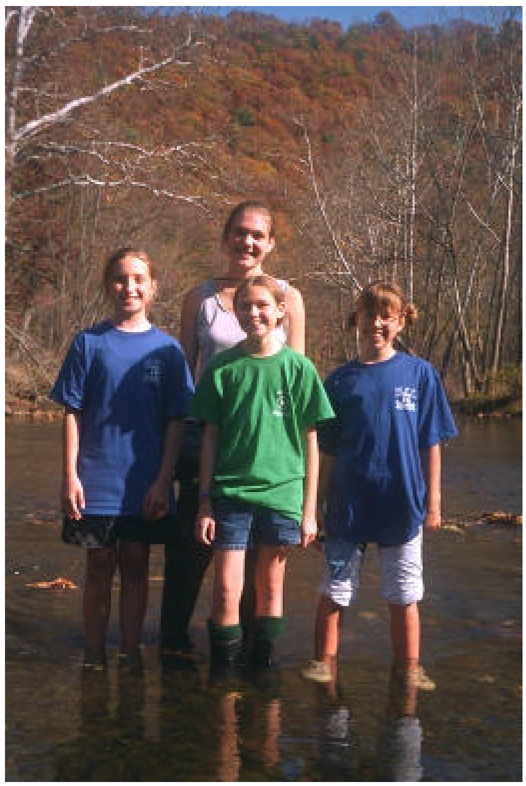
Standing Stone Creek
Water Quality Pre-Assessment



by

Margo Wilson
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and
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2000/2001

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- Andy Patterson, Conservation Manager, Huntingdon County Conservation District, for obtaining a grant through The Pennsylvania League of Women Voters to fund our study.
- Juniata Clean Water Partnership, for providing GIS maps of northern and southern sections of Standing Stone Creek Watershed.
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Standing Stone Creek Assessment

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Abstract

This study focuses on ascertaining the water quality of Standing Stone Creek and determining whether an environmental health issue exists that would prevent the stream from being Huntingdon's potable water supply. To achieve this, a stream assessment was conducted at four sites—within twenty-two miles of its confluent with the Juniata River. They were Alan Seeger Forest (Reeses Corner), Cunningham Bridge, Black's Bridge, and Detwiler Field. A questionnaire was also developed to obtain input about the environmental healthiness of the water from the perspective of personnel of the Huntingdon Water Treatment Plant.

The stream assessment included examining and evaluating the following four components:

1) Biological organisms (benthos or macroinvertebrates) living on the stream bottom:
   - Pollution Sensitive Organisms, e.g., Mayfly, Stonefly, Caddisfly
   - Somewhat Pollution Sensitive Organisms, e.g., Crayfish, Damselfly, Dragonfly, Sowbug
   - Pollution Tolerant Organisms, e.g., Aquatic Worms, Leech.
2) Chemical stream analysis, e.g., dissolved oxygen, pH, total hardness, alkalinity, nitrates, phosphates, total dissolved solids.
3) Physical stream characteristics, e.g., width, depth, velocity, volume.
4) Stream habitat parameters, e.g., attachment sites for macroinvertebrates, embeddedness, shelter for fish and macroinvertebrates, channel alteration, sediment deposition, stream velocity and depth combinations, channel flow status, bank vegetative protection, condition of stream banks, riparian vegetative zone width.

Introduction

Stone Creek is a rural and sparsely residential and agricultural watershed with no industries—a 33 miles long cold-water fishery (144 square miles in size) located almost entirely within Huntingdon County. It begins at the extreme northeastern section of Huntingdon County in the Rothrock State Forest area, near Alan Seeger State Forest. It flows in a southwestern direction through Jackson Miller, and Henderson townships where it empties into the Juniata River, just east of the town of Huntingdon.

Land usage today within the watershed's valley is the same as it was since the establishment of the Borough of Huntingdon at its confluence with the Juniata River in 1796, forestry, agricultural —crop and animal— and residential. There are no industrialization or business complexes along the stream and the area is still sparsely populated.

