

# Shades Creek Coldwater Conservation Plan

*Bear Creek Township, Buck Township  
Luzerne County*

December 2016



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S h a d e s   C r e e k   C o l d w a t e r   C o n s e r v a t i o n   P l a n

Eureka_Manta_2	V6.98	17151965						
DATE	TIME	Temp_deg_C	pH_units	SpCond_uS/cm	HDO_mg/l	HDO_%Sat	TurbDig_NTU	
2/19/2016	13:00:00	1.25	6.45	42	13.99	100.5	1.5	
2/20/2016	1:00:00	1.62	5.97	41.3	13.6	98.8	1	
2/20/2016	13:00:00	3.82	6.04	40.7	12.77	98.4	1	
2/21/2016	1:00:00	2.9	6.06	40.9	13	97.7	1.2	
2/21/2016	13:00:00	3.83	6.14	40.4	12.75	98.3	0.9	
2/22/2016	1:00:00	3.36	6.15	40.9	12.86	97.9	1	
2/22/2016	13:00:00	4.19	5.95	40.4	12.73	99.1	0.7	
2/23/2016	1:00:00	2.46	6.01	41	13.29	98.8	0.7	
2/23/2016	13:00:00	2.87	6.05	40.6	13.2	99.2	0.5	
2/24/2016	1:00:00	2.8	6.04	54.6	13.11	98.3	0.7	
2/24/2016	13:00:00	3.69	6.06	49.8	12.67	97.3	0.8	
2/25/2016	1:00:00	4.17	5.76	46.5	12.38	96.3	72.4	
2/25/2016	13:00:00	3.86	5.54	46	12.49	96.3	5.9	
2/26/2016	1:00:00	2.57	5.65	42.9	13.07	97.4	12.9	
2/26/2016	13:00:00	3	5.76	42.6	13.06	98.5	1.7	
2/27/2016	1:00:00	1.77	5.8	41.8	13.54	98.8	1.6	
2/27/2016	13:00:00	3.13	5.85	41.3	13.06	98.8	1	
2/28/2016	1:00:00	2.44	5.87	41.1	13.21	98.1	1	
2/28/2016	13:00:00	4.68	5.88	40.5	12.44	98.1	1.1	
2/29/2016	1:00:00	3.73	5.9	41	12.61	96.9	1.1	
2/29/2016	13:00:00	4.64	5.94	40.6	12.34	97.1	0.8	
3/1/2016	1:00:00	3.95	5.95	41.3	12.63	97.7	0.9	
3/1/2016	13:00:00	5.12	5.98	40.7	12.36	98.5	0.7	
3/2/2016	1:00:00	5.12	5.99	41.1	12.03	95.9	0.9	
3/2/2016	13:00:00	4.86	6.03	41.7	12.34	97.7	0.9	
3/3/2016	1:00:00	2.31	6.05	41.3	13.28	98.3	0.7	
3/3/2016	13:00:00	2.49	6.08	40.9	13.36	99.3	0.6	
3/4/2016	1:00:00	2.12	6.07	41.2	13.36	98.4	0.5	

The temperature ranged from 1.25-5.12°C, which is normal for this time of year; further monitoring during the summer months would provide a more complete picture of the temperature range. The pH ranged from 5.54-6.45 and was in agreement with the data collected by Wilkes University. This range is typical for the Pocono plateau as the freestone geology provides little buffering capacity. This pH level is within the tolerable range for trout. Continued monitoring with the sonde will allow NLT to track pH levels and detect if the stream is becoming dangerously acidic.

The average specific conductivity was 42.3 uS/ cm. This is in agreement with measurements taken by Wilkes University. This measurement of the ability of water to conduct an electric

current provides insight on the total dissolved ionic compounds in the water, such as sodium or other metals from pollution and stormwater runoff. pH levels can influence specific conductivity as heavy metals become more soluble at a lower pH; this can increase specific conductivity and disrupt natural processes in freshwater ecosystems. Specific conductivity should be monitored throughout the year to monitor for spikes from possible threats such as salt brine runoff from winter road treatments.

