2 1 0
2. Embeddedness	Gravel, cobble, and boulder particles are 0-25% surrounded by fine sediment. Layering of cobble provides diversity of niche space.	Gravel, cobble, and boulder particles are 25-50% surrounded by fine sediment.	Gravel, cobble, and boulder particles are 50-75% surrounded by fine sediment.	Gravel, cobble, and boulder particles are more than 75% surrounded by fine sediment.
SCORE ___	20 19 18 17 16	15 14 13 12 11	10 9 8 7 6	5 4 3 2 1 0
3. Velocity/ Depth Regimes	All 4 velocity/depth regimes present (slow-deep, slow-shallow, fast-deep, fast-shallow). (slow is <0.3 m/s, deep is >0.5 m).	Only 3 of the 4 regimes present (if fast-shallow is missing, score lower than if missing other regimes).	Only 2 of the 4 habitat regimes present (if fast-shallow or slow-shallow are missing, score low).	Dominated by 1 velocity/ depth regime (usually slow-deep).
SCORE ___	20 19 18 17 16	15 14 13 12 11	10 9 8 7 6	5 4 3 2 1 0
4. Sediment Deposition	Little or no enlargement of islands or point bars and less than 5% (<20% for low-gradient streams) of the bottom affected by sediment deposition.	Some new increase in bar formation, mostly from gravel, sand or fine sediment; 5-30% (20-50% for low-gradient) of the bottom affected; slight deposition in pools.	Moderate deposition of new gravel, sand or fine sediment on old and new bars; 30-50% (50-80% for low-gradient) of the bottom affected; sediment deposits at obstructions, constrictions, and bends; moderate deposition of pools prevalent.	Heavy deposits of fine material, increased bar development; more than 50% (80% for low-gradient) of the bottom changing frequently; pools almost absent due to substantial sediment deposition.
SCORE ___	20 19 18 17 16	15 14 13 12 11	10 9 8 7 6	5 4 3 2 1 0
5. Channel Flow Status	Water reaches base of both lower banks, and minimal amount of channel substrate is exposed.	Water fills >75% of the available channel; or <25% of channel substrate is exposed.	Water fills 25-75% of the available channel, and/or riffle substrates are mostly exposed.	Very little water in channel and mostly present as standing pools.
SCORE ___	20 19 18 17 16	15 14 13 12 11	10 9 8 7 6	5 4 3 2 1 0

HABITAT ASSESSMENT FIELD DATA SHEET – HIGH GRADIENT STREAMS (BACK)

Habitat Parameter	Condition Category			
	Optimal	**Suboptimal**	**Marginal**	**Poor**
6. Channel Alteration	Channelization or dredging absent or minimal; stream with normal pattern.	Some channelization present, usually in areas of bridge abutments; evidence of past channelization, i.e., dredging, (greater than past 20 yr) may be present, but recent channelization is not present.	Channelization may be extensive; embankments or shoring structures present on both banks; and 40 to 80% of stream reach channelized and disrupted.	Banks shored with gabion or cement; over 80% of the stream reach channelized and disrupted. Instream habitat greatly altered or removed entirely.
SCORE ___	20 19 18 17 16	15 14 13 12 11	10 9 8 7 6	5 4 3 2 1 0
7. Frequency of Riffles (or bends)	Occurrence of riffles relatively frequent; ratio of distance between riffles divided by width of the stream <7:1 (generally 5 to 7); variety of habitat is key. In streams where riffles are continuous, placement of boulders or other large, natural obstruction is important.	Occurrence of riffles infrequent; distance between riffles divided by the width of the stream is between 7 to 15.	Occasional riffle or bend; bottom contours provide some habitat; distance between riffles divided by the width of the stream is between 15 to 25.	Generally all flat water or shallow riffles; poor habitat; distance between riffles divided by the width of the stream is a ratio of >25.
SCORE ___	20 19 18 17 16	15 14 13 12 11	10 9 8 7 6	5 4 3 2 1 0
8. Bank Stability (score each bank) **Note: determine left or right side by facing downstream**	Banks stable; evidence of erosion or bank failure absent or minimal; little potential for future problems. <5% of bank affected.	Moderately stable; infrequent, small areas of erosion mostly healed over. 5-30% of bank in reach has areas of erosion.	Moderately unstable; 30-60% of bank in reach has areas of erosion; high erosion potential during floods.	Unstable; many eroded areas; "raw" areas frequent along straight sections and bends; obvious bank sloughing; 60-100% of bank has erosional scars.
SCORE ___ (LB)	Left Bank 10 9	8 7 6	5 4 3	2 1 0
SCORE ___ (RB)	Right Bank 10 9	8 7 6	5 4 3	2 1 0
9. Vegetative Protection (score each bank) **Note: determine left or right side by facing downstream**	More than 90% of the streambank surfaces and immediate riparian zones covered by native vegetation, including trees, understory shrubs, or nonwoody macrophytes; vegetative disruption through grazing or mowing minimal or not evident; almost all plants allowed to grow naturally.	70-90% of the streambank surfaces covered by native vegetation, but one class of plants is not well-represented; disruption evident but not affecting full plant growth potential to any great extent; more than one-half of the potential plant stubble height remaining.	50-70% of the streambank surfaces covered by vegetation; disruption obvious; patches of bare soil or closely cropped vegetation common; less than one-half of the potential plant stubble height remaining.	Less than 50% of the streambank surfaces covered by vegetation; disruption of streambank vegetation is very high; vegetation has been removed to 5 centimeters or less in average stubble height.
SCORE ___ (LB)	Left Bank 10 9	8 7 6	5 4 3	2 1 0
SCORE ___ (RB)	Right Bank 10 9	8 7 6	5 4 3	2 1 0
10. Riparian Vegetative Zone Width (score each bank riparian zone)	Width of riparian zone >18 meters; human activities (i.e., parking lots, roadbeds, clear-cuts, lawns, or crops) have not impacted zone.	Width of riparian zone 12-18 meters; human activities have impacted zone only minimally.	Width of riparian zone 6-12 meters; human activities have impacted zone a great deal.	Width of riparian zone <6 meters: little or no riparian vegetation due to human activities.
SCORE ___ (LB)	Left Bank 10 9	8 7 6	5 4 3	2 1 0
SCORE ___ (RB)	Right Bank 10 9	8 7 6	5 4 3	2 1 0