Historically, Stone Creek water quality has been exceptional, having one of the lowest pollution ratings in the Commonwealth.

Only traces of detectable contaminants such as arsenic, barium, cadmium, chromium, lead, mercury, selenium, silver, fluoride, sodium are in the water, nothing to indicate any concern.

Along most of Standing Stone Creek, in central Pennsylvania, are stretches of shallow to medium depth pockets of fast moving water, moving over a predominantly gravel and rocky stream bottom. The more rapid water moves over such rocky beds, oxygen from the air is mixed into the water creating areas that are higher in dissolved oxygen than those of slower moving and less disturbed areas. Most aquatic animals require oxygen for cellular functions to sustain life. Some creatures with simple gas-exchange systems, such as leeches and aquatic worms, can survive in oxygen-depleted environments. However, larger numbers of complex organisms, such as mayflies, stoneflies, and riffle beetles whose gas-exchange systems place higher demand on oxygen, require well-oxygenated environments.

HAMS students hypothesized Standing Stone Creek water quality was excellent, as it was known to support a higher ratio of "good" quality insects compared to "poor" water quality macroinvertebrates.

Though there are no real identified water problems to the naked eye, there is some erosion of its streambanks and nutrient enrichment has been ascertained from chemical testing for nitrates and phosphates.

However, there is a student concern related to environmental health and maintaining the stream as Huntingdon's potable water supply. Specifically, erosion and soil deposition caused by stormwater runoff and nutrient loading or enrichment caused by excessive amounts of nitrates and phosphates in a stream can cause algal blooms that use up a large amount of oxygen they biodegrade. This can also be a human environmental health issue.

Therefore, a letter was sent to Mr. Andy Patterson, Conservation District Manager for Huntingdon County, February 22, 2000, asking for a partnership to complete a stream assessment on Standing Stone Creek.

This resulted in a coalition of the Conservation District, Juniata College Environmental Science Department, and Huntingdon Area Middle School receiving a grant from the Pennsylvania League of Women Voters to complete the project.

<u>Problems Project will address</u>

- The predominately rural watershed is receiving much pressure from two nearby urban areas, State College and Huntingdon.
- Agricultural operations in the watershed were traditionally located on the streambanks of the creek with concentrated increase in animal numbers.
- Logging on both private and public woodlands is flourishing due to excellent quality of the hardwood timber located in this area.

These activities and many more have the potential to impact the quality of an already stressed community water supply for Huntingdon Borough, the most heavily populated urban area in the county.

Objectives/Outcomes/Audiences

- To educate Huntingdon Area Middle School students, the local community, and Huntingdon Borough Council about activities within Standing Stone Creek watershed that impact the quality of the community's drinking water supply.
- To develop a watershed pre-assessment report with recommendations to Huntingdon Borough to seek funding for a comprehensive watershed assessment and management plan specifically designed to protect water quality in the watershed.
- To educate Middle School students about the concept of conservation planning and environmental protection at the watershed level and the methodology required with a comprehensive watershed assessment process.

Mentors to the students for this project were Heather Galbraith, Juniata College intern; Dr. Paula Martin, Associate Professor and Chair, Environmental Science and Studies Department, Juniata College; and Mr. Frederic R. Wilson, Huntingdon Area Middle School, Environmental Club Advisor. Caitie Hanlon, a 10th grade student at High Area High School, also assisted in collecting field study data.

Methods

Macroinvertebrates

We followed accepted methods for conducting aquatic insect analysis of a water body, accepted by national and state agencies. To determine the biodiversity and water quality, a D-Net or seine net (fine, small seine mesh) is used to collect macroinvertebrates living on the streams bottom—under rocks and in the soil—of the bed, which is disturbed by kicking, shuffling, and washing the rocks clean. We fixed the D-Net securely on the stream bottom as not to allow the macroinvertebrates to escape. Aquatic organisms from three different locations of the streams, one-meter square area above the net, were collected at each location.