Dissolved oxygen in Shades Creek averaged 98.1%. The amount of oxygen water can hold is determined by factors like temperature and pH. Algal blooms, which arise from high nutrient levels, can rob the water of oxygen and be detrimental to other species, especially trout. Collected readings indicate high dissolved oxygen levels.

The turbidity of Shades Creek is very low. The majority of readings were below 1.7 NTUs, which indicates almost no suspended solids in the water. Some spikes were noted during monitoring; these can occur from natural events such as storms. If the water is consistently turbid, the system is at risk of sedimentation which interrupts processes like photosynthesis and macroinvertebrate hatches in the stream. This will be important to monitor while construction projects for the Pennant pipeline continue.

Additional data from the Manta probe from June 16, 2016 through August 23, 2016 can be found in Appendix 4. The data conclusions above; the notable differences in values occurred during storm events or as a result of the change in seasons. At this time all data on Shades Creek indicates a very healthy stream.

#### Electro-fishing with Academy of Natural Science

In August of 2016, the Pennsylvania Fish and Boat Commission conducted an electrofishing survey on a 300-meter stretch of Shades Creek just downstream of Rt. 115 on the main stem of Shades Creek that is fed from Indian Lake. The survey focused on classifying Shades Creek as a trout stream. Brown Trout biomass was estimated to be 53.77 kg/ha (Class A) and Brook Trout was 10.17 kg/ha (Class C).

### Fish

Common Name	Scientific Name	CPUE # per 50 m (Single pass electrofishing)
White Sucker	<i>Catostomus commersonii</i>	19
Brook Trout	<i>Salvelinus fontinalis</i>	14
Longnose Dace	<i>Rhinichthys cataractae</i>	13
Margined Madtom	<i>Noturus insignis</i>	10
Brown Trout	<i>Salmo trutta</i>	7
Tessellated Darter	<i>Etheostoma olmestedi</i>	6
Pumpkinseed	<i>Lepomis gibbosus</i>	5
Golden Shiner	<i>Notemigonus crysoleucas</i>	3
Yellow Bullhead	<i>Ameiurus natalis</i>	2
Creek Chubsucker	<i>Erimyzon oblongus</i>	1
Fallfish	<i>Semotilus corporalis</i>	1

### Amphibians

Common Name	Scientific Name	CPUE # per 50 m (Single pass electrofishing)
Eastern American Toad	<i>Anaxyrus americanus</i>	1
Dusky Salamander	<i>Desmognathus fuscus</i>	1
Two-lined Salamander	<i>Eurycea bislineata</i>	3
Spring Salamander	<i>Gyrinophilus porphyriticus</i>	1
Bullfrog	<i>Lithobates catesbeianus</i>	1
Green frog	<i>Lithobates clamitans</i>	1

### Future Monitoring

Based on the sonde data, we may sample for specific pollutants. This data will help identify the source of pollution and other stressors to the system. Biological surveys will be completed in 100 meter stretches on the creek to investigate aquatic macroinvertebrates, amphibians, and fish species. These surveys will occur at locations near the monitoring sondes and can be used to help assess the health of the stream over the course of several seasons/years.

Bear Creek Community Charter School will be a local partner in the mission to protect our coldwater natural resource. NLT will work with the charter school to develop a core group of students. The school group will do macroinvertebrate sampling on a bi-annual basis, maintaining a database of macro-invertebrates on different sections of Shades Creek. They will be an integral part of monitoring the creek and will also learn more about why we are doing the project and the importance of conservation in the process.

### III. Stewardship Recommendations

Active management will help protect Shades Creek's water quality and maintain its status as a Cold Water Fishery.

## Water Quality

The purpose of this plan is to maintain Shades Creek's status as a Cold-Water Fishery and High Quality Stream. There are multiple factors directly impacting water quality including stormwater, stream bank stabilization, and presence of a riparian buffer.