Total Score ________

HABITAT ASSESSMENT SCORE SHEET
HIGH GRADIENT STREAM

STREAM NAME	SEGMENT ID	
GIS ID # __________	STREAM CLASS	
LAT _____________ LONG _____________	RIVER BASIN	
STORET # N/A	AGENCY Western Pennsylvania Conservancy	
INVESTIGATORS		
FORM COMPLETED BY	DATE _________________ TIME _________ AM PM	REASON FOR SURVEY Visual Assessment

Habitat Parameter	Score	Explanation of Score Given *(Complete especially for poor rating)*	
1. Epifaunal Substrate /Available Cover			
2. Embeddedness			
3. Velocity/ Depth Regimes			
4. Sediment Deposition			
5. Channel Flow Status			
6. Channel Alteration			
7. Frequency of Riffles (or bends)			
8. Bank Stability **(score each bank)** ***Note: determine left or right side by facing downstream***	Total of LB & RB	(LB)	
		(RB)	
9. Vegetative Protection **(score each bank)** ***Note: determine left or right side by facing downstream***	Total of LB & RB	(LB)	
		(RB)	
10. Riparian Vegetative Zone Width **(score each bank riparian zone)**	Total of LB & RB	(LB)	
		(RB)	
Total Score		**Add all scores and divide by the number of scores given.**	

ANF CHANNEL UNIT FORM

pg :____________ of __________

R6-2500/2600-22

A. State________ B. County ___________________________ C. Forest___________________________ D. District___________________________

E. Stream Name__________________________ F. 4th HUC Code ____,____,____,____5th_____6th_____ G. USGS Quad _______________________________

H. Reach #_______ I. Sampling Frequency: F_______________________ S________________________ J. Survey Start Date:_____________________________

K. Contacts: REC:_________________________________ OBS:_________________________________

Channel Units								Woody Material				BF	Unstable Banks		Riparian Vegetation			Water Characteristics			
SO	Channel Unit Type & No.	Length	Wet Width	Max Depth	Avg Depth	Pool Crest Depth	Form By	S S	M M	L L	KEY	BF width	Left	Right	Class	Over story	Under story	pH	Conduct	°C	Time

SSLS: Lateral Scour Pool **SSMC:** Mid-Channel Pool **SSPL:** Plunge Pool **SSCV:** Convergence Pool **SSTR:** Trench Pool (BR ONLY) **SDDD:** Debris Dam Pool **SDBV:** Beaver Dam Pool **SDLS:** Landslide Dam Pool **FTRF:** Riffle (0-3%) **FTRR:** Rapid (3-10%) **FTCC:** Cascade (>10%) **FTSH:** Sheet (BR ONLY) **SIDES:** Side Channel Slow **SIDEF:** Side Channel Fast **SPECIAL CASES: CHUD:** Dry Mainstem **CHUM :** Marshland **WF:** Waterfall **CH:** Chute **ARTIF:** Culverts and human-made dams **TR:** Tributary (>1%)

Formed By: **BV** - Beaver, **WD** - Wood, **BR** - Bedrock, **BO** - Boulder, **SB** - Stream Bend, **TR** - Tributary, **CU** - Culvert, **DA** - Dam, **RS** - Restoration, **OT** - Other

Appendix 4:

Permitted Discharges

WATER MANAGEMENT SYSTEM
FINAL ISSUED INDIVIDUAL NPDES PERMIT DOCUMENTS

8/26/2016 10:57:55 AM

Permit Effective Date (or Update Date) from: 5/1/2015 to 4/30/2020
Permit: PA0272833

PERMIT	PERMITTEE	FACILITY	APPLICATION TYPE	ISSUE DATE	EFFECTIVE DATE	EXPIRATION DATE	REGION	UPDATE DATE
PA0272833	COLLINS PINE CO	KANE HARDWOOD	New	04/02/2015	05/01/2015	04/30/2020	NWRO	

No hardcopy/pdf is available for the Kane Borough NPDES discharge. At the writing of this plan, it is very likely that Kane borough was in the renewal process for this permitted discharge, as the current permit expires at the end of September, 2016. Kane Borough was contacted for comment, but expressed a desire to not be involved with this report. LPB 9.6.16