HAMS students collect macroinvertebrates using a seine net, left, and D-Net, right.

Species were placed in a large white collecting pan-in order to see small organisms. We sorted through the organisms and separated them based on appearance, movement, and other physically distinct characteristics. An aquatic bug sheet and aquatic insect field guidebook were used to identify organisms. At times, we used a hand lens or magnifier to identify the smaller insects.

Collected specimens are placed in white pans for identification

Once we knew the total different insect family, we determined the stream's water quality by using a stream quality index assessment. The

Sorting and proper identification of aquatic organisms must occur to obtain a valid assessment of the water quality.

waterway earns a point value based on the different number of families found. Each Taxa 1 (insects sensitive to pollution) organism received 3 points. Taxa 2 (insects somewhat sensitive to pollution) organisms received 2 points each. Taxa 3 (pollution tolerant insects) organisms received 1 point. The streams total point value determined its water quality. A score of less than 10 is poor, 11-to 16 points is fair, 17-22 points is good, and 23 or higher is excellent.

The biological assessment format is shown on the chart below.

Biological Data

Taxa I Sensitive (Good) # Types	Taxa 2 Somewhat Sensitive (Fair) # Types	Taxa 3 Tolerant (Poor) # Types
Caddisfly	Alderfly	Aquatic Worm
Dodsonfly	Beetle larva	Blackfly Larva
Gilled Snail (right)	Clam (River)	Leech
Mayfly	Crane Fly	Midge Fly Larva
Riffle Beetle	Crayfish	Pouch Snail
Stonefly	Damselfly	Other Snails
Water Penny	Dragonfly	
	Fishfly larva	
	Scud	
	Sowbug	
	Watersnipe	
Total varieties found X 3	Total varieties found X 2	Total varieties found X 1

Cumulative Stream Quality Index Assessment

23 and above = Excellent
17 - 22 = Good
11 - 16 = Fair
10 or less = Poor

Stream Quality Score ________________________

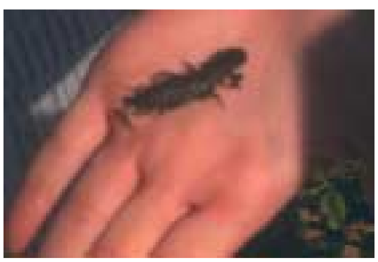
Macroinvertebrate Assessment ________________________

After identifying and counting the number of aquatic insects in each Taxa group, the organisms were returned to the stream. Small populations of macroinvertebrates were collected—to be preserved in ethanol by Juniata College student intern Heather Galbraith.

Biomonitoring

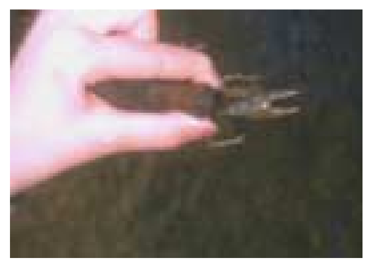
"Biomonitoring, or the study of biological organisms and their responses, is an alternative that can be done as a stand alone assessment or integrated with physical and chemical testing to give a holistic view of the stream's health. Because living organisms integrate all the positive and negative impacts an ecosystem has felt, ecosystem health can be measured by the diversity of the creatures living in it." It is the most widely used approach to indicate stream health.

"Benthic macroinvertebrates, or bottom-dwelling aquatic animals that lack backbones and are large enough to be seen with the naked eye are often called bugs. The term 'bugs' is universally used for these creatures, and many are actually immature forms of aquatic insects, but the group also includes crayfish, snails, clams and worms.