### Riparian Buffer

The large forest tract surrounding Shades Creek acts as the riparian buffer. Currently the width is more than adequate to provide an effective buffer for most of the watershed. Some areas have been disturbed due to the ROWs and residential development. Riparian forests are important to the health of the stream as they provide a buffer from adjoining land uses that may generate runoff and cause erosion. They anchor streamside soils, and the root mass is capable of absorbing nutrients, such as nitrogen, that contribute to the eutrophication of surface water. Riparian woodlands provide shade to surface waters, supporting lower water temperatures and permitting a greater diversity of aquatic species to survive. They provide materials, such as twigs and limbs, that when submerged provide structures and shelters for a variety of fish and organisms. Leaves that fall from riparian trees provide food for aquatic insects that are in turn food for larger aquatic fauna.

The Stroud Water Research Center has found that streams bordered by woodlands have a greater width, lower water velocity, and greater benthic surface area than non-wooded streams. Dissolved nutrients, such as phosphorus and nitrogen, can be removed or absorbed by microbial communities attached to the bottom strata of streams, which in turn feed invertebrates, amphibians, and fish higher in the food chain. Non-wooded streams have a narrow channel with deeper, faster waters, and do not support the wealth of biotic life nor have the capacity to absorb or remove dissolved nutrients.

To ensure the functionality of the riparian buffer, the health of the forest should be maintained and improved as necessary. Further fragmentation should be avoided. While half of the watershed is part of Bear Creek Preserve and Pennsylvania Game Lands 91, and therefore protected in perpetuity, portions of the northern tracts of the watershed are unprotected and could be developed. This would have a significantly negative effect on the headwater streams and all downstream waters.

### Recommendations:

- Prevent fragmentation of riparian buffer, particularly in the sections not protected in the northern part of the watershed.
  - Contain development to areas that are already disturbed, and maintain current extent of the forest.
    - Work with landowners to explore possibility of conserving additional land through easements.
    - Work with townships to assess ordinances and update as needed.
- Improve forest health to maintain integrity of the buffer.

- Monitor annually for further colonization of invasive plants and address before new populations mature.
- **Japanese barberry** should be grubbed out or treated with a wetland approved herbicide such as Rodeo.
- **Japanese knotweed** can be treated by stem injection for small colonies or with a foliar treatment for large colonies. For areas that will be treated with foliar applications, stems can be cut to ground level during June and then allowed to regrow leaves before applying herbicide, approximately 8 weeks later between August and September. Properly dispose of all debris through drying and bagging.
- **Japanese stiltgrass** should be mowed or hand pulled in late summer or can be treated with glyphosate.
- Monitor treated areas to check for effectiveness of treatment and any regrowth, and reapply treatments as needed.
- Replant treated areas with native plants once the invasive plants are controlled.
- Continue deer management program within Bear Creek Preserve to control deer levels with full implementation of NLT regulations.
- Work with other landowners in the upper watershed and townships to implement a deer management program in the rest of the watershed.
- Monitor new plantings for deer browsing. Use fencing or tree tubes if browsing is noted. Consider constructing a deer enclosure for management and educational purposes.
- Apply pesticides on trees infested with gypsy moth.
- Apply pesticides between September and October or mid-late June to trees infested with woolly adelgid.

**Sources:**

National Audubon Society. *Cooling the Hot Spots, Protecting America's Birds, Wildlife, and Natural Heritage from Invasive Species*. 2003, <http://www.stopinvasives.org>.

Sweeney, Bernard, et.al.. *Riparian Deforestation, Stream Narrowing, and Loss of Stream Ecosystem Services*. Proceedings of The National Academy of Sciences of the USA, Vol. 101, No. 39, 2004.

