

COLDWATER CONSERVATION PLAN

**Sobers Run in Bushkill Creek Watershed
Bushkill Township, Northampton County, Pennsylvania**

2005



Prepared for:

Bushkill Stream Conservancy

Prepared by:

F. X. Browne, Inc.

Funded by:



**Coldwater
Heritage Partnership**

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INTRODUCTION

Purpose of Study

The implementation of the Sobers Run Coldwater Conservation Plan is a primary goal of the Bushkill Stream Conservancy (BSC) and many of our partners. Sobers Run is one of the largest tributaries to Bushkill Creek and its lower reach is a focal point within Jacobsburg State Park. The watershed of this exceptional stream begins along the Appalachian Trail atop the Kittatinny, or Blue Mountain, Ridge and is approximately 10 square miles in size. Vast wetlands and vernal pool areas form at the base of the Kittatinny Ridge, providing critical habitat for numerous rare, threatened, and endangered plant and animal species, including the federally listed bog turtle. In fact, nearly the entire headwaters area has been deemed as special protection areas by The Nature Conservancy within two areas known as Rissmiller's Woods and Knecht's Ponds. All of these wetlands and vernal pond areas form tens of rivulet streams which eventually feed two main branches that combine into a single channel within Jacobsburg State Park. All of these streams support reproduction of native brook trout and provide exceptional water quality, habitat, and recreational values. The goal of the proposed project is to upgrade the level of protection of all of these waterways and to protect their exceptional values from land-use change impacts.

The historical land-use in the Sobers Run Watershed has been primarily agricultural, including both livestock and crop farming, with some residential areas at the base of the Kittatinny Ridge. The vast wetlands and water resources in this headwater area to the larger Bushkill Creek, however, have historically discouraged farming practices within the wet, riparian areas, as well as residential development. Therefore, most of the riparian lands remained in tact as woodlands with minimal impact for logging and pasturing. Today, these riparian woodlands serve as highly valuable buffers for water quality and habitat impacts from a rapidly changing landscape.

Urban sprawl, population growth, and greatly improved transportation systems in recent years have shifted land-use throughout our region, converting the relatively poor agricultural lands within the upper portion of the Bushkill Creek Watershed into residential development. While the riparian woodlands contain regulated wetlands and waterways, the majority of these areas is commonly deemed as unregulated, poorly drained soils, allowing land development with a reasonable amount of earthmoving and filling. The result of such ongoing activities will be a tremendous loss of our riparian woodlands and the protection that they afford Sobers Run and Bushkill Creek.

Residential developments also impact the streams further with stormwater and treated wastewater discharges. To date, we have not had any wastewater discharges to Sobers Run, but stormwater discharges are an inherent part of every subdivision development. Additionally, direct impacts to the streams, wetlands, and vernal ponds are beginning to occur for the installation of roads, driveways, lot clearing, and other land development activities.

In an effort to control the level of impact to Sobers Run and Bushkill Creek, the Bushkill Stream Conservancy and its partners have engaged in three very significant projects in recent months, including development of the Sobers Run Coldwater Conservation Plan, development of a Greenways Plan, and the use of the Bushkill Township Official Map to provide protection of the remaining riparian woodlands with the entire watershed of Sobers Run and adjacent areas of the Bushkill Creek watershed. These initiatives all focus on the protection of Sobers Run, but additional measures are still required to maximize protection.

Being a relatively small tributary within the larger, well-known Bushkill Creek watershed, Sobers Run was never officially named, nor was it assessed by the Pennsylvania Department of Environmental Protection to gain its rightful status of Exceptional Value in the Pennsylvania

Code, Title 25, Chapter 93 Water Quality Standards. Rather, Sobers Run was classified in Chapter 93 as “High Quality – Cold Water Fishes” as part of the larger Bushkill Creek watershed, of which it is a part.

This plan and its recommendations include information and provisions necessary to maximize the protection of the coldwater fishery and exceptional water quality of Sobers Run, as well as to protect its riparian corridor from impacts associated with imminent land-use change and development.

Sport Fishing History

When considering the development of a Coldwater Conservation Plan for Sobers Run, one must certainly take into account the role of trout fishing for sport. Sobers Run has long been a special local sport fishery, especially for the keen flyfisherman looking to get away from the mainstream fishery provided along Bushkill Creek.

CURRENT FISHING REGULATIONS

Sobers Run

Managed as “Class A Wild Trout Waters”

Angler must have current PA Fishing License and Trout/Salmon Permit (if over 16-years of age)

Minimum length limit: 7-inches

Creel limit: 5

Season: Normal opening day (mid-April) to Labor Day

WATERSHED CHARACTERISTICS

Location

Sobers Run is located within the Bushkill Creek watershed (state water plan sub-subbasin 1F) within Bushkill Township, Northampton County, Pennsylvania.

More specifically, Sobers Run originates from a collection of spring seeps, wetlands, and vernal ponds at the base of the Blue Mountain Ridge in the northern portion of Bushkill Township, Northampton County. Two main branches form, known as the eastern and western branches, which join to form the main stem at the northernmost point of Jacobsburg State Park and Environmental Education Center. In total, Sobers Run flows in a southerly direction approximately 4 miles from its origin until it meets the Bushkill Creek within heart of Jacobsburg State Park. The main stem section is approximately 1.3 miles long, and the eastern and western branches are approximately 3.3 and 4.9 miles long, respectively.

Sub-watersheds

The Sobers Run watershed is approximately 9.5 square miles, representing approximately 11% of the total watershed area of the larger, 80 square mile Bushkill Creek watershed. The sub-watershed areas of the eastern and western branches of Sobers Run area approximately 3.9 and 5.0 square miles, respectively, with approximately 0.5 square miles draining directly into the main stem.

