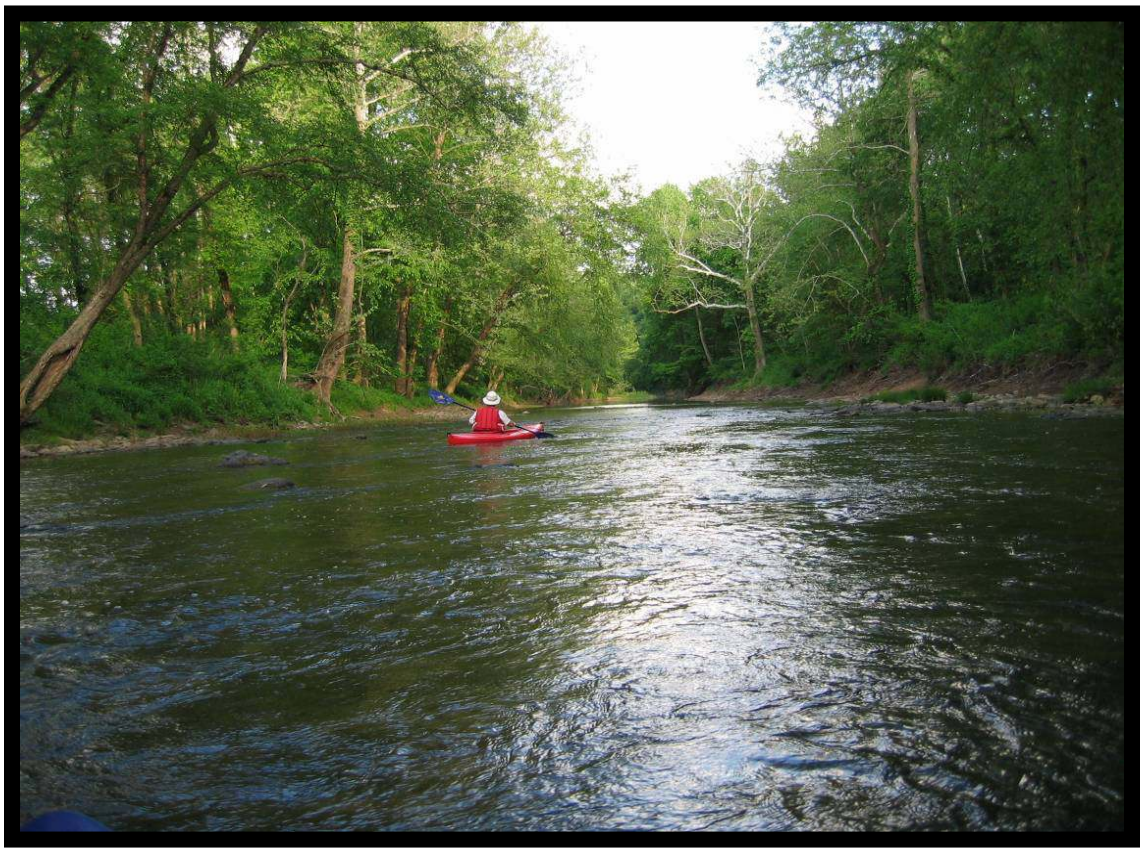
SLEEPY CREEK
WATERSHED ASSESSMENT

Morgan County, WV



Sponsored by:

Sleepy Creek Watershed Association

USDA Natural Resources Conservation Service

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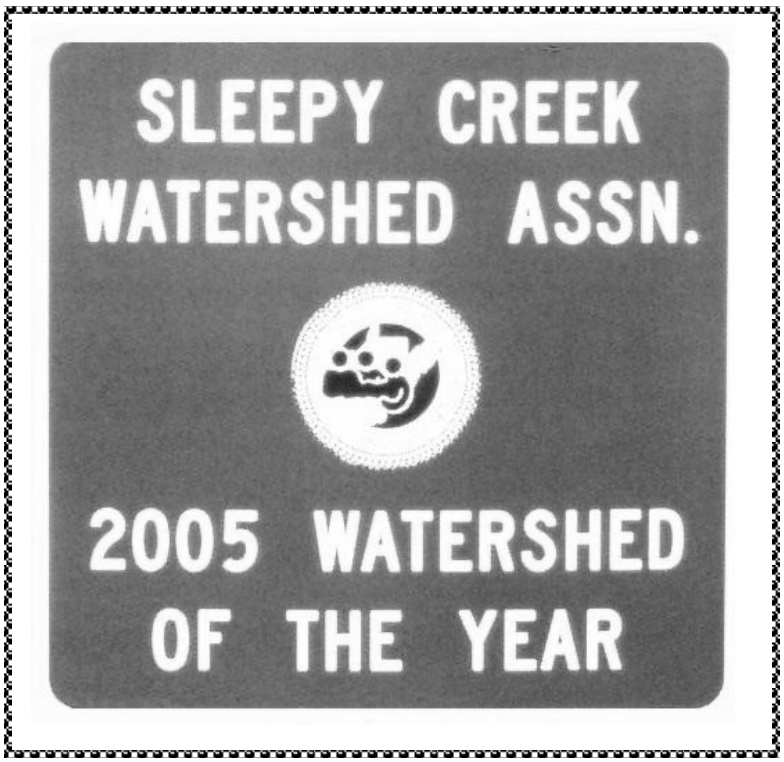

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INTRODUCTION

Sleepy Creek, a winding, picturesque stream in the Eastern Panhandle of West Virginia, flows 42 miles north into the Potomac River with the conjunction at the village of Sleepy Creek, West Virginia. Sleepy Creek is composed of the main branch, the Middle Fork and the South Fork which join in the area of Stotlers Crossroads. The Meadow Branch enters Sleepy Creek about three miles upstream from the mouth.

About half of the watershed area is forested, one third is in agricultural use, and the remaining area is residential or small commercial operations. Residential areas are primarily single family dwellings scattered throughout the area or in large lot subdivisions. Businesses are primarily located along the main transportation corridor of US Route 522. No incorporated towns are located in the watershed.

The boundary of the watershed is made up of three mountain regions; Cacapon Mountain is located to the west, Sleepy Creek Mountain along the Morgan and Berkeley County line, Third Hill Mountain to the east. The topography of the watershed is mainly mountainous with valleys throughout.

Figure 1: Main branch of Sleepy Creek.

WATERSHED AREA

The watershed system is composed of three main branches plus 194 smaller perennial and intermittent streams, which together have about 320 miles of flow path. This network of streams makes up the 93,000 acre Sleepy Creek Watershed. The watershed begins in Frederick County, Virginia, draining approximately 13,000 acres, and flows north into Morgan County, West Virginia where it covers 69,440 acres. The watershed ends at the Potomac River at approximately N39°40′ latitude and W78°05′ longitude.

Major Tributaries

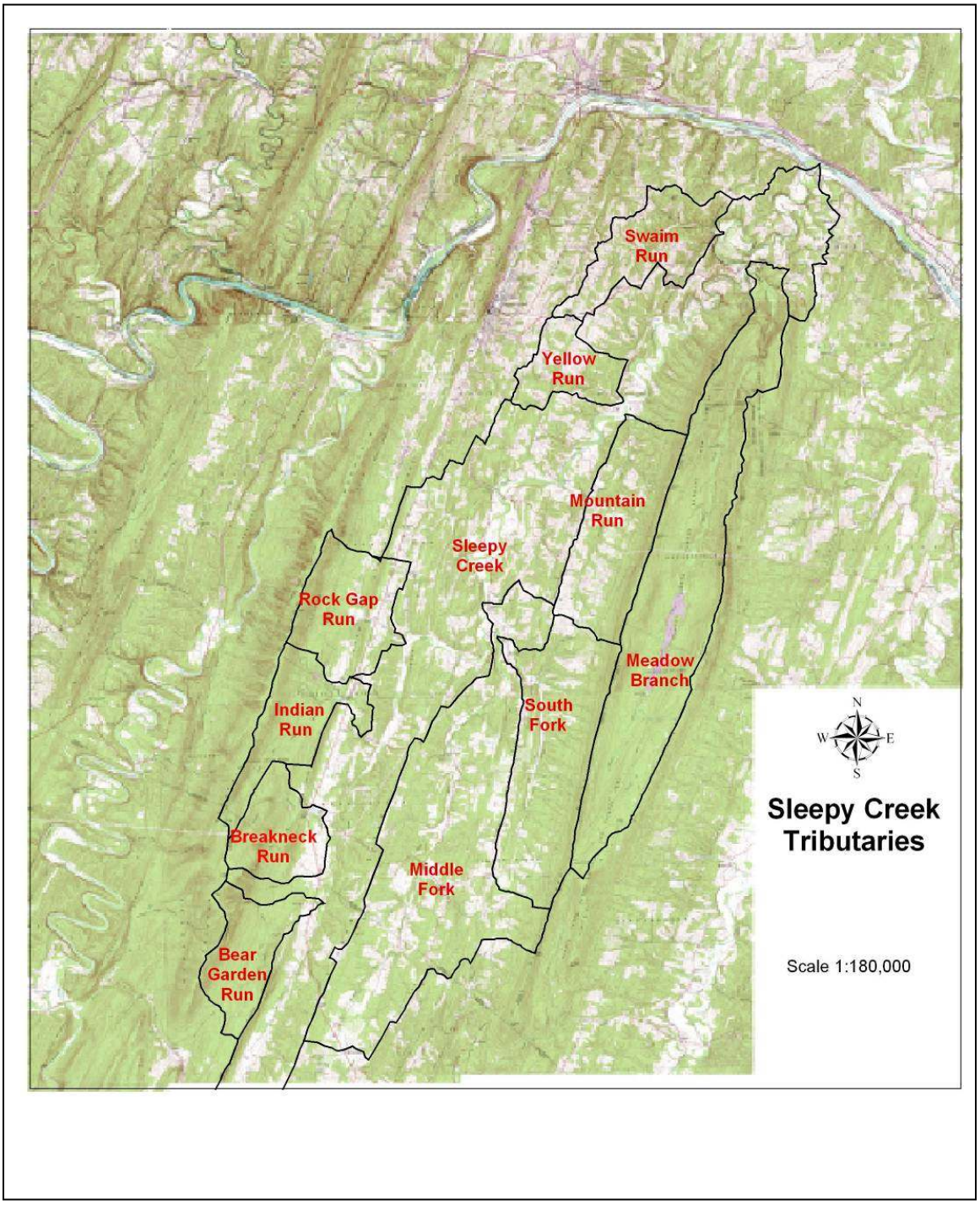
Most of the tributaries of Sleepy Creek are relatively small streams fed by shallow ground water from perched water tables with additional intermittent flow from storm runoff. Tributaries in the upper reaches of the watershed, most notably Indian Run and Breakneck Run, and Rock Gap Run are exceptions with ground water from spring flow consistently contributing base flow.