**Stormwater Runoff**

While the riparian buffer is adequate throughout much of the watershed, there are areas where it is lacking, particularly around the headwaters. Pipeline ROWs and Rt. 115 cross Shades Creek and its tributaries at multiple points. Residential development in the headwaters area also has created gaps in the forest buffer. Stormwater flow through the ROW areas is not effectively filtered or slowed before reaching the waterways. This can result in contaminants reaching the water as well as streambank and channel scouring from high flows (see "Streambank Erosion" section below).

Rt. 115 and Indian Lake Trail contribute multiple problems to water quality, including fragmentation as discussed above. Roadside trash can be an issue if it is washed into the stream during storm events. Salt and anti-skid solutions can also be washed into the stream and affect water chemistry. Constructed wetland systems can be used to detain and treat contaminated runoff in appropriate sites. The local conservation district should be consulted to determine if there are areas where a wetland system would be beneficial.

Residential development in the upper watershed poses similar problems. Trash from residential areas can also reach waterways and impact wildlife. Improperly disposed household products, such as oil or paint strippers dumped onto the ground, can reach the waterways through stormwater runoff or groundwater contamination. Outreach to community members can help them understand what actions may affect water quality and explain ways to protect their watershed.

#### Recommendations:

- Work with ROW owners to plant shrublands or meadows where possible.
- Consult the local conservation district about the effectiveness of a constructed wetland system to treat road runoff.
- Work with townships to hold trash clean-ups with local residents.
- Reach out to community members in the watershed through mailers, workshops, and township events to educate them about stormwater runoff and reducing household pollutants.

#### Streambank Erosion

Streambank erosion is occurring north of Rt. 115. This part of the watershed has more development and fragmentation of the forest buffer, which can contribute to higher intensity stormwater flow and streambank erosion. Based on the extent of the damage, the local Conservation District should be consulted to determine if any engineering solutions are required or if replanting may be sufficient.

#### Recommendations:

- Consult the local Conservation District to determine best options for remediation.

#### Dams

Dams, particularly manmade ones, may have an impact on fish populations. A major threat to trout from dams is thermal pollution; there is also potential for thermal pollution from Indian Lake. The water that pools in these areas can have elevated temperatures compared to the rest of the watershed. Higher temperatures can affect the diversity and population density of macroinvertebrates and fish. Surface water released from these dams can have an impact on downstream waters as well by elevating water temperature. This is of particular concern during summer months when water temperatures are already high. Temperatures of about 68°F-72°F or higher are typically lethal to adult Brook Trout, though ideal conditions for feeding and spawning are between 43°F-53°F. A compounding issue caused by dams is the inability of



downstream populations to migrate to cooler upstream tributaries, subjecting them to higher, and potentially deadly, water temperatures.

Though no fresh beaver activity has been observed, their presence has been noted. Beavers have constructed 3 dams along the upper stretches of Shades Creek on State Game Lands (SGL) 91. All dams have been abandoned, most likely due to trapping, and beaver ponds / meadows now exist. The wetlands created are beneficial to ground water discharge, soil conservation, and aesthetic beauty. They also create habitat for many native wildlife, fish, and plant species. Ground water discharge is improved as these dams trap and store water and then gradually release the water by gravity and underground seepage. Beaver ponds improve soil conservation by entrapping streambed silt and eroding soil. In turn, this newly settled sediment provides conditions for aquatic, early successional plants, and woody vegetation to grow and provide floodplain stabilization. During flood events, these ponds prevent scour and washing of sediment downstream. In areas of extremely cold waters, such as Shades Creek, beaver ponds are beneficial to fisheries. They serve as rearing units for small fish as these ponds provide conditions favorable to higher plankton and micro organisms. The habitat created benefits a wide variety of wildlife, in particular waterfowl.

Water temperature, and other parameters such as dissolved oxygen, should be monitored within the vicinity of the dams and downstream. If elevated temperatures become a problem, dam removal may be necessary. The Army Corps should be consulted about dam removal.

**Recommendations:**

- Monitor water temperature for elevated levels during summer months.
- Monitor fish and macroinvertebrates for population changes, including condition.
- If negative effects are noted, consult the Army Corps about dam removal and reach out to landowners to notify them of any planned changes.