Sobers Run Bushkill Township, Northampton County

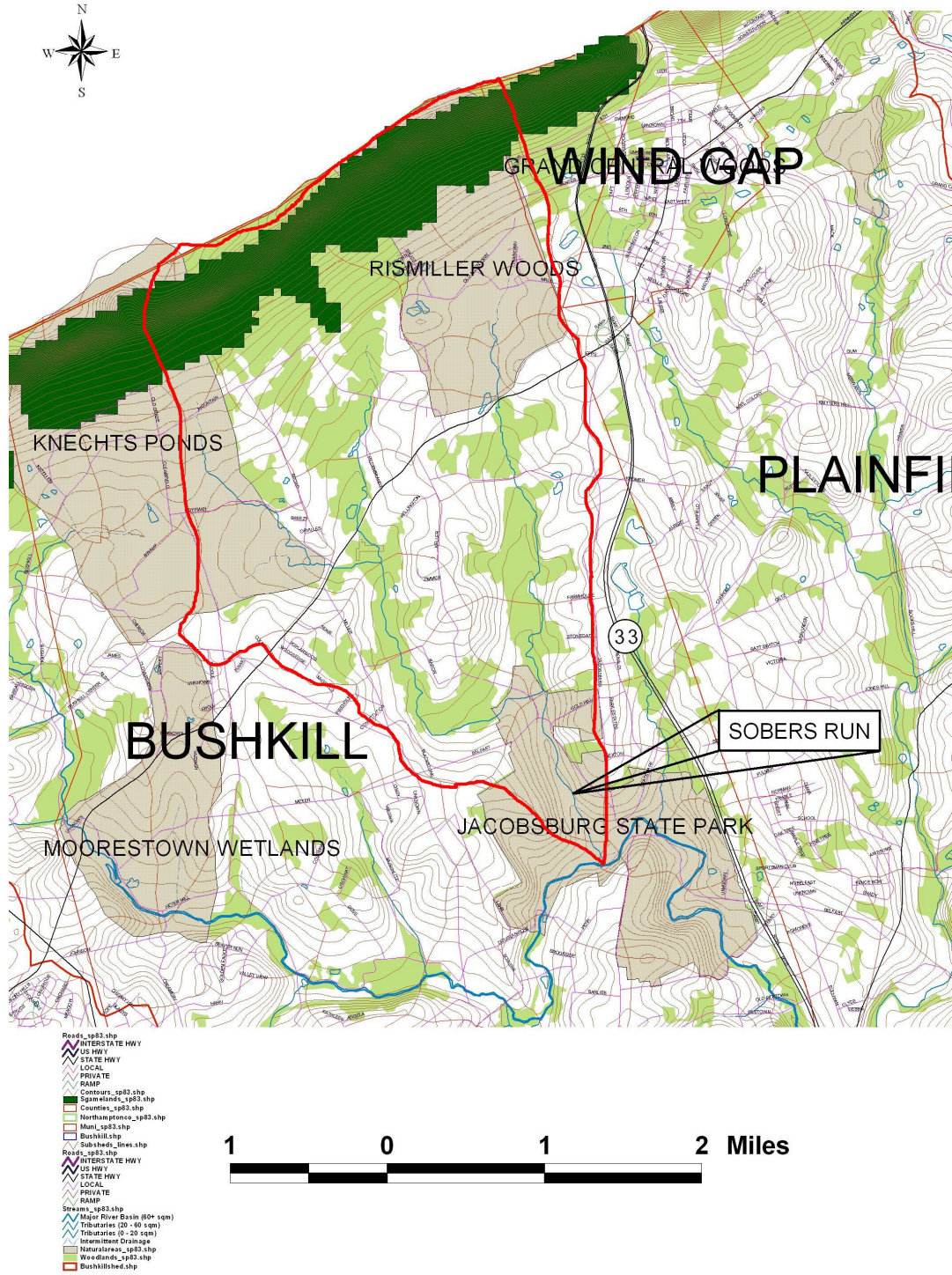


Figure 1

Sobers Run Watershed Map (base mapping from LVPC, 2004)

Ownership

The very headwater lands of the Sobers Run watershed are publicly owned State Gamelands (No. 168) along the Blue Mountain Ridge. The main stem of Sobers Run lies entirely within Jacobsburg State Park and Environmental Education Center. The two main branches of Sobers Run (commonly referred to as east and west branches), between Jacobsburg State Park and the State Gamelands to the north are entirely within privately owned land.

Most privately owned tracts are relatively large, as most have not yet been subdivided for development. According to township officials, most of the riparian landowners have a great appreciation for all that Sobers Run offers, and therefore, they do wish to not develop these lands. Old farms within the watershed, however, are currently being sold for development, as farming in the region is not profitable enough to compete with rising land values for development.

During the course of this project, a series of public meetings was held in partnership with Jacobsburg Environmental Education Center, Bushkill Township, and Bushkill Stream Conservancy. Presentations were given on various aspects of conservation and preservation specifically targeted towards the Sobers Run stream corridors which connect Jacobsburg State Park with the Blue Mountain Ridge to the north. The presentation series was advertised in local newspapers and in the Bushkill Township Newsletter, and individual invitations were extended to significant landowners. The outcome of the public meetings supported the fact that local homeowners and landowners generally supported the conservation and protection measures presented and discussed.

BIOLOGICAL STUDIES

Pennsylvania Fish & Boat Commission

The main stem of Sobers Run within Jacobsburg State Park and Environmental Education Center was electrofished in 1979. A 300 meter stretch north of the LR 48087 bridge produced 64 brown trout (*Salmo trutta*) with lengths between 75mm and 300mm, along with a diverse assemblage of other fish species listed in the following table:

FISH SPECIES OF SOBERS RUN (PAFBC, 1979)
Brook trout, <i>Salvelinus fontinalis</i> (reported)
Brown trout, <i>Salmo trutta</i>
Cutlips minnow, <i>Exoglossum maxillingua</i>
Common shiner, <i>Notropis cornutus</i> ,
Largemouth bass, <i>Micropterus salmoides</i>
Blacknose dace, <i>Rhinichthyys atratulus</i>
Longnose dace, <i>Rhinichthyys cataractae</i>
American eel, <i>Anguilla rostrata</i>
White sucker, <i>Catostomus commersoni</i>
Margined madtom, <i>Noturus insignis</i>
Tessellated darter, <i>Etheostoma olmstedii</i>
Creek chub, <i>Semotilus atromaculatus</i>
Redbreast sunfish, <i>Lepomis auritus</i>
Bluegill, <i>Lepomis macrochirus</i>

Pennsylvania Department of Environmental Protection

More recently, several strategically located stations on Sobers Run were sampled for macroinvertebrate assemblages. The results of this sampling effort are included as Appendix A. Macroinvertebrate species collected and identified included:

SOBERS RUN BENTHIC MACROINVERTEBRATE SPECIES*
BUSHKILL TOWNSHIP, NORTHAMPTON COUNTY, PA (PADEP, APRIL 19, 2005)