Meadow Branch, a sub-watershed on the eastern border of Morgan County, covers 12,800 acres in Berkeley County, West Virginia. The headwaters of Meadow Branch lie in the Sleepy Creek Wildlife Management Area, a public recreation area managed by the WV Department of Natural Resources. Most of this watershed is protected from development and has only controlled logging activity. It is comparatively pristine with the only potential contamination sources coming from wildlife.

Table 1: Sub-watersheds in the Sleepy Creek Watershed.

Sleepy Creek Sub-watersheds	**Estimated Watershed Area (Acres)**	**Hydrologic Unit Code**
Sleepy Creek	37,000	0207004140
Middle Fork of Sleepy Creek	15,500	
South Fork of Sleepy Creek	7,500	
Meadow Branch	12,800	0207004150
Mountain Run	5,500	
Indian Run	3,500	
Swaim Run	3,500	
Bear Garden Run	3,000	
Breakneck Run	2,700	
Yellow Run	2,000	
Total All acreages calculated using ArcGIS: 93,000 acres		

Figure 2: Subwatersheds in Sleepy Creek. Source USDA – NRCS Customer Service Toolkit



RESOURCE CONCERNS

The major threat to the watershed comes from residential and commercial development. Some agricultural practices may also contribute to stream degradation. Currently, the population in Morgan County is about 15,000 with growth recorded at a rapid pace of 24% for the last census period of 1990 to 2000.

Sleepy Creek Watershed Association (SCWA), incorporated under charter as a 501(c) 3 non-profit organization, is a volunteer citizens group whose purpose is to protect and preserve Sleepy Creek and its watershed, while involving and educating the public in the importance of the watershed and how to accomplish these goals.

Resource concerns for Sleepy Creek Watershed reflect the issues that are related to the major threats. A survey of the Sleepy Creek Watershed Association members was conducted in 2004.

Figure 3: Streambank erosion along the main branch.

Resource Concerns listed in order of priority:

1. Riparian Zones
2. Biodiversity
3. Threatened/Endangered Species
4. Development
5. Stream Bank Erosion
6. Wetlands
7. Soil Erosion
8. Water Quality

NATURAL RESOURCES

Geology

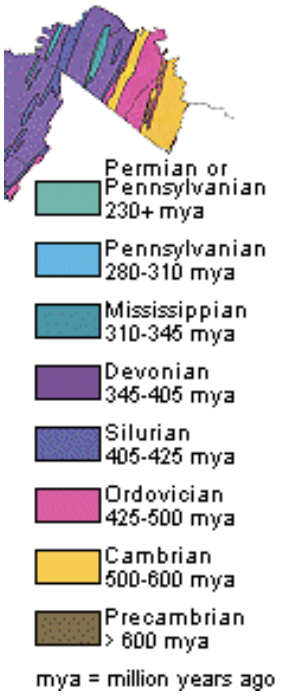
Physiographic Region

The terrain of Sleepy Creek Watershed is composed of mountains and valleys that lie in a southwest to northeast orientation, which is part of the Northern Appalachian Ridges and Valleys Physiographic Province. This province is characterized by a series of long, narrow mountains with caps made up of resistant sandstone and conglomerate, and valleys, made up of shale and a limited amount of carbonate rock.

Land Forms

The headwaters of the main branch of Sleepy Creek flow from the western slopes of Timber Ridge; the Middle Fork begins on the eastern side of this ridge, and the South Fork originates on the slopes of Sleepy Creek Mountain. Meadow Branch originates between Sleepy Creek Mountain and Third Hill. The dominant geologic structures are the Cacapon Mountain anticline, Pious Ridge syncline, Sleepy Creek anticline, Yellow Spring Run Fault, New Hope Fault, and Meadow Branch syncline.

Figure 4: Geologic ages



Source: WV Geological and Economic Survey

The landforms of this area clearly show the effects of uplift, folding, and geologic erosion. The valleys between the mountain ridges are underlain primarily by shale, which is relatively soft and easily eroded over time. The valleys are strongly dissected by small intermittent and perennial streams that form a trellis pattern. The ridgetops are usually broad and gently sloping to moderately steep. Side slopes are usually steep or very steep.

Rock Systems

The highly folded and faulted rocks of the watershed are all sedimentary in origin and were formed during the Devonian, Silurian, and Mississippian periods. The youngest rocks in the watershed are the Pocono Group Sandstones, which are members of the Mississippian geologic period. The oldest rocks are the Tuscarora sandstones which are Silurian age rocks. The Tuscarora sandstones have been folded into a well defined anticline that forms Cacapon Mountain. Rocks of the Devonian system are the most extensive in the Sleepy Creek drainage area and are exposed in wide bands east and west of Sideling Hill. They include the shales, siltstones and fine-grained sandstones of the Hampshire, Chemung, Braillier and Mahantango Formations.

Topographic Quadrangles

Topography maps produced by the US Geologic Survey place the watershed into the following quadrangles: Stotlers Crossroads, Glengary, Ridge, Cherry Run, Big Pool, Hancock, and Great Cacapon.

Figure 5: Typical folding of shale and sandstone bedrock in an exposed outcrop along the streambank.

Soils

Soil Formation

Soils are formed from the effects of time, climate, and living organisms on specific parent materials in relationship with the surrounding topography. Each of these factors modifies the influence of the others. Parent material and topography have produced the major differences among the soils in Morgan County. Climate and living organisms generally show their influence throughout broad areas over long periods. The influence of time on soil may occur over centuries as it does with leaching of minerals through the soil profile, or in relatively short intervals such as happens with floods or landslides.

Residual Parent Material

Most of the soils in Sleepy Creek Watershed were formed in residual material weathered from siltstone, shale, sandstone, or limestone. Residual material is the oldest parent material. Soils formed in residuum may or may not show a high degree of development. While these soils have had the longest time for the soil forming processes such as weathering to occur, the process may have been hindered by slope or by rock that is resistant to weathering. Soils formed in material weathered from hard sandstone show a very limited degree of development.

Figure 6: Weikert silt loam is a common residual soil.

Colluvium

Colluvium located on foot slopes, on toe slopes, and near the head of drainageways has moved downslope from residual soils. This material is younger than the underlying residual material, but the soil-forming processes have had a considerable amount of time to act on the parent material to form complex horizons within the soil profile.

Alluvium

The alluvial parent material on terraces and flood plains has washed from upland soils that formed in residual and colluvial material. The soils on the terraces are much older than the soils on the flood plains. They also are strongly leached and have a moderately well developed soil profile. The floodplain soils are the youngest soils in the county and exhibit weakly developed profiles.

Soil Properties

Soils react and respond differently to various uses. Soils properties influence agricultural and timber productivity as well as site selection and design of residential and commercial developments. Production of agricultural crops is related to chemical properties such as natural fertility, water holding capacity, and acidity as well as physical properties such as steepness of slope, amount of rocks, and the potential of topsoil for erosion. Soil properties affect building sites through properties such as soil wetness, flooding potential, corrosive potential to underground utility lines and pipelines, and permeability for waste water disposal or growth of plants.

Table 2 describes water features soils in the Sleepy Creek Watershed that have a high ground water table or are located in a floodplain. A high ground water table refers to a saturated zone in the soil. The depth is based mainly on observations of the water table at

selected sites and on evidence of a saturated zone, namely grayish colors or mottles (redoximorphic features) in the soil. A saturated zone that lasts for less than a month is not considered a water table. A complete list of soils and the extent of each soil mapping unit is in the watershed is found in Appendix A.

Table 2: Soils in Sleepy Creek Watershed with restrictive water features.