**Sources:**

Pennsylvania Council of Trout Unlimited. *Eastern Brook Trout of Pennsylvania: Roadmap to Restoration*. [http://www.patROUT.org/docs/referencematerials/easternbrooktroutrestorationroadmap.pdf?sfvrsn=2file:///C:/Users/vinton/Downloads/Beaver%20Management%20in%20Pennsylvania%202010-2019%20\(2\).pdf](http://www.patROUT.org/docs/referencematerials/easternbrooktroutrestorationroadmap.pdf?sfvrsn=2file:///C:/Users/vinton/Downloads/Beaver%20Management%20in%20Pennsylvania%202010-2019%20(2).pdf)

**Forest Health**

A healthy forest will continue to provide a riparian buffer for Shades Creek and enhance habitat for wildlife. Current threats to forest health include invasive plants, deer browsing, pests, and lack of regeneration of native plants.

Invasive Plants

Three main invasive plants were noted in the watershed: Japanese barberry, Japanese knotweed, and Japanese stiltgrass. These populations should be controlled through manual removal, mowing, or herbicide treatment. Invasive plants have been managed during past years

along the stream corridor of the Preserve. Annual inspections are required since established colonies of invasive plants are located upstream and seeds will travel downstream.

All herbicides used to treat knotweed along or near Shades Creek should be approved for wetlands and application should be done by a licensed operator following the product label instructions. Applications in wetlands during periods with standing water should be avoided; herbicides should be applied during drier times of the year. If application must be done during wet periods, a permit must be acquired from PA Fish and Boat Commission. Natural Lands Trust and the authors of this document are not liable for damages associated with misuse or improper application of herbicides. Where trade names are used no endorsement is implied.

In addition to treating current populations, the watershed should be monitored for other invasives moving into the area. It is easier and requires fewer resources to address new populations before they mature and spread.

#### Recommendations:

- Monitor annually for further colonization of invasive plants and address before new populations mature.
- **Japanese barberry** should be grubbed out or treated with a wetland approved herbicide such as Rodeo.
- **Japanese knotweed** can be treated by stem injection for small colonies or with a foliar treatment for large colonies. For areas that will be treated with foliar applications, stems can be cut to ground level during June and then allowed to regrow leaves before applying herbicide, approximately 8 weeks later between August and September. Properly dispose of all debris through drying and bagging.
- **Japanese stiltgrass** should be mowed or hand pulled in late summer or can be treated with glyphosate.
- Monitor treated areas to check for effectiveness of treatment and any regrowth, and reapply treatments as needed.
- Replant treated areas with native plants once the invasive plants are controlled.

#### Deer Management

Deer populations in this region have been increasing due to a loss of large predators, fragmentation of forests, and previously strict hunting limits (this policy has been changed to better control deer populations). High population levels pose a risk to conservation lands due to over-browsing of herbs, shrubs, and tree seedlings. Over-browsing can dramatically decrease structural and species diversity, creating a forest with little or no understory except for invasive plants. Invasive plants, which are not a preferred food source for deer, can take advantage of the newly opened spaces and disturbed soil to colonize an area.

Sustainable deer population levels are approximately one deer per 64 forested acres. Based on this estimate, the Shades Creek watershed can support approximately 85 deer. Currently, the

deer population is being controlled through a deer management program within Bear Creek Preserve, private hunting clubs, and State Game Lands 91.

Deer populations should be monitored to determine if there is any change in population or if further control efforts are needed. Monitoring deer populations can be done through population counts, fecal counts, and estimations from hunting takes. A more feasible approach is to monitor based on the condition of forested areas. A forest with well developed structural and species diversity of native plants has little deer impact, indicating a small deer population. A forest with little to no shrubs or understory has a high deer impact and indicates a large, unsustainable deer population.