MAYFLIES		TRUE FLIES	
		Ceratopogonidae	<i>Probezzia</i>
Baetidae	<i>Baetis</i>	Chironomidae	<i>sp.</i>
Ephemerellidae	<i>Drunella</i>	Empididae	<i>Chelifera</i>
	<i>Ephemerella</i>		<i>Clinocera</i>
	<i>Serratella</i>		<i>Hemerodromia</i>
Heptageniidae	<i>Epeorus</i>	Simuliidae	<i>Prosimulium</i>
	<i>Stenonema</i>		<i>Simulium</i>
Isonychiidae	<i>Isonychia</i>		<i>Stegopterna</i>
Leptophlebiidae	<i>Paraleptophlebia</i>	Tipulidae	<i>Antocha</i>
			<i>Dicranota</i>
STONEFLIES			<i>Hexatoma</i>
Chloroperlidae	<i>Sweltsa</i>		<i>Limonia</i>
Leuctridae	<i>Leuctra</i>		<i>Tipula</i>
Nemouridae	<i>Amphinemura</i>		
Perlidae	<i>Acroneuria</i>	BEETLES	
Perlodidae	<i>Isoperla</i>	Dryopidae	<i>Helichus</i>
	<i>Remenus</i>	Elmidae	<i>Dubiraphia</i>
Pteronarcyidae	<i>Pteronarcys</i>		<i>Microcylloepus</i>
			<i>Optioservus</i>
CADDISFLIES			<i>Oulimnius</i>
Brachycentridae	<i>Micrasema</i>		<i>Promoresia</i>
Glossosomatidae	<i>Agapetus</i>		<i>Stenelmis</i>
Hydropsychidae	<i>Cheumatopsyche</i>		<i>Ectopria</i>
	<i>Diplectrona</i>	Psephenidae	<i>Psephenus</i>
	<i>Hydropsyche</i>		<i>Anchytarsus</i>
Hydroptilidae	<i>Stactobiella</i>	Ptilodactylidae	
Philopotamidae	<i>Chimarra</i>	MISC. INSECT TAXA	
	<i>Dolophilodes</i>	Cordulegasteridae	<i>Cordulegaster</i>
Polycentropodidae	<i>Polycentropus</i>	Corydalidae	<i>Nigronia</i>
Rhyacophilidae	<i>Rhyacophila</i>	Gomphidae	<i>Lanthus</i>

* Non-insect taxa included Cambaridae *cambarus*, Hydracarina sp., and Oligochaeta sp.

This sampling indicated that the uppermost reaches of the main stem of Sobers Run to its headwaters at the foot of the Blue Mountain Ridge qualified as Exceptional Value (EV) classification in Chapter 93 based on the biological criteria. Sampling at the other stations indicated that the primary tributary, locally referred to as the western branch of Sobers Run, and the remainder of the main stem of Sobers Run nearly qualified for EV classification, missing by only a few percentage points with the methodology used for the sampling date.

It should be noted that the PADEP sampling on April 19, 2005 was completed following severe weather and highly erosive streamflow conditions. Considerable bed scour was observed at the stations on the western branch tributary. Consequently, additional macroinvertebrate sampling following more stable and normal conditions may help to improve biological monitoring scores enough to qualify for the EV classification.

CHEMICAL STUDIES

Lafayette College

Lafayette College conducted a year long monitoring program on the main stem of Sobers Run within Jacobsburg State Park during 2000. Chemical data, along with limited physical data, are presented in the following table:

Summary of Water Quality Data for 2000

Sample Location	Sample Date	Anion Concentrations (mg/L)					Cation Concentrations (mg/L)						Field Parameters				
		F ⁻	Cl ⁻	NO ₃ ⁻	PO ₄ ⁻³	SO ₄ ⁻²	Li ⁺	Na ⁺²	NH ₄ ⁺	K ⁺	Mg ⁺²	Ca ⁺²	Temp. (°C)	pH	Cond. (uS/cm)	Turb. (NTU)	D.O. (mg/L)
7	3/18/2000	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
7	4/15/2000	0.04	9.53	10.06	ND	18.51	ND	4.10	ND	0.83	3.09	12.13	NA	NA	NA	NA	NA
7	5/24/2000	0.05	4.68	2.99	ND	16.10	ND	3.70	ND	1.13	2.64	12.32	NA	NA	NA	NA	NA
7	6/14/2000	0.04	5.84	5.22	ND	16.11	ND	4.37	ND	1.16	3.31	14.23	14.5	6.60	110	3	10
7	7/17/2000	0.04	6.79	4.73	ND	27.03	ND	4.41	ND	1.09	3.83	16.67	18.0	7.19	134	7	11
7	8/16/2000	0.02	7.10	13.10	ND	11.64	0.86	8.08	0.13	2.06	5.63	19.84	18.1	7.48	138	0.75	10
7	9/16/2000	0.04	6.10	6.44	ND	16.00	ND	5.16	ND	1.70	4.04	16.92	14.8	6.72	138	1.5	12
7	10/15/2000	0.01	6.53	10.38	ND	10.59	ND	3.96	0.06	1.17	4.00	14.72	15.9	6.90	140	0.7	10
7	11/19/2000	0.02	6.61	7.97	ND	19.30	ND	3.63	ND	0.99	3.82	15.06	4.5	7.20	140	0.5	12
7	12/18/2000	0.03	3.77	13.66	ND	20.81	ND	2.98	ND	1.54	3.18	13.25	2.0	7.30	124	8	14

NA = not analyzed
ND = not detected

Nutrient concentrations during the study period were relatively low with nitrogen and phosphorus at or near non-detect for all monitoring events. Other chemical parameters were also relatively low, with respectively little variability amongst seasons. Water temperature reached an observed maximum of 18.1°C during August, which is well below temperatures shown to be stressful for coldwater fish. Respectively, the dissolved oxygen remained very high, even during the most stressful summer months, with a minimum observed concentration of 10 mg/L which is several times higher than concentrations known to be stressful for coldwater fish. pH values were near neutral for all monitoring events, and both conductivity and turbidity values were relatively low and well within ranges for high quality and exceptional value streams in our region.

This article is the second in a series of articles on the major topics of concern in the Commission's theme, "Conserve 2000." This feature explains the global, regional and local aspects of the topic of fish habitat with the state fish, the brook trout, as the focal point. Because the brook trout is a Pennsylvania native, we can readily see the effects of human activity on this species and its habitat over several hundred years.

Habitat and the Brook Trout

by Walt Dietz

Have you ever caught a wild brook trout? If you have, you were probably awed by its orange belly, red spots and the green markings on its back. It's one of Pennsylvania's most colorful fish. But you probably didn't catch it just anywhere. Wild brook trout need the coldest and cleanest water, like that which flows in a small stream beneath a shady forest. Today, most of these shaded streams can be found only in the forested mountains. That's because much of our landscape has been opened up to agriculture and development. Can you imagine what the state might have been like 400 years ago? Pennsylvania was entirely forested then and nearly every stream had a wild brook trout in it.