Soil Mapping Symbol	Soil Name	Depth of High Water Table Below Surface (Feet)	Flooding Duration	Flooding Frequency
AnB	Andover	0.0-1.5	None	None
Ba	Basher	1.5-2.0	Very brief	Occasional
BeB	Berks -Clearbrook	1.0-2.5	None	None
BeC	Berks -Clearbrook	1.5-2.5	None	None
BrB	Brinkerton	0.0-1.0	None	None
BuB	Buchanan	1.0-3.0	None	None
BuC	Buchanan	1.5-3.0	None	None
BxC	Buchanan	1.5-3.0	None	None
CrB	Clarksburg	1.5-2.5	None	None
CrB	Clarksburg	1.5-2.5	None	None
CvB	Clearbrook	0.5-1.5	None	None
Cz	Combs	3.5-6.0	Brief	Occasional
Dz	Dunning	0.0-0.5	Brief	Occasional
ErB	Ernest	1.0-3.0	None	None
ErC	Ernest	1.0-3.0	None	None
Ho	Holly	0.0-0.5	Brief	Frequent
HwB	Hustontown	1.3-2.5	None	None
Ln	Lindside	1.5-3.0	Brief	Occasional
Me	Melvin	0.0-1.5	Brief	Frequent
MhA	Monongahela	1.5-2.5	None	None
MhB	Monongahela	1.5-2.5	None	None
MhC	Monongahela	1.5-2.5	None	None
Pg	Philo	1.5-3.0	Very brief	Occasional
Ph	Philo	1.5-3.0	Very brief	Occasional
Ps	Pope	3.5-6.0	Very brief	Occasional
Px	Pope	3.5-6.0	Very brief	Occasional
Pz	Pope-Philo	3.0-5.0	Extremely brief	Frequent
SxC	Sideling	2.5-3.5	None	None
SxE	Sideling	2.5-3.5	None	None
SyE	Sideling	2.5-3.5	None	None
Ta	Tioga	3.0-6.0	Brief	Occasional
TyA	Tygart	0.5-1.5	None	None

CLIMATE

The climate of this region is semi-humid continental. The area has distinct temperature differences between the summer and winter seasons, with averages ranging from 85°F in the summer to 23°F in the winter. The average annual precipitation is about 38 inches, with the largest amounts occurring during the spring and summer seasons. The first frost of the year usually occurs in mid October, while the last frost occurs about mid to late April creating a growing season of about 182 days.

Temperature

The climate station at Cacapon State Park National Climatic Data Center COOPID 461324 and 466674, which has complete data since 1973 and limited information going back to 1948, recorded 26°F as the lowest temperature on January 21, 1985. In winter, the average temperature is 31.9°F and the average daily minimum temperature is 22.5°F. In summer, the average temperature is 71.7°F and the average daily maximum temperature is 83.3°F. The highest recorded temperature of 104°F by the Cacapon State Park climate station was on July 17, 1988: however, the station at nearby Martinsburg, which has a much longer record, recorded a temperature of 111°F on July 11, 1936.

Table 3: Average Temperature TAPS Station: CACAPON STATE PARK 2, WV1324 Start year - 1973 End year - 2000 Temperature: 28 years available out of 28.

Temperature (Degrees F.)

Month	Average daily maximum	Average daily minimum	Average	2 yrs in 10 will have:		Average growing degree days*
				maximum more than	minimum less than	
Jan	38.2	20.1	29.2	66	-8	23
Feb	42.7	23.0	32.9	72	0	45
Mar	51.7	30.1	40.9	82	8	141
Apr	63.2	40.0	51.6	88	22	352
May	72.8	49.7	61.2	91	32	650
Jun	81.0	57.6	69.3	95	41	875
Jul	85.2	62.6	73.9	98	47	1040
Aug	83.6	60.4	72.0	97	43	984
Sep	76.2	52.8	64.5	93	35	725
Oct	65.2	41.2	53.2	85	25	410
Nov	54.1	33.8	43.9	78	14	174
Dec	42.5	24.5	33.5	68	2	45
Yearly Average	63.0	41.3	52.2			5463
Extreme	104	-26		99	-10	

*A growing degree day is a unit of heat available for plant growth. It can be calculated by adding the maximum and minimum daily temperatures, dividing the sum by 2, and subtracting the temperature below which growth is minimal for the principal crops in the area (Threshold : 40.0 deg. F)

Precipitation and Weather Patterns

The average annual total precipitation is 38.66 inches at Cacapon State Park. Of this, about 25.28 inches, 65 percent, usually falls in April through October as rain. The growing season for most crops falls within this period. The heaviest one day rainfall recorded at Cacapon State Park was 5.04 inches on September 7, 1996. Thunderstorms occur on about 32 days each year, and most occur between May and August. The average seasonal snowfall is 22.7 inches. The greatest snow depth at any one time during the period of record was 32 inches recorded on January 8, 1996. On an average, 23 days per year have at least 1 inch of snow on the ground. The heaviest one day snowfall on record was 26.5 inches recorded on February 12, 1983.

The average relative humidity is about 55 percent during mid-afternoon. Humidity is higher at night, with averages at dawn of 80 percent in the winter and 90 percent in the summer. The sun shines about 60 percent of the time in summer and 40 percent in winter. Prevailing winds are variable depending upon location and local topography. In general, wind is from the south in most months, except in winter when northwest winds predominate. Wind speeds are usually highest from January to April, averaging about 10 miles per hour.

The tables below list temperature and precipitation data for the nearby Climate Information Station at Cacapon State Park.

Table 4: Average Precipitation by Month TAPS Station: CACAPON STATE PARK 2, WV1324 Start year - 1973 End year - 2000

Precipitation (Inches)

Average	2 yrs in 10 will have:		Average days with 0.1 inches or more	Average total snow fall
	less than	more than		
2.61	1.14	3.91	5	7.9
2.17	0.93	3.10	5	6.7
3.16	1.91	4.26	7	4.8
3.04	1.68	4.30	6	0.2
3.80	1.92	5.48	7	0.0
3.82	2.37	5.00	6	0.0
4.19	2.25	6.20	7	0.0
3.74	2.16	5.16	6	0.0
3.44	1.72	4.74	5	0.0
3.25	1.10	5.06	5	0.0
3.02	1.52	4.44	5	0.8
2.43	1.04	3.67	4	2.3
Average annual totals:				
38.66	29.63	44.09	68	22.7
Average number of days per year with at least 1 inch of snow on the ground: 23				

LAND USE

Land use within Sleepy Creek Watershed is mixed with over half in forest lands. Agricultural land and subdivisions make up the bulk of the remaining land use. Very little land is considered urban, although many residences are scattered throughout the area with many located on lots of two to ten acres in size.

Table 5: Land Use in the West Virginia portion of Sleepy Creek Watershed	**1979 (in acres)**	**2003 (in acres)**
Forest (Private)	38,605	29,655
Forest (Public)	8,950	8,966
Cropland and hayland	14,214	9,052
Pasture	6,240	1,207
Orchard	330	200*
Other agriculture (farmsteads, buildings, idle land, etc.)	2,625	1,800*
Urban, subdivisions, commercial, and industry (includes all subdivision area including area used for roads and right of ways)	990	8,000
Wetlands		1,900
Roads (1979 includes only federal and state roads, 2003 includes all roads including subdivision roads)	1,090	1,230
Non-agricultural (parks, utilities, and other miscellaneous land use)	2,434	2,450

Data for 1979 is from the *WV Agricultural Water Management Quality Plan June 1979*.
Data for 2003 is from Farm Service Agency farm reports.
* Estimated based on land use trends in Morgan County.

Figure 7: Typical land use patterns of interspersed woodland and agricultural land observed in the Sleepy Creek Watershed.

Forests

Forests protect watersheds, provide opportunities and settings for recreation and aesthetic enjoyment, serve as habitat for wildlife, and produce wood and other forest products. They have played a major role in the history and culture of this area.

Sleepy Creek Watershed is primarily forested. According to the 1979 "West Virginia Agricultural Water Quality Management Plan 208", forested land totaled 38,605 acres in the West Virginia portion of the watershed. Approximately 65% of the forested land is composed of pure hardwood species, 18% is mixed hardwood/pine and 17% of the watershed is pure pine. Over the years, forested land has been subdivided for use as large lot residential property.

From the mid 19th century through the 1950's the forests experienced heavy timbering. Since 1999 an average of 20 logging operations per year are undertaken in the West Virginia portion of the watershed. An average timber harvest is approximately 412 acres of which 113 are clear-cut. The clear cutting is done to create pastureland, area for residential development, or for forestry management purposes. About 15% of the forestland in the West Virginia area is being actively managed through the WV Forest Stewardship Program or a similar land tax assessment program designed to encourage managed timberland. Loblolly pine (*Pinus taeda*) is the species usually selected for replanting clear cuts since the 1980's. Prior to that time Virginia pine was the species of choice planted for the thriving pulp and paper industry. A lumber yard in Berkeley Springs managed by WestVaCo, a national paper company with a mill at Luke, Maryland, was the main trader consumer of small woodlot cuts of lower quality timber. Many older, closely spaced, strait row plantations of Virginia pine still dot the landscape of the watershed. These small monocultures are distinguished most often by a large number of wind throws, which are trees that have been uprooted because of the shallow root systems resulting from the close planting space.

Table 6: Recent logging activity in the Sleepy Creek.