Dobsonfly (Hellgrammite)

Gilled Snails



Crayfish

Several characteristics of macroinvertebrates make them ideal indicators of water quality. They cover a whole range of pollution sensitivity from highly sensitive stoneflies and mayflies down to very tolerant aquatic worms, so the presence or absence of particular taxonomic groups provides a good measure of pollution. Unlike fish, benthic macroinvertebrates are relatively immobile. So if bugs are absent from their usual haunts, it is likely that pollution drove them out and not simply that they got the urge to go elsewhere. They have the ability to show the effects of long and short-term pollution as well as cumulative impacts to the ecosystem. Finally, they may show impacts not indicated by physical and chemical sampling."

Mentors for this project—a college intern and an Associate Professor of Environmental Science and Studies—HAMS students and a high school student, all participate in the identification of macroinvertebrates of Standing Stone Creek.

Note: The information dealing with "Biomonitoring" is adapted exclusively from Pennsylvania Fish and Boat Commission (PAFBC) resources obtained over the internet. The macroinvertebrates were collected from Standing Stone Creek as part of this study.

Water Quality Tests

A combination of water testing kits and meters that used chemicals or electronics were used to perform the water tests. Tests conducted were dissolved oxygen, pH, total hardness, alkalinity, nitrates, phosphates, total dissolved solids and conductivity.

We used two different electronic instruments to learn the water temperature. The first was an Otterbine Sentry III Oxygen/Temperature Monitor and the second a LaMotte Meter. Each had an electric probe that was placed into the water sample and within seconds the instrument gave a temperature reading. We also used a hand thermometer.

To find the pH, we used a LaMotte pH Meter and Hach pocket pH pen. We set or calibrated the pH tester by putting it in a pH buffer solution of 7.0. A pH of 7.0 is neutral. This means that the liquid is not an acid or base (acidic or alkaline). Once the pH meter reading was set at 7.0, the probe was placed into the water sample. Then, we waited until the meter showed a constant number. This number is the pH of the water. A number less than 7.0 would show that the water is an acid. A number greater than 7.0 indicates that the water is alkaline.

Student researchers obtain the pH of the water by conducting several repetitions using a pH meter and pH pen. Juniata College, student intern, Heather Galbraith records the information.

We used a LaMotte CDS 5000

Conductivity/TDS Meter and TDS pen to learn the total dissolved solids and conductivity of the water. We placed the electronic probe in the water sample and waited for a number to appear.

We used a LaMotte Dissolved Oxygen Kit and the Otterbine Sentry III Oxygen/Temperature Monitor to get the dissolved oxygen (amount of gaseous oxygen) level of the water.

Two Huntingdon Area Middle School students conduct separate dissolved oxygen tests of Standing Stone Creek. Conducting repetitions of the test provides a more accurate indication of the amount of gaseous oxygen in the water.

The LaMotte kit required that we follow a step-by-step set of instructions for mixing different chemicals to learn the dissolved oxygen level. The Otterbine Sentry Monitor had an electric probe that provided the dissolved oxygen level in number form after calibrating the meter based on water temperature and land elevation.

To discover the total hardness and alkalinity levels, we used two chemical water testing kits. For hardness, we used a LaMotte Hardness Kit, and for alkalinity, a Hach Alkalinity Kit. Both these tests require following instructions for mixing different chemicals, giving the test result in parts per million (ppm).

Pictures above, left, a student conducts an alkalinity test, on the right, total hardness, as part of a pre-assessment of the water quality of Standing Stone Creek.

The nitrates and phosphates levels were determined by using A DREL 2000 Spectrophotometer. We received training for using this equipment by Heather Galbraith at the Huntingdon Area Middle School on September 18, 2000. This instrument required that we follow precise instructions to enter a predetermined method code. After entering the code and preparing the water sample, light rays pass through the sample. After a set time, the Spectrophotometer provided a number in parts per million (ppm).

We would then record all our water tests on a data chart for analysis. The last row would be where we put the average for each test.