Before the 1600s, wild brook trout were widely distributed throughout the state. They could be found in just about every watershed, including the Ohio, Allegheny, Susquehanna and Delaware. Pennsylvania provided the perfect habitat for the native brook trout because of the forests.

The area that became Pennsylvania includes nearly 29 million acres. Very few clearings could be found before the 1600s, except for those made by natural events or Native Americans. No wonder it was named Pennsylvania. "Penn," for William Penn, the Quaker leader who purchased the land from the Indians, and sylvania, which is Latin for "woods."

This blanket of forest was important to the health of streams and rivers. Tall hemlocks, white pine and a variety of deciduous trees shaded the valleys. Shade kept the water temperatures cold. Trees protected the banks from erosion. Gravel stream bottoms were clean and unsilted. There was plenty of food and shelter among the submerged tree roots. The conditions were perfect for brook trout survival and reproduction.

Changing landscape

The landscape changed when European settlers arrived and began to cut the forests in the 1600s and 1700s. This activity changed the habitat of the native brook trout. There seemed to be an endless supply of trees at that time. There were so many trees that the first settlers looked at the forests as a hindrance. They cut timber for fuel, homes, furniture and tools. Still, the early settlers hardly had an effect on the state's endless forest.

Large amounts of timber were not really cut until the early 1700s. Europeans had already overexploited their own resources. They sought to develop the New World and use its abundant

resources. Pennsylvania timber became a valuable commodity. It fed a growing country and a global economy, but not without consequences to our local forests and waters.

Shipbuilding was the first industry to take advantage of the state's trees. England needed timber to build ships, so the White Pine Act of 1722 was created. It reserved all the white pines for the British Navy. Lumber was used to make hulls. "Spars," long white pine logs, were used for masts. Can you imagine the size of a tree needed for the main ship mast? The minimum size was 96 feet tall and 15 inches in diameter at the top. A spar's size made it hard to transport. That's why the first trees to be cut were those closest to major riverbanks-not good for the health of aquatic habitats. The banks of eastern rivers like the Delaware and the Susquehanna became the first targets. Trees were felled by hand and the logs were pulled to the water by oxen. Logs were then floated to Baltimore and Philadelphia. Lumber and spars were shipped back to England and made into ships. Those ships were later used against America during the revolutionary war and for exploration of new frontiers. Imagine the importance that Pennsylvania trees had in the world's economy and history

Industrial heritage

The new country's population was growing in the early 1800s. And forest resources were needed to meet its demands. This is when large-scale timbering began. Wood became an important part of America's industrial heritage. The iron, tanning and lumber industries all relied on forests.

In the early 1800s, Pennsylvania became an important source of iron. Making iron required wood for charcoal. It was the fuel used to melt iron ore. Most of the forests had already been cut near the river valleys for the shipbuilding industry. So the mountainsides of central Pennsylvania became the next focus. Iron ore was present and trees were abundant. Iron furnaces were established and entire communities would be built up around them.

By 1860, there were 150 iron furnaces in Pennsylvania. They required over 1.5 million acres of trees per year. That's a lot of trees cut down to produce a lot of iron. This iron fed a growing nation and a growing world. That's right: Pennsylvania iron was an important part of the global economy. Take the small town of Axemann in Centre County, for example. It once produced iron ax heads that were shipped all over the world.

The landscape around iron furnaces was eventually stripped bare of trees. Only open clear cuts were left.

The tanning industry also relied heavily on the use of trees. Tree bark provided the tannin that was used to "tan" animal hides. The best source for tannin was the bark of eastern hemlocks. The best place to find plenty of hemlocks was northeast Pennsylvania. Counties like Monroe and Pike became the location of several important tanneries. Buffalo hides were brought from the West to these tanneries. By the mid-1800s, the Pocono region became the second largest leather producer in America. That's how places like Tannersville, in Monroe County, got its name. Eventually the areas around the tanneries also ran out of trees. By the 1800s, much of the landscape in northeastern Pennsylvania was deforested.

The lumber industry took advantage of the central portion of the state. This area was still heavily forested. But transporting large logs from these remote areas was a problem. The solution was splash dams. They were built on small mountain streams to impound and stop the flow of water. Trees were pulled to the empty streambed, the dam was opened and water pushed the trees to the next dam. Can you imagine the effect that splash dams had on brook trout habitat? The trees could be transported from remote areas to major rivers, like the Susquehanna and Allegheny.

Booms were constructed on the rivers to catch and hold the logs. Logs were then formed into huge "rafts" and floated downriver to Williamsport, Philadelphia, Harrisburg and even as far away as New Orleans.

Pennsylvania's lumber industry also had an important place in history. Take, for instance, Williamsport, which had many sawmills. It became the world's largest lumber producer by 1880.

Stream and river habitats

By the late 1800 to early 1900s, almost all areas of Pennsylvania had been cut at least once. Forest cutting up to this time was not really managed with sustainability in mind. Environmental effects were not considered. The effect of logging on streams and rivers was not even considered. Loggers would move on to a new area once the trees were cut. The result was that our stream and river habitats were degraded. So was the water quality. Without trees for shade, water temperatures rose. The higher temperatures became too stressful for brook trout. There was no vegetation to hold the soil. Erosion washed silt into prime spawning habitat. The silt covered the gravel and made it impossible for brook trout to reproduce. The aquatic insects that brook trout feed on could not survive. Shelter in the form of tree roots was lost. The result was that native brook trout populations were depleted from much of their original range.

Depleted fish populations brought about concern. The aristocracy of the New World enjoyed sport fishing, but there were no fish! Their solution to the problem was to stock new fish. There was little thought about restoring or improving habitat. They believed that stocking fish would bring back good populations. It also gave them an opportunity to duplicate the species that they once caught in their homeland -- Europe. So they brought in carp during the mid-1800s. Smallmouth bass were introduced from the Potomac River. They were released into the Delaware and Susquehanna rivers during the 1870s. Brown trout from Europe were introduced in the late 1800s.

Rainbow trout were eventually transferred from western North America to the East Coast. Brown, rainbow and brook trout were raised in hatcheries and then released into the wild.

Little did they know that they were providing a source of competition for the native brook trout. When they co-exist in the same habitat, brown trout compete with brook trout for resources.