Year	Acres Clear Cut	Acres Select Cut
2003	155	149
2002	59	244
2001	19	831
2000	301	80
1999	194	255
1998	34	232
Total	**762**	**1791**

Forest Decline

Throughout the years there have been several major threats that have contributed to the decline of forest health in the watershed. Threats from disease, insects, and invasive plant species complicated by severe weather have caused large scale changes in the watershed. In the late 1800's chestnut blight (*Cryphonectria parasitic*) a fungal disease, and Dutch elm disease eliminated the chestnuts and elms in the area. Several other species, such as pitch pine, once timbered, were unable to reestablish.

In recent decades infestations of Gypsy moth (*Lymantria dispar* L.), a voracious consumer of foliage in its larval stages, has attacked primarily oaks, although it will eat leaves from as many as 500 other hardwood species. The moth, a native of Europe and Asia, was introduced in Massachusetts in the late 1800's, as a potential silk producer. An aggressive insecticide spray program underwritten by the WV Department of Agriculture

was relatively successful at keeping the insect attack at bay on private lands. The public lands in the watershed, which did not benefit from the annual sprays lost many large oaks through the combination of insect infestation and droughts that occurred simultaneously. Recently the small hemlock wooly adelgide (*Adelges tsugae*) has invaded the area attacking the small hemlock population found in shady coves along streams. The insect is believed to be a native of Asia and feeds at the base of needles. A heavy infestation can cause death of the host in about five years, especially if other environmental stress is present.

Infestations of lower value tree species from Asia, such as tree of heaven (*Ailanthus altissima*) have been increasing. These trees are more common for several reasons. As areas are timbered nutrients are not recycled back into the soil. Natural soil fertility, typically low in the watershed, is further reduced from erosion and reduction of soil organic matter from the oxidation of carbon. Increased air pollutants such as nitrous oxide and sulfuric oxide contribute to trees unable to resist common diseases. Rainfall in the region is more acidic than in previous centuries. Acid rain and the limited buffering capacity of the soils in the watershed also affect forest soil productivity. Many invasive plants are more adapt at thriving on poorer sites and in spreading their populations through means assisted by humans.

Common species

Native tree species present in the watershed are typical of Appalachian hardwood and conifer re-growth forests.

Common native tree species found in abundance:

Red oak (*Quercas rubra*)
Black oak (*Q. velutina*)
White oak (*Q. alba*)
Chestnut oak (*Q. prinus*)
Scarlet oak (*Q. coccinea*)
Butternut hickory (*Carya cordiformis*)
Pignut hickory (*C. glabra*)
Shagbark hickory (*C. ovata*)
Tulip poplar (*Liriodendron tulipifera*)

Common conifer species:

Virginia pine (*Pinus virginiana*)
White pine (*P. strobus*)

Other native tree species found throughout the watershed:

Black locust (*Robinia pseudoacacia*)
Black cherry (*Prunus serotina*)
White ash (*Fraxinus americana*)
Sycamore (*Platanus americana*)
Silver maple (*Acer saccharinum*)
Red maple (*A. rubrum*)
Sassafras (*Sassafras albidum*)
Black gum (*Nyssa sylvatica*)

Other less abundant conifers:

Hemlock (*Tsuga canadensis*)
Pitch pine (*Pinus rigida*)

Agriculture

Agricultural land is the second largest land user in the watershed. Corn, wheat, hay, and pasture for beef cattle makeup the majority of the area's farmland. Some orchards are present but have experienced a significant decline in recent years. There are about 370 farm operating units in the watershed on record with USDA. These farm units have about 1,193 farm fields covering 10,260 acres with 9,050 acres of crop, hay and grazed hayland, and 1,200 acres of pasture. Today fewer farms cultivate large acreages of field crops and rely instead on quality hay as a cash crop sold to horse owners or as forage for livestock. While there are some smaller livestock such as llamas and goats, Angus and Hereford beef cattle herds are far more common.

Historical Agricultural Land Use

Before 1960, a majority of land less than 25 percent slopes was actively farmed. Major field crops included corn, wheat, and hay. Vegetables were grown on many farms with tomatoes and potatoes the most common produced for off farm sales. Several tomato canneries existed in the watershed and employed many seasonal workers. Apple and peach orchards were common, and local labor provided help with harvesting and packing fruit. Several dairy farms milking about 40 to 60 cows existed, and most farms raised beef cattle for market and hogs for home butchering.

Twenty-five years ago, according to the 1979 "West Virginia Agricultural Water Quality Management Plan 208", of the 23,400 acres listed as in agricultural production in the Sleepy Creek watershed 14,214 acres were in cropland and hay, 6,240 acres were used for permanent pasture, and orchards were found on 330 acres.

Annual tillage with a moldboard plow fractured structure, prevented organic matter accumulation, and increased sheet and rill erosion. Gullies, formed where water flow concentrated, were common on the rolling hillsides. As topsoil eroded, mixing of subsoil with topsoil created an increase in pH and lowered fertility in the rooting zone.

Conservation in the watershed increased with the formation of the Eastern Panhandle Conservation District in 1942. Many hillside diversion ditches constructed to slow runoff coming off of crop fields that were installed during the first years of the conservation district still exist throughout the watershed. Agricultural lime quarried and burned at several locations in the county supplied soil amendments to control soil acidity.

In the Sleepy Creek Watershed, the most fertile soils are found on the floodplain and stream terraces. These soils frequently have subsurface wetness. Old underground drainage systems, commonly called "tile" systems or shallow surface ditches running perpendicular to the streams known as bedding ditches, were installed from 1950 through 1980.

Ponds and springs were the most common sources of livestock water. Ponds were constructed in shale soils and were often installed with the help of USDA financial assistance programs available at the time.

Present Agricultural Land Use

Agriculture has seen a decline in the watershed as fewer residents pursue it as a primary source of income. A current summary of agriculture in the West Virginia portion of the watershed is shown in the following table.

Only one small dairy exists, and only one large orchard survives in the watershed. The remaining farms produce primarily beef cattle and hay. Field corn and silage corn are produced for on-farm feed. Wheat is grown in a crop rotation and usually interplanted with hay. Wheat grain is usually sold, and the straw is in great demand as mulch. High quality hay for horse farms is shipped to surrounding states and is one of the major crops now produced. One type of agriculture that has seen an increase in the number of farms in the last few years is that of fresh vegetables for direct marketing. A small but active farmers market exists, and many farms produce sweet corn for direct sales to the public.

Table 7: Current farm statistics in Sleepy Creek Watershed in Morgan County.	
Number of farm tracts	373
Average farm tract size in Morgan County	120 acres
Average amount of cropland and pasture per farm	27.5 acres
Number of farms with cropland	295
Amount of cropland acres	9052
Average crop field size	7.5 acres
Maximum / Minimum crop field size	56.5 acres / 0.3 acres
Number of farms with permanent pastures	68
Amount of permanent pasture	1207 acres
Average permanent pasture size	9.1 acres
Maximum / Minimum permanent pasture field size	42.4 acres / 0.5 acres

Data for the watershed was summarized using current records on file with USDA at the Martinsburg Field Service Center. This information is based on reports from agricultural producers and landowners that have participated in any USDA sponsored programs over the last 25 years. This information may not account for agricultural land converted to another land use within the last five years, and does not account for non-participants in USDA program. However, it is perhaps the most accurate count available due to the limitations of the National Agricultural Statistic Service, which is also used as a source of agricultural land use patterns.

Agricultural Productivity

Limited rainfall and shallow droughty soils are a challenge for long term productivity; however, with careful management these soils can produce good yields.

Agricultural productivity is dependent on soil type and management practices. Soils can be naturally fertile, or may need amendments applied to compensate for nutrient withdrawal by crops and to adjust acidity to a more neutral pH. Adding fertilizers and

manure to improve nutrient levels of phosphorus and potassium is common. Nitrogen levels are addressed on an annual basis through fertilizer application or through crop rotations that include a legume. Soil acidity is adjusted by adding some form of pulverized limestone, which may also be a source of calcium and magnesium.

To achieve maximum productivity for each soil type, management practices need to address erosion hazard from land disturbance on steep slopes, maximize infiltration of runoff, increase water holding capacity, improve drainage problems, and prevent competition for sunlight, moisture , and nutrients.

Figure 8: High quality hay is the most common crop in the watershed.

Erosion prevention includes dense sod or cross slope cultivation. Infiltration of precipitation and water holding capacity are intrinsic characteristics that increase with increases of organic matter. Drainage is altered through installation of systems that lower seasonal water tables or through fracturing of subsurface hardpans.

Today common conservation practices include crop rotations, limiting tillage operations, seasonal residue management, long term hay, rotationally grazed pastures, and fertility management.

Yields for agricultural crops grown in the watershed the most common soils are summarized in Appendix A.

Developed land

Increasing population growth has contributed to the major change of land use from agriculture and forestland to rural, residential subdivisions.

Subdivisions & Single Family Homes

According to the 1979 "West Virginia Agricultural Water Quality Management Plan 208", urban, commercial, and industry totaled 990 acres including interior roads. Today, there are about 95 subdivisions covering about 7,000 acres of land with over 2,300 lots located in the watershed. The majority of subdivision lots range from about 2.0 to 5.0 acres in size. Roads within these subdivisions total about 29 miles in length. A list of subdivisions is found in Appendix B. In addition to roads, it is estimated that there may be eight to 20 miles of driveways constructed to serve these lots.