Water Quality Monitoring Tests

Dissolved Oxygen	pH	Hardness	TDS	Alkalinity	Nitrates	Phosphates

Water Quality Parameters

Parameter	Unpolluted Stream	Polluted Stream
Dissolved Oxygen	The higher the amount of oxygen the better the quality...Trout- 10 ppm, Bass- about 7/8 ppm 0-3 Creatures flee 4-5 Creatures can survive Greater than 5 Creatures thrive	Less than 5 ppm is considered unacceptable for most aquatic organisms
pH (Hydrogen ion present)	Water with pH range from 6.5-8.6 will have little effect on life processes	Water with pH less than 5 or greater than 9 will support little aquatic life
Total Hardness	Soft water- 0-60 ppm Hard water 120-180 ppm	Values below 250 ppm are acceptable for drinking Over 500 ppm is hazardous to health
Dissolved Solids	Clean water has low amounts of D.S., ... Clear water is water less than 50 ppm... 50 ppm to 150 ppm is not bad	Caused by erosion, runoff, materials from industries, etc. Over 500 ppm for any monthly average is unacceptable...single test should not be over 750 ppm
Alkalinity	Good streams have between 100 and 200 ppm... are able to buffer the water from acidity... levels between 20 and 200 ppm are typically found in fresh water	Poor streams have lower alkalinity levels, < 50 ppm... could be effected by acid rain or acid mine drainage
Nitrates/Phosphates	Nitrates and phosphates are necessary for organisms in small quantities Clean water- less than .1 ppm	Higher readings indicate fertilizer, industrial waste, sewage and/or other nutrient enrichments Greater than .10 ppm is nutrient loading

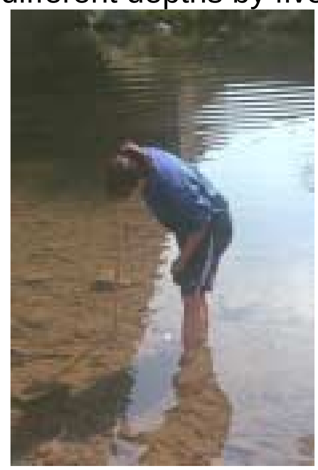
This chart is used in the 6th grade STREAMS program at the Huntingdon Area Middle School. Adapted and used with permission. We used it to interpret water quality.

Physical Measurements

As part of our stream assessment, we needed to acquire the width, depth, velocity (speed) and volume of the water body.

The width was determined at by using a 100 meter measuring tape to see how wide the stream was at the different locations.

We got the average depth of the stream by taking five measurements at different locations using a meter stick and dividing the total of the five different depths by five.



A cadre of students works together to obtain the average depth of the water.

We also determined the speed that the water was flowing at the four places we visited. To determine the speed, we used the following items: 1) a walnut (can use a small ball) that could float a little above the water 2) two sticks tied five meters apart with a rope, and 3) a stopwatch.

Two methods were used to get average speed, resulting in similar meters-per-second. The first was to get the speed at one location in the stream five times (appropriate maximum). The second was to get the speed at four different depths at the same location five times.

First, we pulled the sticks and rope the full five meters apart in one of the deepest parts of the area. Then we placed a walnut upstream from the first stick so it would be going the same speed of the water when it reached the stick. When the ball reached the first stick, someone would yell, "Start" and we would start the stopwatch. When the walnut reached the downstream stick, someone would yell, "Stop," so that we would stop the timing. We did this procedure five times, recording the time the ball needed to travel the five meters each time.

Students learn water speed by timing the rate a ball takes to flow five meters.

The final step was to divide five meters by the averaged time it took the ball to travel the five-meter length, which gave us the speed in meters-per-second.

To determine volume of water flow, we multiplied the stream's width, times the average depth times the stream velocity times a constant. The constant for a rocky or rubble bottom stream, like Standing Stone Creek, is .8. A mud or sand bottom stream would be .9.

The processes for averaging width, depth, velocity and volume using different locations and one location are seen in the chart below.