Lessons from the past

Today things are much different. We have learned many lessons from the past. The way we go about managing and protecting Pennsylvania's forests and waters has improved. Forestry

practices have changed and many important habitat management methods have been learned over the years. Landscape ecology is evaluated before cutting forests. In most cases, forests are no longer clear-cut. Cutting rotations are ecologically based and managed more carefully. Timbered areas are replanted after trees are removed. Some mature trees are left standing to act as a seed stock for new trees. Vegetation buffers are left along streambanks and roads. Buffers minimize the effects of logging operations. These techniques result in healthier forests. They also result in better water quality.

The way in which we manage fisheries in Pennsylvania has also changed. The Fish & Boat Commission follows a plan for streams and rivers that are cold enough to hold trout. Waters are grouped as "wild" or "hatchery-supported." There are several criteria that fisheries biologist use. A wild trout fishery must also be able to sustain a naturally reproducing population of wild trout. It must provide adequate habitat. These waters are labeled "Class A Wild Trout Waters" and are not stocked. In this way, wild brook trout are managed more like a renewable natural resource.

Streams that cannot support wild trout are stocked with hatchery-raised trout. Stocking provides the opportunity for anglers to catch a trout, in a stream that would normally not allow them to reproduce on their own. Chances are there is a hatchery-supported trout stream only minutes from your home.

Riparian buffers

Habitat protection and enhancement play an important support role in fisheries management. A focal point for protecting and enhancing aquatic habitats is riparian buffers. A riparian buffer is a zone of trees and vegetation between water and an upland area. Riparian buffers are important to the health of a stream. They shade the water, stabilize banks and intercept surface runoff. Studies show that water temperature is 10 degrees cooler in streams that are lined with buffers. They purify runoff by trapping sediment, fertilizers and pollution. They even provide food in the form of leaf litter for aquatic insects. The insects in turn are food for forage fish and trout. Ultimately, we can improve fish populations if we protect and enhance riparian buffers.

The Commission, along with other agencies, also protects habitat through laws and regulations. People who want to alter a stream or river in any way must apply for a special permit. The request is reviewed to make sure that the habitat will not be degraded. The Commission enforces habitat protection laws that are broken.

The Commission is also involved with many stream and river enhancement projects through its Adopt-a-Stream Program. This program is one of the ways in which individuals and organizations can help. It's a cooperative effort that improves and protects aquatic and riparian habitats. The program provides assistance for those willing to donate time and effort toward waterway protection and enhancement. Projects might include fish habitat restoration, stream corridor management and stabilization projects.

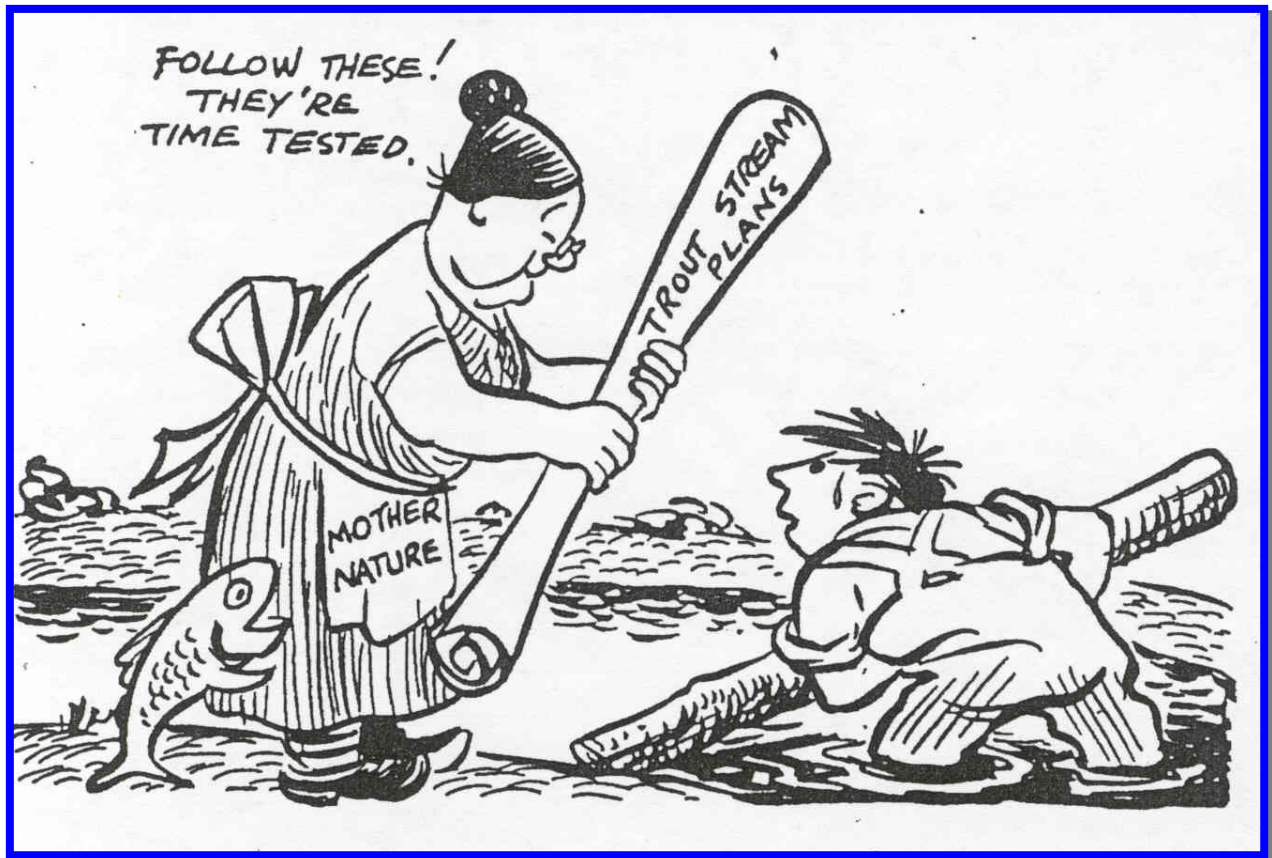
Environmental conditions in Pennsylvania are much improved. Our forests and waters have rebounded thanks to the efforts of many agencies, organizations and individuals. Hardwood forests now cover nearly 60 percent of the Commonwealth. These forests protect more than 25,000 miles of streams and provide clean water for aquatic animals. Around 13,000 miles of

streams are clear and cold enough to support trout. Wild brook trout populations have also improved. Their numbers and dispersal in watersheds isn't what it was before the 1600s. Nevertheless, they can once again be found over much of the terrain they once inhabited.