Recommendations:

- Continue deer management program within Bear Creek Preserve to control deer levels with full implementation of NLT regulations.
- Work with other landowners in the upper watershed and townships to implement a deer management program in the rest of the watershed.
- Monitor new plantings for deer browsing. Use fencing or tree tubes if browsing is noted. Consider constructing a deer enclosure for management and educational purposes.
- Monitor forest health and browsing impact. If heavy browsing conditions persist despite deer management program, consider hiring a sharpshooter to decrease population levels.

Pests and Disease

Gypsy moths favor oak trees, but will feed on the foliage of many trees, including conifers in the watershed. Though only about 20% of trees suffer mortality on average, there is potential for higher die offs. Forest defoliation from the Gypsy moth destroys wildlife habitat, increases the risk of wildfire, and affects water quality.

Mortality can change the forest composition, with resistant plants becoming more prevalent. A virus and a fungus have been impacting gypsy moth populations, though not in numbers large enough to stop the spread of this pest. Identifying gypsy moths is fairly easy due to colors of caterpillars and adults as well as the distinctness of egg masses. Egg masses are fairly large compared to other insect eggs, making it possible to count masses in the Fall, predict Spring outbreaks, and plan accordingly if needed. Natural environmental factors help control Gypsy moths including a disease-causing fungus known as *Entomophaga maimaiga* and a large metallic green ground beetle known as *Calosoma sycophanta* which was introduced into New England from Europe. Other insects, such as oak leafroller, oak leaf tier, two lined chestnut borer, and oak sawflies, as well as pathogenic fungi such as oak wilt and Armillaria, can compound the impact of the Gypsy moth. Current control methods include pesticide applications.

The hemlock woolly adelgid is another pest of concern for the watershed. Woolly adelgid is a fluid feeding insect that feeds on hemlock tree and can cause high mortality levels. Treatment

options include spraying an insecticide between September and October to target overwintering females or mid-late June for nymphs. Researchers are studying the effectiveness of predator beetles, and this may become an option for management in the future.

Recommendations:

- Apply pesticides on trees infested with gypsy moth.
- Apply pesticides between September and October or mid-late June to trees infested with woolly adelgid.
- Complete a woolly adelgid study to determine extent of impact and possible effects to the forest.

**Sources**

US Forest Service. *Gypsy Moth in North America*. 2003.

<http://www.fs.fed.us/ne/morgantown/4557/gmoth/>

[http://www.dcnr.state.pa.us/cs/groups/public/documents/document/dcnr\\_005626.pdf](http://www.dcnr.state.pa.us/cs/groups/public/documents/document/dcnr_005626.pdf)

Pennsylvania State University. *Insect Advice from Extension: Hemlock Woolly Adelgid*. 2016.

<http://ento.psu.edu/extension/factsheets/hemlock-woolly-adelgid>

Fragmentation

Forest fragmentation will negatively affect water quality through reduction of the forest buffer, as described above, and will impact habitat for many important species. The Cerulean Warbler has been experiencing a population decline over the last 50 years, losing approximately 74% of their total population since 1966. Ceruleans Warblers depend on interior, deciduous forest for habitat. They breed in mature hardwoods either in uplands or along streams. Loss of such habitat will further imperil the species. Fragmentation also creates more edge, which is readily colonized by invasive plants, and allows open-habitat bird species like the Brown Cowbird to enter forests where it parasitizes other bird's nests.

The largest source of fragmentation in the watershed is residential development. Future development should be discouraged in forested areas and should be concentrated in areas that are already impacted. Pipelines, power lines, and Rt. 115 transect through the watershed a number of times fragmenting the forest.

Recommendations:

- Contain development to areas that are already disturbed, and maintain current extent of the forest.
  - Work with landowners to explore possibility of conserving additional land through easements.
  - Work with townships to assess ordinances and update as needed.

## Sources

The Cornell Lab of Ornithology. *Cerulean Warbler Bird Guide*.