Figure 9: New home construction in the watershed is experiencing an increasing rate as out of state contractors move into the area seeking undeveloped land.

Residential Ordinances

Morgan County's "Ordinance Regulating the Establishment of Real Estate Subdivisions" Section 10.8 outlines the regulations that deal with protecting water quality. If roads are included in the subdivision plan, the developer must submit an erosion control plan that meets the standards and specifications of the Eastern Panhandle Soil Conservation District. Inspections are done quarterly by the County Engineer to ensure compliance with the plan.

Morgan County also has an ordinance for stormwater management. Minimum control requirements state "stormwater management facilities shall control post-development levels for the 24-hour, 2-year- and 10-year frequency storms to a level equal to or less than the pre-development levels for the 24-hour, 2-year, and 10-year frequency storms, respectively, and shall pass the 24-hour 100-year frequency storm without damage to the facilities. Both the volume and rate of runoff shall be controlled."

Waste Water

The majority of houses and other facilities in Sleepy Creek Watershed use individual, on-site sewage treatment systems, usually referred to as septic systems. Traditional systems include a septic tank and drainage field sized by the number of bedrooms in a house and the permeability rate (commonly know as the perc rate) of the soil. Alternative systems are permitted on an infrequent basis and are usually used for retrofitting a failing system. Septic system failures are quite common and are frequently due to seasonal high water tables that occur in the shale soils. Regulations for wastewater management and treatment are overseen by the WV Department of Health and Human Services, Public Health Sanitation Division, and are found in "West Virginia Division of Health Legislative Rules" Title 64. Locally, the Morgan County Health Department oversees permitting and inspection of installation of septic systems.

Potable Water

Almost all residential drinking water is supplied by individual wells which pull their water from ground water found in the shales of the area. Wells are usually drilled from 120 to 400 feet deep and are cased about 40 to 80 feet. Current Morgan County Health Department Regulations require that the casing have grouting on the outside to prevent contamination from shallow ground water. The water yield of these aquifers can be quite low with a range of about 3 to 15 gallons per minute recharge common. Well drillers are certified by the WV Office of Environmental Health Services, Environmental Engineering Division with well permits for individual wells being issued by the Morgan County Health Department.

Commercial Development

Commercial development in the watershed is predominately small, scattered business that supports the tourist industry or provides services to residents. Common business enterprises include home builders and contractors, bed-and-breakfasts, and scattered retail shops. One of the single largest employers in the watershed is Tom Seely Furniture. The small solid oak and pine furniture manufacturer covers about ten acres. In 2001 they were recipients of the WV Business Environmental Leadership Award for achievements in pollution prevention.

Wildlife Habitat

Wildlife is abundant in the watershed. Some species such as whitetail deer, Canada geese and wild turkey are so populous that are considered a nuisance by many as they decimate crops and landscaping plants in search of food. Other formerly common species such as bobwhite quail and eastern bluebird have experienced large declines through loss of habitat. Habitat decline is primarily the result of land development pressures; however climate change and increase in invasive, non-native species may also contribute to alterations of the habitat.

Figure 10: Young beaver.

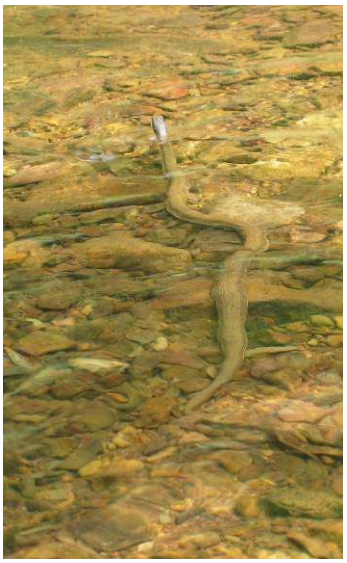


Figure 11: Common watersnake.

Figure 12: Wood turtle.

Figure 13: A native rhododendron commonly called pink honeysuckle.

Threatened and Endangered Species

Sleepy Creek Watershed is home to 23 rare species, which the West Virginia Department of Natural Resources has been monitoring over the past several years. The endangered wood turtle (*Glyptemys insculpta)*, which is found in only eight counties in West Virginia, is common in the main branch. Black minks (*Mustela vison)* are often seen. The endangered wildflower, Harperella (*Ptalimnium nodosum*), has also managed to survive in the creek as one of only 10 populations between Alabama and Maine.

Table 8: Rare species occurrence survey from 2004. (Source K. O'Malley, WVDNR)

Scientific Name	Common Name	Occurrences
Acris crepitans crepitans	Eastern Cricket Frog	2
Catocala herodias gerhardi	Pine Barrens Underwing	1
Coragyps atratus	Black Vulture	3
Coreopsis verticillata	Whorled Coreopsis	2
Euchlaena milnei	A Looper Moth	2
Glyceria laxa	Northern Manna-Grass	1
Glyptemys insculpta	Wood Turtle	6
Heterodon platirhinos	Eastern Hog-Nosed Snake	3
Liparis loeselii	Loesel's Twayblade	2
Neotoma magister	Allegheny Woodrat	2
Oenothera argillicola	Shale Barren Evening-Primrose	2
Pandion haliaetus	Osprey	1
Piptochaetium avenaceum	Blackseed Needlegrass	1
Potamogeton pulcher	Spotted Pondweed	1
Pseudacris triseriata feriarum	Upland Chorus Frog	1
Pseudotriton ruber	Northern Red Salamander	1
Ptilimnium fluviatile	Harperella	1
Pycnanthemum muticum	Blunt Mountain-Mint	1
Schoenoplectus purshianus	Weakstalk Bulrush	1
Solidago arguta var harrisii	Shale Barren Goldenrod	2
Sorex hoyi winnemana	Southern Pygmy Shrew	2
Sylvilagus obscurus	Appalachian Cottontail	1
Veronica scutellata	Marsh Speedwell	1

Mussels

A qualitative unionid (mussel) survey was conducted on the lower 25.2 miles of Sleepy Creek, Morgan County from its confluence with the Potomac River upstream to the confluence of the Middle Fork. The lower 0.9 mile of the Middle Fork was also surveyed and unionid concentrations documented. Data and site location information is provided in Table 9. Snorkel runs were made floating downstream unless otherwise noted. Numerous wood turtles (G*lyptemys insculpta*) were observed throughout Sleepy Creek and are indicated in Table 8. Eight species of unionids were observed in Sleepy Creek, although only four had greater than two individuals. Two specimens of *Lampsilis radiata* are new records for West Virginia.

Table 9: Mussel species found during summer 2004 survey in Sleepy Creek.

Scientific name	Common Name
Alasmidonta undulate	Triangle floater
Elliptio complanata	Eastern elliptio
Elliptio fisheriana	Northern lance
Lampsilis cariosa	Yellow lamp mussel
Strophitus undulatus	Squawfoot
Pyganodon cataracta	Eastern floater
Utter imbecillus	Paper pondshell
Lampsilis radiata	Eastern lamp mussel

Figure 14: Eastern floater.

Figure 15: Eastern lamp mussel

WATER QUALITY

Sediment

A major source of water impairment is sediment in runoff during storms. Sediment comes from soil disturbance activities that occur during construction, agricultural and logging activities, and from poorly vegetated areas that allow sheet erosion to occur. The USDA Natural Resources Conservation Service estimates that concentrated erosion that occurs during major soil disturbance can, if not controlled, generate 20 to 50 tons of displaced soil in a relatively short amount of time. Sheet erosion usually is on the order of 5 to 10 tons of soil per acre from areas like unpaved driveways, road banks, ditches, and overgrazed pastures and may continue for years. Mass erosion that occurs on streambanks can also contribute large amounts of sediment during storms that generate significant runoff.

Chemistry and Nutrients

West Virginia Department of Agriculture has collected data since 2002 from one location located at the point where Sleepy Creek flows into the Potomac River (See Appendix C).

Table 9: Sleepy Creek Water Quality Data (WV Department of Agriculture)

	Average	Median	Minimum	Maximum
pH	8.0	8.1	6.8	8.8
Temperature (C)	13.2	12.4	0	29.4
Conductivity	156.9	112.5	7.0	914.0
Dissolved Oxygen Probe	14.8	11.6	5.6	95.1
Suspended Solids (ppm)	6.7	1.5	0	41.0
Total Phosphorus	0.008	0.007	0	0.042
Total Kjeldahl Nitrogen	0.172	0.192	0.062	0.226
Total Nitrogen	0.483	0.507	0.290	0.640
Ammonia - N	0.095	0.075	0	0.324
NO_3 N	0.261	0.200	0	2.500
NO_2-N	0.002	0.001	0	0.011

Bacteria

West Virginia Department of Environmental Protection has a TMDLs (total maximum daily load) program, which identifies streams with pollution problems and develops a program specific to each stream to reduce or eliminate the pollution problem. WVDEP did not list Sleepy Creek or any of it's tributaries on the WV 303(d) list in 2002, but has collected TMDLs data and proposed seven sampling sites located along Sleepy Creek and two of its tributaries, Meadow Branch and Hands Run, for the 2006 TMDL list. The major impairment concern for these waterways is fecal coliform bacteria.