The above article by Walt Dietz provides good background information on what land-use conditions must have been like in the Sobers Run Watersheds.

General recommendations supported by the Pennsylvania Fish and Boat Commission for small wild trout streams like Sobers Run include:

1. The Pennsylvania Fish and Boat Commission should continue to manage Class A wild brook trout fisheries such as Sobers Run under conventional, statewide angling regulations with no stocking.
2. The Pennsylvania Fish and Boat Commission should continue to sample the wild trout populations to monitor the effects of stream sedimentation and low flow on trout abundance, and to learn more about natural variations in brook trout abundance.
3. Corrective measures should be taken to reduce man-related sources of sedimentation in the drainage basin. Stream sedimentation conditions have clearly worsened in recent years due to increased development with the Sobers Run watershed.
4. Efforts by Bushkill Township and the Pennsylvania Department of Transportation to address problems associated with runoff and erosion from roads adjacent to the stream through the Department of Environmental Protection's Dirt and Gravel Road Program should be pursued. Additionally, other drainage improvements and roadway management practices should be undertaken as necessary to prevent further sedimentation from roadways within the Sobers Run watershed.



CONCLUSIONS

1. Sobers Run, in its entirety, meets the regulatory criteria and definitions as an Exceptional Value stream under PA Code – Chapter 93. Portions of Sobers Run meet the biological and water quality standards, while other sections may only meet the definitions for having significant local resource value.
2. Sobers Run is not currently as well protected as it should be from future impacts of land-use change and development.
3. The greatest threat to Sobers Run is from imminent land-use change and development within its watershed. Stormwater runoff (quantity and quality) likely represents the greatest threat from such development.
4. The wooded riparian corridors along Sobers Run and its feeder streams and headwater wetlands protect the stream from thermal impacts by creating a dense shaded canopy. These riparian woodlands also help to filter pollutants from stormwater runoff from agricultural and urban land-uses in adjacent cleared areas. Therefore, the riparian woodlands should be protected to the maximum extent possible from degradation.

RECOMMENDATIONS

The following recommendations are made to best preserve and protect the Sobers Run as an exceptional value coldwater stream:

1. Upgrade Sobers Run to Exceptional Value classification under the Pennsylvania Code Chapter 93 Water Quality Standards regulations which will best protect the stream from both point and non-point source discharges, as well as to best control encroachments on the stream channel. Due to the lengthy petitioning process that is normally required to make such an upgrade and the extremely high rate of development and development pressures in the region, it is strongly recommended to pursue this upgrade through the local, Northeast Regional Office of the Pennsylvania Department of Environmental Protection (PADEP). This task should be completed by a partnership of Bushkill Stream Conservancy, Bushkill Township EAC/Supervisors, Jacobsburg Environmental Education Center, Lafayette College (physical and chemical data), Muhlenberg College (biological data) in conjunction with biologists at the Northeast Regional Office of PADEP. Supporting letters from the Lehigh Valley Greenways Initiative partners should be submitted to Fred Morrocco, Director of the Bureau of Water Supply and Waste Water Management, with copies furnished to the Secretaries of PADEP and Pennsylvania Department of Conservation and Natural Resources (PADCNR).
2. Educate riparian landowners and local citizens with regards to the resource value of Sobers Run. Such education will be a critical step towards achieving the necessary stewardship to protect Sobers Run into the future. This task should be completed by Bushkill Stream Conservancy, Bushkill Township EAC, and Jacobsburg Environmental Education Center.
3. Maintenance of trails within Jacobsburg State Park and the proposed trails connecting Jacobsburg State Park to the old rail line rights-of-way to the north (waterbars, blockades for vehicular traffic, limited use conditions, etc.). This task should be completed by Jacobsburg Environmental Education Center/State Park (maintenance crew), along with possible assistance by area mountain bike and equestrian groups and individuals.
4. Riparian buffer improvements along Sobers Run where buffers have been impacted by past clearing and development activities. This task should be completed through the direction and supervision of Bushkill Stream Conservancy and Bushkill Township EAC, as well as by respective landowners along Sobers Run. Grant funding for such projects should be sought under the Pennsylvania Growing Greener Program, Lehigh Valley Greenways Initiative, and other potential sources.
5. Educate landowners in the headwater areas about the vital role they play in protecting the headwaters wetlands, spring seeps, and vernal ponds that form and feed Sobers Run. This task should be completed by Bushkill Stream Conservancy, Bushkill Township EAC, and Jacobsburg Environmental Education Center.

6. Promote stream clean-up and habitat improvement projects through the “Adopt-A-Stream” project. This task should be completed by Bushkill Stream Conservancy, Bushkill Township EAC, and Jacobsburg Environmental Education Center.
7. Correct the numerous streambank erosion problems along Sobers Run using a combination of structural and bioengineering. This task should be completed through the direction and supervision of Bushkill Stream Conservancy and Bushkill Township EAC, as well as by respective landowners along Sobers Run. Grant funding for such projects should be sought under the Pennsylvania Growing Greener Program, Lehigh Valley Greenways Initiative, and other potential sources.
8. Bushkill Township should adopt the most feasible, stringent stormwater management regulations as part of their Act 167 stormwater management planning to protect Sobers Run from both water quality and quantity degradation problems. This task should be completed by Bushkill Township EAC/Supervisors with technical assistance from the Lehigh Valley Planning Commission.
9. Bushkill Township should make appropriate changes within their Subdivision and Land Development Ordinance (SALDO) and Zoning Ordinance, as well as other environmental protection ordinances to best protect Sobers Run from degradation. This task should be completed by Bushkill Township EAC/Supervisors with technical assistance from the Lehigh Valley Planning Commission.
10. The wetlands, vernal ponds, spring seeps, and other water features in the Sobers Run watershed should be mapped using hyperspectral imagery. This imagery may be used to create an invaluable Geographic Information Systems data layer that may be effectively used by the Bushkill Township Planning Commission and Environmental Advisory Council to review site development plans. This task should be completed by Bushkill Stream Conservancy through grant funds sought through the Pennsylvania Growing Greener Program, Lehigh Valley Greenways Initiative, and other potential sources.
11. Sobers Run should be monitored for all pertinent physical, chemical, and biological parameters. A minimum of three stations should be established; one on the main stem near the outlet into Bushkill Creek within Jacobsburg State Park, and one on each of the two main branches near their confluence at the northern most boundary of Jacobsburg State Park. Physical parameters should include temperature, flow (discharge), and dissolved oxygen. Chemical parameters should include phosphorus (dissolved and total), nitrogen series (ammonia, nitrate/nitrite, total Kjeldahl nitrogen, and total nitrogen), total suspended solids (and/or turbidity), pH, and conductivity. Biological parameters should include periphyton (attached algae), macrophytes (rooted aquatic vascular plants), macroinvertebrates (in accordance with EPA Rapid Bioassessment Protocol), and fish (every three to five years). Monitoring frequency should be monthly unless noted otherwise. This task should be completed by volunteer monitors from Lafayette College, Jacobsburg Environmental Education Center (working with other groups such as local high schools), Bushkill Stream Conservancy, Trout Unlimited, and the Retired Seniors Volunteer Program (RSVP). Chemical and physical parameters should be monitored by Lafayette College with assistance from RSVP. Macroinvertebrate monitoring