[https://www.allaboutbirds.org/guide/Cerulean\\_Warbler/lifehistory#at\\_consv](https://www.allaboutbirds.org/guide/Cerulean_Warbler/lifehistory#at_consv)

## Forest Regeneration

Forest regeneration is negatively impacted by invasive plants and deer browsing. A low rate of regeneration can lead to canopy gaps and increased dominance by invasive plants. If regeneration rates are low, seedlings can be planted to help restore the forest layers. All plantings should be protected from deer with fencing or tree tubes.

## Recommendations:

- Control stressors, such as deer browsing and invasive plants, that suppress regeneration.
  - Monitor annually for further colonization of invasive plants and address before new populations mature.
  - **Japanese barberry** should be grubbed out or treated with a wetland approved herbicide such as Rodeo.
  - **Japanese knotweed** can be treated by stem injection for small colonies or with a foliar treatment for large colonies. For areas that will be treated with foliar applications, stems can be cut to ground level during June and then allowed to regrow leaves before applying herbicide, approximately 8 weeks later between August and September. Properly dispose of all debris through drying and bagging.
  - **Japanese stiltgrass** should be mowed or hand pulled in late summer or can be treated with glyphosate.
  - Monitor treated areas to check for effectiveness of treatment and any regrowth, and reapply treatments as needed.
  - Replant treated areas with native plants once the invasive plants are controlled.
  - Continue deer management program within Bear Creek Preserve to control deer levels with full implementation of NLT regulations.
  - Work with other landowners in the upper watershed and townships to implement a deer management program in the rest of the watershed.
  - Monitor new plantings for deer browsing. Use fencing or tree tubes if browsing is noted. Consider constructing a deer enclosure for management and educational purposes.
- Plant seedlings in areas with poor regeneration, particularly areas with canopy gaps. Protect plantings with tree tubes.

## Public Use

### Fishing

As fishing is allowed within the watershed, steps should be taken to protect the native brook trout. Over-fishing has contributed to population decline and should be curtailed to allow populations to rebound. A catch and release program should be implemented for Brook Trout in areas of the watershed north of the pipeline to improve population levels. This program

should follow the PA Fish and Boat Commission's regulations for trout catch and release fishing with all tackle. Fishing south of the pipeline should follow PA Fish and Boat's regulations for Commonwealth Inland Waters. While not regulatory or enforceable, further recommendations about best practices can be made to help protect Brook Trout. Barbless hooks should be recommended as they can reduce mortality in fish that are caught and then released. Live bait should be avoided as new species can be introduced into the stream if the bait escapes, thereby increasing competition for food and habitat for native species. Outreach efforts such as signage can be employed to encourage best practices.

#### Recommendations:

- Implement a catch and release program following PA Fish and Boat Commission's regulations in all waters north of the pipeline and in tributaries that feed into areas north of the pipeline (see "Fishing Regulations" map). Monitoring and enforcement should be done through a partnership with the PA Fish and Boat Commission.
- Follow PA Fish and Boat Commission's regulations for Commonwealth Inland Waters for all waters south of the pipeline.
- Restrict usage of live bait, particularly earth worms and minnows, through outreach efforts such as signage at fishing locations or Preserve entrance.
- Utilize presentations or signage to recommend best practices for equipment, handling, and release through outreach efforts to reduce fish mortality due to catch and release.

#### Trails

Trails should be maintained regularly and monitored for erosion. Eroded trails should be rerouted to prevent stream sedimentation. The trail system should also be monitored for social trails, as these can impact sensitive areas and species.

#### Recommendations:

- Monitor trails for erosion and social trails.
- Reroute eroded trails. Clearly mark closed sections with signage, fences, or vegetative barriers.
- Close social trails as they are found by blocking with fencing or vegetation and replanting the trail section.