Table 10: Sleepy Creek TMDL Fecal Coliform Measurements (WVDEP)				
ANCode	**Mile Point**	**Stream Name**	**Date**	**Fecal Coliform Colonies**
WVP-9	26.7	Sleepy Creek	8/26/03	14000
WVP-9	35.6	Sleepy Creek	6/10/98	290
WVP-9	36.8	Sleepy Creek	6/10/98	560
WVP-9	37.0	Sleepy Creek	8/26/03	360
WVP-9-B	0.1	Meadow Branch	8/26/03	580
WVP-9-B	12.8	Meadow Branch	6/3/98	420
WVP-9-D	2.6	Mountain Run	6/10/03	220
WVP-9-E	7.0	Middle Fork/Sleepy Creek	6/10/98	230
WVP-9-E-1		South Fork/Sleepy Creek	6/4/98	280
WVP-9-G	0.6	Indian Run	8/26/03	2000
WVP-9-I		Hands Run	6/10/98	1100

Aquatic macro-invertebrates

Aquatic macro-invertebrates are good indicators of a stream's health. A technique that is used to determine a stream's health is known as the Save Our Streams' biological monitoring technique, which looks at four different categories of macro-invertebrates: shredders, collectors, scrapers, and predators. These are used to point out problems that may be occurring in the stream. The basic process of this technique, once specimens are collected, is to determine the number of different types of macroinvertebrates, the relative number of macroinvertebrates, and each type of macroinvertebrates' tolerance to pollutants. Once this is determined, a score is given to each sampling site, which is then placed into a category of unimpaired, gray zone, or impaired.

The current data that WVDEP has for SOS biological monitoring was conducted during 1998 and 2000 (See Appendix C). This information shows three locations within the watershed that are considered to be in the "gray zone".

Table 11:Sleepy Creek Macroinvertebrate Data (WVDEP)										
AN Code	**Mile Point**	**Stream Name**	**Date Sampled**	**Total Individuals**	**Percent of Two Dominant Taxa**	**Percentage of dominate two Chironomids**	**Percent Ephemeroptra**	**Number Total Taxa**	**Number Ephemerottera Taxa**	**WVSCI Score**
WVP-9	36.6	Sleepy Creek	5/29/02	237	80.59	42.62	50.21	20	9	65.99
WVP-9-B	0	Meadow Branch	6/3/98	205	61.95	30.24	39.51	18	7	66.34
WVP-9-E	7.0	Middle Fork	6/10/98	205	43.90	22.93	48.29	12	5	66.41

Stream Visual Assessment

Protocol

A grant from the WV Stream Partners Program provided funding for a visual assessment of Sleepy Creek. An agreement with Shepherd University Institute of Environmental Studies and Eastern Panhandle Conservation District provided oversight for data collection by a Shepherd student. The stream was surveyed on foot and by kayak, between May 17 and June 23, 2005, to pinpoint critical areas of bank erosion, obvious sedimentation, inadequate riparian buffers, and to locate the confluence of tributaries and drainageways for mapping. Sleepy Creek was mapped with data points established using Geographic Information System (GIS) technology and Global Positioning System (GPS) coordinates. A total of 308 points of reference were collected along 33.1 miles of the main stem. Maps were produced employing these data points on digital USGS 1:24,000 topographical base maps, along with satellite image layers (mrSIDS). A database of information about each location was developed, with nine maps covering the main stem of the watershed, linked with over 1000 digital photographs.

Assessment findings

In the lower portion of the watershed, the stream depth of the creek vacillated from shallow riffles to pools of about 18 to 60 inches. The width of the main creek varies little over its length, averaging 50 to 60 feet wide, except where it braids. The pattern of long swift reaches, shallow riffles and deep pools repeats on a regular basis. The bottom varies from broken chunks of shale with very little silt, to angled solid bedrock, to deep, slow moving, silty pools. Most of the creek is quiet and secluded with few houses in sight.

The southern half of the creek differs somewhat from the northern half. There are more farms, more roads, and more drainageways and tributaries entering in the southern portion. There is also more evidence of siltation in the upper reaches. Potential problems include direct livestock access to the creek, many road crossings and fords, and areas with inadequate streambank buffer zones. The southern creek alternates from 20 to 40 wide and 50 to 60 feet in width, excluding braided sections.

For the visual assessment the amount of sedimentation was not quantitatively measured. The location of the source was noted where possible, and the location where silt was deeply embedded in the main channel. When the substrate becomes embedded with silt, fish spawning grounds are impaired and habitat is lost for macrophytes essential to the natural stream ecology.

The bed substrate in Sleepy Creek is largely comprised of chunky slabs of shale, with large interstitial spaces for fish. Some reaches have severe sediment problems. Bank erosion is common in bends and where steep slopes are adjacent to the stream. Aquatic vegetation varies from areas with lush vegetation, to areas with a solid bedrock substrate and no vegetation at all.

The water was mostly clear throughout the length, with a few notable exceptions. A permitted sewage discharge near Smith Crossroads appears to impair the stream with nutrients from the effluent. This conjecture is based on the abundant growth of algae directly downstream from the discharge point. Several locations with evidence of direct access by livestock have a substantial amount of silt build up in the water. One other area where water clarity and siltation are a problem is where Breakneck Run enters Sleepy Creek carrying a long plume of sediment with it.

Figure 16: The endangered plant, Harparella.

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Figure 17: WVDOT Department of Highways representatives and Sleepy Creek Watershed Association President, Gale Foulds.

APPENDIX A

Table 12: Soils in Sleepy Creek Watershed.		
Map Unit Symbol	**Soil Series**	**Approximate Acreage**
AgB	Allegheny loam, 3 to 8 percent slopes	150
Ba	Basher fine sandy loam	450
BbC	Berks channery loam, 3 to 15 percent slopes, very stony	700
BcF	Berks-Calvin channery loams, 35 to 65 percent slopes	3650
BeC	Berks-Clearbrook channery silt loams, 8 to 15 percent slopes	1250
BkB	Berks-Weikert channery silt loams, 3 to 8 percent slopes	1000
BqF	Blackthorn very gravelly sandy loam, 35 to 55 percent slopes, rubbly	100
BrB	Brinkerton silt loam, 3 to 8 percent slopes	100
BuC	Buchanan gravelly loam, 8 to 15 percent slopes	3550
CbC	Calvin-Berks channery loams, 8 to 15 percent slopes	2200
CkF	Calvin-Klinesville channery loams, 8 to 15 percent slopes	12200
ClE	Calvin-Klinesville channery loams, 35 to 65 percent slopes	100
CrC	Caneyville silt loam, 25 to 35 percent slopes	50
CvB	Clarksburg gravelly silt loam, 8 to 15 percent slopes	750
Cz	Clearbrook-Cavode silt loams, 0 to 8 percent slopes	100
DrE	Combs fine sandy loam	3450
DsC	Dekalb-Rock outcrop complex, 15 to 25 percent slopes, rubbly	150
Dz	Downsville gravelly loam, 8 to 15 percent slopes	100
ErC	Dunning silty clay loam	550
HaF	Ernest silt loam, 8 to 15 percent slopes	750
HdF	Hazleton-Dekalb complex, 35 to 65 percent slopes, extremely stony	1950
HlF	Hazleton-Dekalb-Rock outcrop complex, 35 to 65 percent slopes, rubbly	1750
Ho	Hazleton-Lehew-Dekalb complex, 35 to 65 percent slopes, extremely stony	1050
HwB	Holly silt loam 1,	100
Ln	Hustontown silt loam, 3 to 8 percent slopes	50
LzD	Lindside silt loam	150
Me	Litz channery silt loam, 15 to 25 percent slopes	100
MhC	Melvin silt loam	1450
MrC	Monongahela silt loam, 8 to 15 percent slopes	50
MsE	Murrill gravelly loam, 8 to 15 percent slopes	500
Ph	Murrill loam, 15 to 35 percent slopes, extremely stony	1700
Px	Philo silt loam	600
Pz	Pope silt loam	400
Qm	Pope-Philo fine sandy loams	4
RgG	Quarry, limestone	150
SkF	Rock outcrop-Rough complex, 55 to 100 percent slopes	350
SnF	Schaffenaker-Rock outcrop complex, 35 to 65 percent slopes, rubbly	400
SyE	Schaffenaker-Vanderlip loamy sands, 35 to 65 percent slopes, very bouldery	5100
TyA	Sideling gravelly loam, 15 to 35 percent slopes, rubbly	200
WaC	Tygart silt loam, 0 to 3 percent slopes	1050
WkF	Weikert channery silt loam, 8 to 15 percent slopes	41550

Non-irrigated Yields by Map Unit

Yields commonly found in the Sleepy Creek Watershed under a good level of management without irrigation. Absence of a yield indicates that the soil is not suited to the crop or the crop generally is not grown on the soil.