should be conducted by Jacobsburg State Park with assistance from local high schools and other groups. Periphytin and macrophyte monitoring should be completed by Bushkill Stream Conservancy volunteers and Jacobsburg Environmental Education Center staff. Fish surveys should be completed by qualified members of Trout Unlimited and Bushkill Stream Conservancy. Data produced should be entered and stored by Bushkill Stream Conservancy.

12. A fish survey should be completed on the two main branches of Sobers Run to confirm the reports of native brook trout, as well as to document the current fish assemblage. This task should be completed by qualified members of Trout Unlimited and Bushkill Stream Conservancy.
13. All 'greenways' identified on the Bushkill Township Official Map should be preserved through procurement of easements, purchase of development rights, and fee-simple purchase, amongst other possible means for land preservation. Additional environmentally sensitive lands within the Knechts Ponds, Rissmillers Woods, and Moorestown Wetlands natural areas, as well as other areas within the Sobers Run watershed, should be identified and targeted for preservation through similar means. Open Space funds are available through Northampton County and the Lehigh Valley Greenways Initiative, and possibly through Bushkill Township if their proposed Open Space Referendum passes on the November ballot. This task should be undertaken by Bushkill Township and the partners involved in the Lehigh Valley Greenways Initiative.

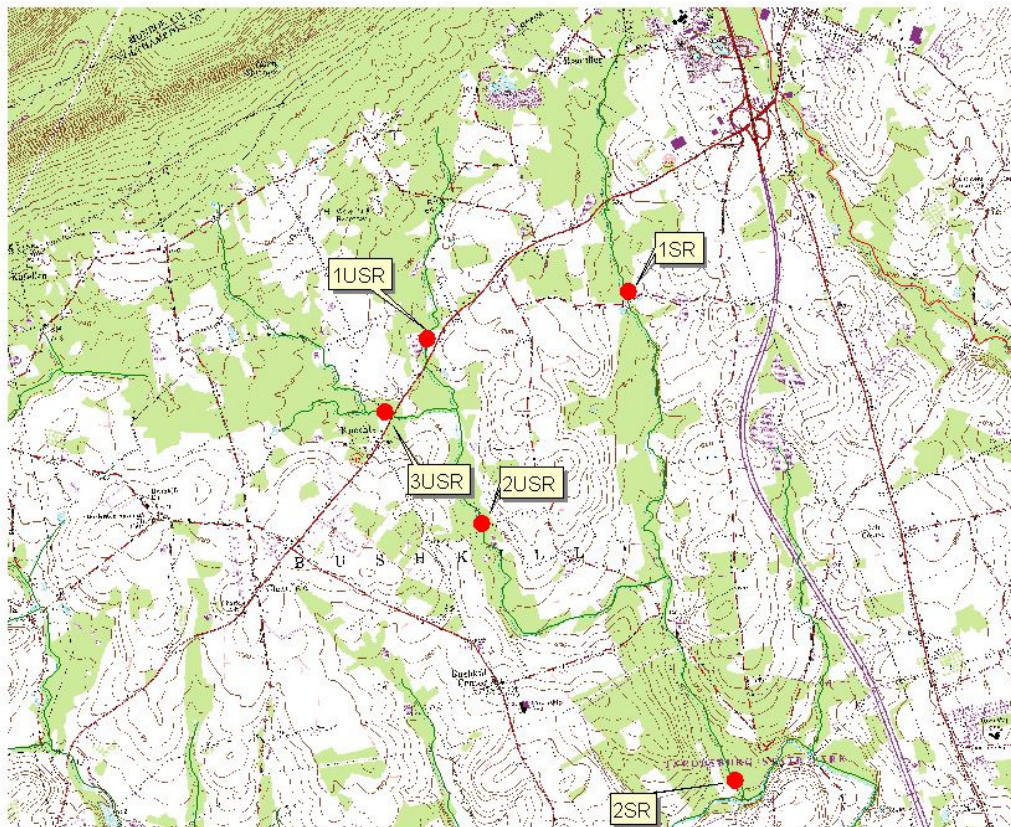
APPENDIX A

Sobers Run Macroinvertebrate Data **(Pennsylvania Department of Environmental Protection, 2005)**

TABLE 1
STATION LOCATIONS
SOBERS RUN BASIN SURVEY (01F)
NORTHAMPTON COUNTY

STATION	LOCATION
1SR	Sobers Run (04646): 40 meters upstream of T615 bridge crossing. Bushkill Township, Northampton County Lat: 40 49 14.9 Long: 75 18 40.9 RMI: 2.88 Date: 4/19/05
2SR	Sobers Run (04646): 25 meters upstream of footbridge near confluence with Bushkill Creek. Bushkill Township, Northampton County Lat: 40 47 9.7 Long: 75 18 11.3 RMI: 0.11 Date: 4/19/05
1USR	Unt Sobers Run (04647): 250 meters upstream of SR0512 bridge crossing. Bushkill Township, Northampton County Lat: 40 49 3.0 Long: 75 19 51.9 RMI: 2.46 Date: 4/19/05
2USR	Unt Sobers Run (04647): 15 meters upstream of T611 bridge crossing Bushkill Township, Northampton County Lat: 40 48 17.4 Long: 75 19 34.0 RMI: 1.46 Date: 4/19/05
3USR	Unt Sobers Run (04648): 25 meters upstream of SR0512 bridge crossing. Bushkill Township, Northampton County Lat: 40 48 47.7 Long: 75 20 3.4 RMI: 0.36 Date: 4/19/05
R1	Wild Creek (03959) reference station: 75 m upstream of SR1001 bridge crossing. Penn Forest Township, Carbon County Lat: 40 56 24.6 Long: 75 35 5.4 RMI: 6.38 Date: 4/19/05

FIGURE 1. SOBERS RUN STATION LOCATIONS.