Stream Width, Depth, Speed and Volume

Different Location Technique	**Approximate Maximum Technique** (All data at one area)
Stream width ________________	Stream width ________________
Depth at point A ______________ meter	Depth at point A ______________ meter
Depth at point B ______________ meter	
Depth at point C ______________ meter	
Depth at point D ______________ meter	
A+B+C+D / 4 = average depth __ meter	A+B+C+D / 4 = average depth __________ meter
Time at A ______________ seconds	Time at A ______________ seconds
Time at B ______________ seconds	Time at B ______________ seconds
Time at C ______________ seconds	Time at C ______________ seconds
Time at D ______________ seconds	Time at D ______________ seconds
A+B+C+D / 4 = average time __________ meter	A+B+C+D / 4 = average time __________ meter
5 meters / average time = stream velocity _____________m/second	5 meters / average time = stream velocity _________m/second
Volume of flow = wdvc w = width d = depth v = velocity/speed c = constant (.8)	Volume of flow = wdvc w = width d = depth v = velocity/speed c = constant (.8)
Volume of flow ________ m3/second	Volume of flow ________ m3/second

Habitat Assessment

The last activity we did when we were out in the field was a Stream Habitat Assessment. There were ten stream parameters (categories) we reviewed at each of the four locations. They were: 1) Attachment sites for macroinvertebrates or aquatic insects that live under rocks on the stream bottom, 2) Embeddedness of the stream bottom, 3) Shelter for fish and macroinvertebrates, 4) Channel alteration, 5) Sediment deposition—soil built up on the stream bottom, 6) Stream velocity and depth combinations, 7) Channel flow status, 8) Bank vegetative protection—looking for undercut and vertical banks without vegetation, 9) Condition of stream banks, and 10) Riparian vegetative zone width.

The pre-assessment included examining the stream from its headwater to mouth. The picture on the left is in the forest area Standing Stone Creek's headwater. The picture on the right is near the confluence with the Juniata River.

For parameters 1 through 7, we would discuss and evaluate the left and right sides of the stream and assign a number between 0 and 20. Each range of five numbers indicated a classification quality for the stream. Optimal (excellent) was 16-20, suboptimal (good) was 11-15, marginal (fair) was 6-10 and poor (bad) was 0-5.

Parameters associated with Bank Vegetative Protection, Conditions of Banks, and Riparian Vegetative Zone Width are scored differently. Each side of the stream received a separate number, with optimal 9-10, optimal 6-8, marginal 3-5, and poor 0-2. We could than access the total stream parameter and left and right banks alone.

We averaged the assessed score from the four sites for each of the ten habitat parameters to obtain a final rating. The Stream Habitat Assessment Field Data Sheet for Attachment Sites for Macroinvertebrates for Rocky Bottom Sampling, used by Environmental Protection Agency and the senior Environment Corps, follows on the next pages.

Trees provide a stream canopy and a scenic view of Standing Stone Creek nearJackson's Corner, 12 miles north of Huntingdon on a beautiful Fall afternoon..

Stream Habitat Assessment Field Data Sheet

Rocky Bottom Sampling

Site: ________________ Date: ______ Time: ______

Surveyed by: ____

Habitat Parameter	Optimal	Suboptimal	Marginal	Poor
1. Attachment Sites for Macro-invertebrates	Well-developed riffle and run; riffle is wide as stream and length extends 2 times the width of stream; cobble predominates; boulders and gravel common.	Riffle is as wide as stream but length is less than 2 times width; cobble less abundant; boulders and gravel common.	Run area may be lacking; riffle not as wide as stream and length is less than 2 times the width; gravel or large boulders are bedrock prevalent; some cobble present	Riffles or run virtually nonexistent; large boulders and bedrock prevalent; cobble lacking.
Score:	20 19 18 17 16	15 14 13 12 11	10 9 8 7 6	5 4 3 2 1 0
2. Embeddedness	Fine sediment surrounds and fills in 0-25% of the living spaces around and in between the gravel, cobble, and boulders.	Fine sediment surrounds and fills in 25-50% of the living spaces around and in between the gravel, cobble, and boulders.	Fine sediment surrounds and fills in 50-75% of the living spaces around and in between the gravel, cobble, and boulders.	Fine sediment surrounds and fills in more than 75% of the living spaces around and in between the gravel, cobble, and boulders.
Score:	20 19 18 17 16	15 14 13 12 11	10 9 8 7 6	5 4 3 2 1 0
3. Shelter for Fish and Macro-invertebrates	Snags, sub-merged logs, undercut banks, cobble and rocks, or other stable habitat are found in over 50% of the site.	Snags, sub-merged logs, undercut banks, cobble and rocks, or other stable habitat are found in over 30-50% of the site.	Snags, sub-merged logs, undercut banks, cobble and rocks, or other stable habitat are found in over 10-30% of the site.	Snags, sub-merged logs, undercut banks, cobble and rocks, or other stable habitat are found in less than 10% of the site.
Score:	20 19 18 17 16	15 14 13 12 11	10 9 8 7 6	5 4 3 2 1 0