Table 13: Yields of farm crops in the Sleepy Creek Watershed. (Source: USDA NRCS)

Map Symbol	Land Capability Class	Corn (Bushels/acre)	Grass-legume hay (Tons/acre)	Pasture (Animal Unit Months)	Winter Wheat (Bushels/ac)
AgB	2e	115	3.50	7.0	50
Ba	2w	120	3.50	8.5	50
BbC	6s	---	---	4.5	---
BcF	7e	---	---	---	---
BeC	3e	65	2.50	5.0	25
BkB	3e	70	2.50	5.0	30
BqF	7s	---	---	---	---
BrB	4w	90	2.50	5.0	40
BuC	3e	90	3.00	5.5	40
CbC	3e	75	2.50	6.0	30
CkC	4e	70	2.00	5.5	30
CkF	7e	---	---	---	---
ClE	7e	---	---	4.5	---
CrC	3e	90	3.00	6.5	40
CvB	3w	80	3.00	6.5	35
Cz	2w	135	4.50	8.5	60
DrE	7s	---	---	---	---
DsC	3e	105	3.00	7.0	45
Dz	4w	100	3.00	7.0	30
ErC	3e	90	3.00	6.5	40
HaF	7s	---	---	---	---
HdF	7s	---	---	---	---
HlF	7s	---	---	---	---
Ho	3w	100	3.00	5.5	45
HwB	2e	100	3.00	6.5	45
Ln	2w	120	3.50	---	55
LzD	4e	70	2.50	5.5	30
Me	3w	115	3.00	6.0	50
MhC	3e	90	3.00	6.5	35
MrC	3e	110	3.00	7.5	40
MsE	7s	---	---	---	---
Ph	2w	130	3.50	7.5	60
Px	2w	130	4.00	8.0	60
Pz	5w	---	---	7.0	---
Qm		---	---	---	---
RgG		---	---	---	---
SkF	8s	---	---	---	---
SnF	7s	---	---	---	---
SyE	7s				
TyA	3w	95	3.00	5.5	45
WaC	4e	55	2.00	3.0	20
WkF	7e	---	---	---	---

APPENDIX B

Table 14: Subdivisions located in Sleepy Creek Watershed.

Name	Total Acres	Number of Lots	Lot Sizes	Length of Roads in Ft.
Almost Heaven	90.4	23	2.2 - 7.8	7085
Apple Orchard	190.0	94	2	1963
Beaver Dam	141.8	45		1913
Beeler*	6.5	8	0.5 - 1.62	1600
Brookview Acres	42.0	21	2.0 - .5	388
Buzzard Acres*	35.0	7	5.04 - 5.48	1600
Cacapon East	270.6	34	3	2172
Cacapon Ridge*	90.0	18	5.0 - 8.4	8000
Cacapon South	209.0	61	0.5 - 1.5	3027
Canterbury Hills				939
Cedar Ridge	54.3	18	2.0 - 4.0	405
Chestnut Grove	143.8	56	2.0 - 6.0	1222
CJ Anders*	39.1	8	4.0 - 5.0	6400
Clatterbuck*	38.0	38	0.97 - 34.59	3200
Cleveland	24.0	12	2.0 - 2.22	133
Colonial Village	233.9	85	2.0 - 5.0	3606
Coolfont - Sleepy Creek Association	121.4	16	3.8 - 21.0	876
Cowles Kessler*	9.9	3	3.0+	0
Deer Run Woods	128.8	11	5.0 - 21.92	1000
Deer Spring Woods	103.1	31	2.0 - 5.0	1024
Dehaven Estates*	10.0	5	2	0
Ellis*	41.4	5	5.0 - 19.7	0
Fearnow Acres				890
Fox Platt*	30.0	4	6.7 - 16.7	2800
George*	20.0	9	2.3 - 4.4	0
Greenwood Acres	50.6	10	5	520
Greenwoods	244.1	33	5.0+	2441
Henry*	13.0	13	0.5 - 1.0	400
Highland Ridge*	76.7	35	2.0 - 5.0	800
Highview	22.0	8	2.0 - 4.0	567
Hillcrest	15.3	7	2.0+	444
Kesecker, Wade*		6		1600
L&N	82.0	41	2.0 - 2.6	715
Lakeview Estates*	40.9	10	1.98 - 6.61	800
Linwood Knoll	71.5	22	3.25	874
Longview	85.0	40	2	1496
McCarter Tract*	40.0	4	9.92 - 14.27	4000
Mallard Creek	86.3	24	2.47 - 11.65	1112
Mawani Village	82.5	28	2.0 - 12.0	1216
Mel - lon West	44.8	8	5.04 - 8.64	164
Michael, L.N.*	50.0	25		1600
Miller's	20.0	4	5	115
Mountain Lick Run	91.4	33	2.0 - 4.0	833
Mt. Tabor Association*	182.8	51	1.3 - 4.0	8000
New Hope Acres	105.0	35	3.0 - 4.2	3931
Oak Forest	336.5	97		3990

Name	Total Acres	Number of Lots	Lot Sizes	Length of Roads in Ft.
Oakland Hills	167.5	43	2.0 - 7.07	2600
Ocer Run*				3600
Old Mill Manor	158.0	17	5.0 - 12.0	1291
Olive Stickley*	12.7	3	4.23	0
Panarama Estates*	46.1	11	3.69 - 5.08	0
Piggot Acres*	63.8	10	5.0 - 10.0	0
Piney Ridge	158.8	30	5.0 - 8.9	1328
Pious View	34.8	11	2.0 - 3.83	162
Posey Hollow	213.1	11	5.4 - 58.9	806
Pritchard Farms	57.0	6	8.0 - 10.0	479
Quail Run	70.1	13	5.0 - 7.1	280
Rankins	10.0			235
Ridge Terrace	18.2	10	2.16	24
Rock Gap Woods	131.4	27	2.05 - 5.17	1265
Ruppenthal Farm				190
Salem View	92.2	18	4.78 - 5.8	845
Shade*	192.5	9	9.0 - 87.0	0
Shirley Farms	134.0	67	2	1465
Sleepy Creek Farms	175.0	60	2.10 - 5.08	190
Sleepy Creek Forest	64.0	64	0.35 - 9.43	2341
Sleepy Creek Hide - a - way	85.0	85	0.6 - 4.3	1287
Sleepy Creek Mountain Estates				14208
Sleepy Creek Mountain Retreat	170.0	79		2826
Sleepy Creek Orchard	164.0	66	1.8 - 4.8	952
Sleepy Hill	325.3	54	5.0 - 12.5	995
Sleepy Ridge	86.6	17	5.0 - 5.6	565
Sleepy View Estates	20.0	16	1.0 - 5.5	650
South Morgan Hills	205.7	35	3.5 - 11.6	1893
Spring Valley	92.4	26	1.9 - 5.4	2487
Spruce Pine Hollow	100.0			10272
Stotler's Crossroads	140.7	25	5.0 - 10.0	285
Sweetwater*				800
Tall Pines	40.2	12	2.33 - 5.1	377
Thunderbird Hills	100.0	59	0.25 - 6.1	2495
Timber Ridge	160.0	79	2.3 - 16.0	3313
Tower Acres	73.6	43	1.81 - 5.08	415
Turkey Ridge	110.0	55	2.3 - 16.0	225
Twin Lakes East	52.0	26	2.3 - 5.0	0
Twin Mountain View	61.7	25	2.0 - 3.5	1043
Unger	60.2	11	3.2 - 11.9	205
Valley Dale				164
Valley View	111.0	41	2.0 - 7.0	281
Walker*	51.0	6	2.5 - 12.07	0
Weber Heritage				801
Weber, L. Grace*	128.8	13	4.0 - 31.0	2000
Total	7951.1	2329		151,561
*Not found on MC OES road list				29 miles

APPENDIX C

Table 15: Chemical sampling at the conjunction of Sleepy Creek flows and the Potomac River. Note: All data is provisional and subject to revision (Source: WV Department of Agriculture)