**TABLE 2. SEMI-QUANTITATIVE BENTHIC MACROINVERTEBRATE
DATA AND RBP METRIC COMPARISONS:
SOBERS RUN WATERSHED, NORTHAMPTON COUNTY, APRIL 19, 2005.**

		1WC (REF)	1SR	2SR	1USR	2USR	3USR
MAYFLIES							
Baetidae	<i>Baetis</i>	15	14	12	4	12	14
Ephemerellidae	<i>Drunella</i>		2	35	5	8	1
	<i>Ephemerella</i>	24	43	49	20	15	35
	<i>Serratella</i>	2					
Heptageniidae	<i>Epeorus</i>	11	26	9	3	3	4
	<i>Stenonema</i>	5	1	9	6	8	1
Isonychiidae	<i>Isonychia</i>			1			
Leptophlebiidae	<i>Paraleptophlebia</i>	6	2			1	8
STONEFLIES							
Chloroperlidae	<i>Sweltsa</i>	1					
Leuctridae	<i>Leuctra</i>	6	2		1	1	1
Nemouridae	<i>Amphinemura</i>	10	3	6	22	20	32
Perlidae	<i>Acroneuria</i>	3		6	1	1	1
Perlodidae	<i>Isoperla</i>	12	1	4		6	9
	<i>Remenus</i>				1		
Pteronarcyidae	<i>Pteronarcys</i>	3	1				
CADDISFLIES							
Brachycentridae	<i>Micrasema</i>	1				4	
Glossosomatidae	<i>Agapetus</i>				2		
Hydropsychidae	<i>Cheumatopsyche</i>	6			4	7	
	<i>Diplectrona</i>	1	6			1	
	<i>Hydropsyche</i>	9	3	7	8	14	1
Hydroptilidae	<i>Stactobiella</i>					2	
Philopotamidae	<i>Chimarra</i>				4	3	
	<i>Dolophilodes</i>	12			1	1	
Polycentropodidae	<i>Polycentropus</i>	1					
Rhyacophilidae	<i>Rhyacophila</i>	6	6	6	3	5	5
TRUE FLIES							
Ceratopogonidae	<i>Probezzia</i>		1			1	
Chironomidae	<i>sp.</i>	41	69	34	60	54	92
Empididae	<i>Chelifera</i>		1		1	1	1
	<i>Clinocera</i>			1		1	
	<i>Hemerodromia</i>			3	3	1	1
Simuliidae	<i>Prosimulium</i>	1	3	2	26	7	3
	<i>Simulium</i>	3	35	16	36	12	3
	<i>Stegopterna</i>				1		2
Tipulidae	<i>Antocha</i>					1	1

	<i>Dicranota</i>	4	1				1
	<i>Hexatoma</i>	4	1	1			
	<i>Limonia</i>					1	
	<i>Tipula</i>		1				
BEETLES							
Dryopidae	<i>Helichus</i>					1	
Elmidae	<i>Dubiraphia</i>					1	1
	<i>Microcylloepus</i>			1			
	<i>Optioservus</i>		1			4	
	<i>Oulimnius</i>	6		2	1	6	14
	<i>Promoresia</i>	6	1	1	1	9	
	<i>Stenelmis</i>					1	
Psephenidae	<i>Ectopria</i>			1			1
	<i>Psephenus</i>		2	5			
Ptilodactylidae	<i>Anchytarsus</i>	4					
MISC. INSECT TAXA							
Cordulegasteridae	<i>Cordulegaster</i>	1					
Corydalidae	<i>Nigronia</i>	5	1				
Gomphidae	<i>Lanthus</i>	1	3	2		2	2
NON-INSECT TAXA							
Cambaridae	<i>Cambarus</i>			2		1	1
Hydracarina	<i>sp.</i>	1	1			1	
Oligochaeta	<i>sp.</i>			1	1	2	1
Subsample Size		211	231	216	215	219	236
T Rich.		31	27	25	24	37	26
score (c/r)		n/a	87%	81%	77%	119%	84%
bc score		8	8	8	7	8	8
mEPT		15	11	9	12	15	10
score (c/r)		n/a	73%	60%	80%	100%	67%
bc score		8	6	3	7	8	4
mHBI		3.13	3.70	3.03	4.15	4.11	4.10
score (c-r)		n/a	0.57	-0.1	1.02	0.98	0.97
bc score		8	8	8	4	4	5
%Dom		19.4	29.9	22.7	27.9	24.7	39
score (c-r)		n/a	10.5	3.3	8.5	5.3	19.6
bc score		8	8	8	8	8	2
m %Mayfly		22.7	32	47.7	15.8	16	20.8
score (r-c)		n/a	-9.3	-25	6.9	6.7	1.9
bc score		8	8	8	8	8	8
TOTAL SCORE		40	38	35	34	36	27
Comparison to Reference		n/a	95%	88%	85%	90%	68%
Ch 93 Designated Use		EV	HQ	HQ	HQ	HQ	HQ
Existing Use		n/a	EV	HQ	HQ	HQ	CWF

**TABLE 3. BIOLOGICAL CONDITION SCORING COMPARISONS,
SOBERS RUN WATERSHED, NORTHAMPTON COUNTY, APRIL 19, 2005.**

METRIC	STATIONS					
	1SR	2SR	1USR	2USR	3USR	R1
1. TAXA RICHNESS	27	25	24	37	26	31
Cand/Ref (%)	87	81	77	119	84	
Biol. Cond. Score	8	8	7	8	8	8
2. MOD. EPT INDEX	11	9	12	15	10	15
Cand/Ref (%)	73	60	80	100	67	
Biol. Cond. Score	6	3	7	8	4	8
3. MOD. HBI	3.70	3.03	4.15	4.11	4.10	3.13
Cand-Ref	0.57	-0.10	1.02	0.98	0.97	
Biol. Cond. Score	8	8	4	4	5	8
4. % DOMINANT TAXA	29.9	22.7	27.9	24.7	39	19.4
Cand-Ref	10.5	3.3	8.5	5.3	19.6	
Biol. Cond. Score	8	8	8	8	2	8
5. % MOD. MAYFLIES	32	47.7	15.8	16	20.8	22.7
Ref-Cand	-9.3	-25	6.9	6.7	1.9	
Biol. Cond. Score	8	8	8	8	8	8
TOTAL BIOLOGICAL CONDITION SCORE	38	35	34	36	27	40
% COMPARABILITY TO REFERENCE	95	88	85	90	68	N/A