Habitat Parameter	Optimal	Suboptimal	Marginal	Poor
4. Channel Alteration	Stream straightening, dredging, artificial embankments, dams or bridge abutments absent or minimal; stream with meandering pattern.	Some stream straightening, dredging, art-ifical embank-ments or dams present usually in areas of bridge abutments absent or minimal; no evidence of recent channel alteration activity.	Artificial embankments present to some extent on both banks; and 40 to 80% of stream site straightened, dredged, or otherwise altered.	Banks shored with gabion or cement; over 80% of stream straightened and disrupted
Score:	20 19 18 17 16	15 14 13 12 11	10 9 8 7 6	5 4 3 2 1 0
5. Sediment Deposition	Little or no enlargement of islands or point bars and less than 5% of the bottom affected by sediment deposition.	Some new increase in bar formation, mostly from coarse gravel; 5-30% of bottom affected; slight deposition in pools.	Moderate deposition of new gravel, coarse sand on old and new bars; 30-50% of the bottom affected; sediment deposits at stream obstructions and bends; moderate deposition in pools.	Heavy deposits of fine material, increased bar development; more than 50% of bottom affected; pools almost absent due to substantial sediment deposition.
Score:	20 19 18 17 16	15 14 13 12 11	10 9 8 7 6	5 4 3 2 1 0
6. Stream Velocity and Depth Combinations	Slow (<1 ft/s) /deep (>1.5 ft); slow/shallow; fast/deep; fast/shallow combinations all present	3 of the 4 velocity/depth combinations are present; fast current areas generally dominate.	2 of the 4 velocity/depth combinations are present; Score lower if fast current areas missing.	Dominate by 1 velocity/depth category (usually slow/shallow areas).
Score:	20 19 18 17 16	15 14 13 12 11	10 9 8 7 6	5 4 3 2 1 0
7. Channel Flow Status	Water reaches base of both lower banks and minimal amount of channel substrate is exposed.	Water fills > 75% of available channel; <25% of channel substrate is exposed.	Water fills 25- 75% of the available channel and/or riffle substrates are mostly exposed.	Very little water in channel and mostly present as standing pools.
Score:	20 19 18 17 16	15 14 13 12 11	10 9 8 7 6	5 4 3 2 1 0