Site Number	Lab	Sampler	Date	Time	Sample ID	pH (Meter)	Conductivity	DO Probe	Suspended Solids (PPM)
PT-SC1	013002OR10	JMM	1/30/2002	1151	1	7.9	183.3	12.98	
PT-SC1	020502OR10	JMM	2/5/2002	1246	2	8.2	193.3	14.63	
PT-SC1	022802OR10	JMM	2/28/2002	102	3	8	194.7	13.64	
PT-SC1	031902OR10	JJH/JMM	3/19/2002	1220	4	7.8	171	12.24	
PT-SC1	032602OR10	JMM	3/26/2002	1254	5	7.8	120.4	12.3	
PT-SC1	040902OR10	JMM	4/9/2002	1251	6	7.7	114.5	11.09	
PT-SC1	042302OR10	JMM	4/23/2002	1243	7	8	113.4	10.98	
PT-SC1	052102OR10	JMM	5/21/2002	129	8	7.9	90.6	11.54	
PT-SC1	052902OR10	JMM	5/29/2002	1218	9	7.8	111.6	9.87	
PT-SC1	060402OR10	JMM	6/4/2002	127	10	7.8	121	9.36	
PT-SC1	070902OR10	JMM	7/9/2002	207	11	8.1	142.2	8.72	
PT-SC1	080602OR10	JMM	8/6/2002	112	13	8.2	173.9	8.85	
PT-SC1	082202OR10	MBH	8/22/2002	103	14	8	180	7.72	
PT-SC1	091202OR10	MBH	9/12/2002	110	15	7.8	71.3	5.56	
PT-SC1	092402OR10	DWR	9/24/2002	1256	16	8	50.6	7.58	
PT-SC1	101002OR10	DWR	10/10/2002	953	17			95.1	
PT-SC1	102402OR10	DWR	10/24/2002	235	18	8.2	354	11.23	
PT-SC1	110702OR10	DWR	11/7/2002	1014	19	7.8	121.1	18.08	
PT-SC1	112102OR10	DWR	11/21/2002	132	20	8.5	914	13.16	
PT-SC1	121002OR10	DWR	12/10/2002	954	21	8	96.9	18.29	
PT-SC1	012203OR10	DWR	1/22/2003	1244	22	8.8	89.4	12.82	41
PT-SC1	012903OR10	DWR	1/29/2003	1023	23	8.5	7		0
PT-SC1	021303OR10	DWR	2/13/2003	909	24	8.7	84.7		0
PT-SC1	031803OR10	DWR	3/18/2003	1038	25	8.1	60		2
PT-SC1	032603OR10	MBH	3/26/2003		26				1.2
PT-SC1	042403OR10	DWR	4/24/2003	1109	27	8.4	64.7		1.2
PT-SC1	042903OR10	DWR	4/29/2003	142	28	7.9	501		1.2
PT-SC1	052003OR10	DWR	5/20/2003	956	29	8.2	310		4
PT-SC1	052103OR10	DWR	5/21/2003	853	30	8.6	306		1.2
PT-SC1	062403OR10	DWR	6/24/2003	147	31	8.1	64.8	11.72	3
PT-SC1	073003OR9	SBF	7/30/2003	100	32	8.2	124	10.26	1.5
PT-SC1	082703OR9	SBF	8/27/2003	1049	33	8.1	92.3		11
PT-SC1	092503OR9	SBF	9/25/2003	1001	34	8.1	75		6
PT-SC1	102703OR9	DWR	10/27/2003	304	35	7.4	105		1.5
PT-SC1	112003OR9	DWR	11/20/2003		36				39
PT-SC1	122903OR9	DWR	12/29/2003	948	37	8.8	66.9		1.2
PT-SC1	012304OR9	CAF	1/23/2004	115	38	7.5			97.7
PT-SC1	022604OR9	CAF	2/26/2004	140	39	6.8			76.2
PT-SC1	031504OR9	CAF	3/15/2004	1225	40	7.1			167.8
PT-SC1	041904OR9	CAF	4/19/2004	1235	41	8.1			72.3
PT-SC1	052404OR9	CAF	5/24/2004	100	42	8.2			79.7

Table 16: Nutrient sampling at the conjunction of Sleepy Creek flows and the Potomac River. Note: All data is provisional and subject to revision (Source: WV Department of Agriculture)

Site Number	Sample ID	Total P	TKN	TN	Ammonia N	N03-N	N02-N	Comments/Remarks
PT-SC1	1	0			0.192	0.100		
PT-SC1	2	0			0.139	0.400		
PT-SC1	3	0			0.159	0.000		
PT-SC1	4	0.0032			0.161	0.000		
PT-SC1	5	0			0.165	0.500		
PT-SC1	6	0.0097			0.146	0.000		
PT-SC1	7	0.0065			0.108	0.100		
PT-SC1	8	0			0.075	0.100		
PT-SC1	9	0				0.100		
PT-SC1	10	0			0.057	0.000		
PT-SC1	11	0			0.140	0.100		
PT-SC1	13	0.0065			0.064	0.100		
PT-SC1	14	0			0.086	0.100		
PT-SC1	15	0.0065			0.324	0.000		
PT-SC1	16	0			0.120	0.200		
PT-SC1	17	0.0065			0.073	0.100		
PT-SC1	18	0.0065			0.063	0.300		
PT-SC1	19	0.0065			0.112	0.300		
PT-SC1	20	0.0065			0.081	0.400		
PT-SC1	21	0.0065			0.052	0.200		
PT-SC1	22	0.0129			0.205	0.300	0.0024	
PT-SC1	23	0.0388			0.043	0.700	0.0016	
PT-SC1	24	0			0.033	0.200	0.0014	
PT-SC1	25	0.0097			0.060	0.300	0.0027	
PT-SC1	26	0.0032			0.079	0.200	0.0015	
PT-SC1	27	0.0065			0.055	0.100	0.0028	Milk temp., sunny; clear, moderate flow
PT-SC1	28	0.0097			0.028	2.500		Sample lost-leaked; cloudy, moderate rain, water clear, moderate flow
PT-SC1	29	0.0065			0.086	0.200	0.0055	Sunny, warm, water high and muddy
PT-SC1	30	0.0097			0.071	0.100	0.0056	Cloudy, cool, raining, water muddy
PT-SC1	31	0			0.003	0.100	0.0031	Sunny, warm, water level high and muddy and rapid
PT-SC1	32	0.0029			0.042	0.100	0.0029	Flow up, slightly colored, sunny day
PT-SC1	33	0.0162			0.131	0.600	0.0110	Flow up, muddy water, cloudy
PT-SC1	34	0.013			0.000	0.400	0.0014	Flow up, slightly discolored, cloudy day
PT-SC1	35	0.0097			0.097	0.000	0.0050	Cloudy, rainy, normal flow, clear water
PT-SC1	36	0.029			0.301	0.171	0.0000	
PT-SC1	37	0.0097			0.015	0.334	0	Cool, clear weather; medium flow, clear water
PT-SC1	38	0.042	0.175	0.507	0.032	0.300	0.0000	Normal and clear flow, icy, cold
PT-SC1	39	0.010	0.203	0.64	0.056	0.380	0.0000	Clear water, normal flow, cloudy
PT-SC1	40	0.006	0.192	0.44	0.033	0.22	0.0000	Cool, sunny, clear and normal flow
PT-SC1	41	0.013	0.226	0.54	0.056	0.26	0.0000	Sunny, warm, clear and normal flow
PT-SC1	42	0.026	0.062	0.29	0.075	0.15	0.0000	Normal and clear flow, sunny, hot

Table 17: Macroinvertabrate sampling (Data supplied by WV Department of Environment).

ANCode	Mile Point	Stream Name	Date Sampled	Total Individuals	Percent of Dominant 2 Taxa	Chironomidae (Midge Larvae)	Ephemeroptera Percentag	Total Taxa	Number of Ephemer	WVSCI
WVP-9	1	Sleepy Creek	6/1/98	305	52.13	27.54	62.95	20	10	78.55
WVP-9	10	Sleepy Creek	6/1/98	186	51.61	7.53	63.44	15	8	78.02
WVP-9	12.2	Sleepy Creek	6/2/98	177	44.63	25.42	51.41	20	10	79.23
WVP-9	15.2	Sleepy Creek	6/2/98	187	50.27	7.49	75.94	18	10	85.76
WVP-9	18.2	Sleepy Creek	6/3/98	175	48.57	32.57	46.86	18	9	69.51
WVP-9	21.6	Sleepy Creek	6/3/98	238	48.32	20.17	67.23	19	10	80.66
WVP-9	23.6	Sleepy Creek	6/3/98	208	44.71	6.25	87.98	16	10	87.67
WVP-9	33.2	Sleepy Creek	6/10/98	214	50.47	38.32	54.21	19	11	75.33
WVP-9	35.6	Sleepy Creek	6/10/98	200	46.5	32.5	53	20	12	79.63
WVP-9	36.8	Sleepy Creek	6/10/98	196	56.12	16.84	63.78	19	12	80.36
WVP-9	36.6	Sleepy Creek	5/29/02	237	80.59	42.62	50.21	20	9	65.99
WVP-9-B	0	Meadow Branch	6/1/98	200	53	38	56.5	16	11	72.99
WVP-9-B	12.8	Meadow Branch	6/3/98	205	61.95	30.24	39.51	18	7	66.34
WVP-9-B-1-A	0.1	Roaring Run	6/3/98	112	66.96	9.82	79.46	16	7	76.66
WVP-9-D.8	0.5	UNT Sleepy Creek RM 24.5 (Lick Run)	6/3/98	203	42.86	9.36	62.07	15	9	79.61
WVP-9-E	1.5	Middle Fork / Sleepy Creek	6/3/98	206	68.45	5.83	43.2	15	10	71.84
WVP-9-E	7	Middle Fork / Sleepy Creek	6/10/98	205	43.9	22.93	48.29	12	5	66.41
WVP-9-E-1		South Fork / Sleepy Creek	6/4/98	190	29.47	8.95	68.42	18	10	86.01
WVP-9-F		Rock Gap Run	6/2/98	179	53.63	7.26	69.83	19	11	83.14
WVP-9-G	0.25	Indian Run	6/10/98	230	62.17	8.26	86.52	17	10	83.23
WVP-9-G-1		North Fork Run	6/1/98	206	84.95	11.65	83.98	15	9	74.22
WVP-9-G-1		North Fork Run	6/1/98	334	80.84	12.87	82.63	18	11	79.69
WVP-9-G-2	0	South Fork / Indian Run	6/3/98	165	34.55	16.36	66.06	18	14	88.34
WVP-9-G-3		Middle Fork / Indian Run	6/2/98	262	72.14	20.99	66.79	18	10	76.09
WVP-9-I		Hands Run	6/10/98	212	50	15.09	75	21	13	90.77
WVP-9-G-2	0	South Fork / Indian Creek	7/12/00	203	49.75	39.9	37.44	21	9	69.9

WVSCI Scoring Criteria >68.0 Unimpaired >60.6 to 68 "Gray Zone" < or = 60.6 Impaired

Sleepy Creek Watershed Association