#### Unwarranted Use (ATVs, predation)

Unwarranted use includes wildlife predation and illegal ATV use. Illegal wildlife predation is of concern for timber rattlesnakes; though they have recently been delisted as a species of concern, hunting of the species is still regulated. Clear policies regarding take and enforcement of policies will help protect populations. Illegal take may also become a concern for brook trout if a catch-and-release policy is enacted. Again, monitoring of fishing will be important to enforce this policy. Partnering with the PA Fish and Boat Commission would help enforce regulations.

ATV use is a noted problem along the ROWs which fragment the forest. Planting these areas with shrubs will make them harder to navigate with vehicles. Increased monitoring of the area will also curtail this issue.

Leave No Trace signage throughout the watershed, such as that found at Bear Creek Preserve, can encourage people to be considerate visitors and discourage negative uses through education. Signs should be used at public entrance points to the forest or streams.

#### Recommendations:

- Increase monitoring and enforcement for illegal take of important species.
  - Options for monitoring and enforcement may include motion-sensor cameras in sensitive areas, posting signage notifying visitors about the regulations, and consulting the Pennsylvania Fish and Boat Commission or Bureau of Forestry about enforcement.
- Implement a catch and release program following PA Fish and Boat Commission's regulations in all waters north of the pipeline and in tributaries that feed into areas north of the pipeline (see "Fishing Regulations" map). Monitoring and enforcement should be done through a partnership with the PA Fish and Boat Commission.
- Plant shrubs as permitted within ROWs that are being used by ATVs. Contact utility companies for permission.
- Monitor areas used by ATVs with motion-sensor cameras.
- Use Leave No Trace signage to encourage responsible use of the watershed and discourage illegal take of wildlife.

### Climate Change

Climate change is a large uncertainty facing the environment that could potentially have many negative impacts. Numerous climate models analyzing varying emissions rates predict that Pennsylvania will get warmer and wetter. Based on high and low emission scenarios modeled by the International Panel on Climate Change, temperature could increase by approximately 2.5°F in the next decades and between 2-5.5°F by mid century. By the end of the century, average temperature is predicted to increase between 4-8°F during winter months and 5.5-11°F during the summer. Precipitation could increase 5% by mid century and by the end of the century increase 12%. Most of this increased precipitation is predicted to occur in the spring and fall, potentially causing more short term droughts during the summer. Days above 90°F per year are expected to increase, which will further increase the risk of droughts.

As the climate changes, habitat regions will shift north, possibly as much as 350-500 miles. The rate of change and distance will affect species' ability to migrate with or adapt to any changes. Some species such as oaks may experience an increase in suitable habitat in PA, while many others, such as black cherry trees and numerous birds will face a shifting and decreasing habitat availability (Union of Concerned Scientists 2008).

# Coldwater Heritage Partnership Budget Report

Organization: Natural Lands Trust, Inc.

Grant Amount: \$5,000

Contract Dates: February 2015 - September 2016



Items	Description	Estimated Expenses		Actual Expenses			
		CHP Grant Cost	Organization's Cost	CHP Grant Cost	Organization's Cost		
			Cash	In-Kind			
Professional Services/Labor	Water Samples \$50 each			\$1,000.00		\$500.00	
	Coord. of partners 40hrs @ \$11.15			\$500.00		\$1,115.00	
	Writing of the plan (80hrs @\$25)	\$2,000.00		\$2,000.00		\$400.00	
Travel	Mileage (\$.56/ mile @ 400miles)	\$230.00		\$217.45			
	Travel Expenses						
Equipment and Supplies	real-time sonde	\$2,670.00		\$2,769.90		\$109.70	
	pack of Whirl-Pak Bags			\$70.00			
	Data receiver and software			\$500.00		\$663.03	
Administrative	Office supplies (phone and ink)	\$50.00		\$35.00			
	mailing to community members	\$50.00		\$12.65			
Meeting/Rentals							
Other							
<b>Total</b>		<b>\$5,000.00</b>	<b>\$0.00</b>	<b>\$2,105.00</b>	<b>\$5,000.00</b>	<b>\$772.73</b>	<b>\$2,015.00</b>

Initial and Date

*KB* 3/11/17