Habitat Parameter	Optimal	Suboptimal	Marginal	Poor
8. Bank Vegetative Protection Note: determine left or right bank side by facing upstream (score each bank)	More than 90% of streambank surfaces covered by natural vegetation, including trees, shrubs, or other plants; vegetation disruption, through grazing or mowing, minimal or not evident; almost all plants allowed to grow naturally.	70-90% of the streambank surfaces covered by natural vegetation, but one class of plants is not well represented; some vegetative disruption evident; more than one-half of the potential plant stubble height remaining.	50-70% of the streambank surfaces covered by natural vegetation; patches of bare soil or closely cropped vegetation common; less than one-half of the potential plant stubble height remaining.	Less than 50% of the streambank surfaces covered by vegetation is very high; vegetation has been removed to 2 inches or less in average stubble height.
Score: **Score:**	Left Bank 10 9 Right Bank 10 9	8 7 6 8 7 6	5 4 3 5 4 3	2 1 0 2 1 0
9. Condition of Banks (score each bank)	Bank stable: no evidence of erosion or bank failure; little potential for future problems.	Moderately stable; infrequent, small areas of erosion mostly healed over.	Moderately unstable; up to 60% of banks in site have areas of erosion; high erosion potential during floods.	Unstable; many eroded areas; "raw" areas frequent along straight sections and bends; obvious bank collapse or failure; 60-100% of bank has erosional scars.
Score: **Score:**	Left Bank 10 9 Right Bank 10 9	8 7 6 8 7 6	5 4 3 5 4 3	2 1 0 2 1 0
10. Riparian Vegetative Zone Width (score each riparian zone)	Width of riparian zone > 50 feet; no evidence of human activities (i.e., parking lots, roadbeds, clearcuts, mowed areas, or crops) within the riparian zone.	Width of riparian zone 35-40 feet; no evidence of human activities (i.e., parking lots, roadbeds, clearcuts, mowed areas, or crops) within the riparian zone.	Width of riparian zone 20-40 feet; no evidence of human activities (i.e., parking lots, roadbeds, clearcuts, mowed areas, or crops) within the riparian zone.	Width of riparian zone < 20 feet; no evidence of human activities (i.e., parking lots, roadbeds, clearcuts, mowed areas, or crops) within the riparian zone
Score: **Score:**	Left Bank 10 9 Right Bank 10 9	8 7 6 8 7 6	5 4 3 5 4 3	2 1 0 2 1 0

Equipment

Chemical Measurements
- DREL 2000 Spectrophotometer - Nitrates
  powder pillow-NitroVer5
  Phosphates power pillow-PhospaVer3
- Otterbine Sentry III Oxygen/Monitor
- LaMotte pH Meter
- LaMotte Conductivity/ TDS Meter
- LaMotte Dissolved Oxygen Kit
- LaMotte Hardness Kit
- Hach Alkalinity kit
- Hach pH pens
- pH buffer solutions
- Hach TDS pen
- Safety Glasses
- Disposal Bottle/glassware
- Distilled Water
- Waste Bottle
- Glassware/Bottles
- Water Instruction Sheets-Dissolved Oxygen,
  Total Hardness, Alkalinity
- Water Quality Parameter Sheet
- Kimwipes
- Cloth wipes

Biological Measurements
- D-Net (small seine net)
- Macro Identification Sheet
- Guide to Aquatic Insect Field Guide
- Collection Pans (White)
- Eye Dropper
- Magnifier/Hand lens (ID small organisms)
- Ice Cube Trays (Separate organisms)
- Collection Tubes
- Water Boots & Water Shoes
- Ziploc baggies
- Tweezers
- Paintbrush-small
- Sampling Collection Jars
- Ethanol

Physical Measurements
- 165 feet/50 meters tape
- Water Boots & Water Shoes
- Meter Stick
- 5 Meter Poles
- Ball, Walnut or Bobber
- Calculator
- Stop Watch
- Clipboard
- Batteries
- Pencil/pen
- Thermometer

Stream Habitat Assessment
- Physical Habitat Assessment-Field Data
  Sheet

Others
- First Aid Kit
- Paper
- Camera
- Film
- Computer
- Printer
- Scissors
- Construction paper
- Display Board
- Clear tape
- Masking tape
- Glue
- Vehicle
- Money

Water Treatment Plant
Questions for Stone Creek Assessment
10/9/2000

1. What does the Water Treatment Plant treat for?

2. How does the Water Treatment Plant prepare Stone Creek water to be potable for Huntingdon Borough?

3. Do you ever conduct water tests upstream for such things as pH, nitrates, phosphates, etc.? If so, what tests, how often, where?

4. Do you conduct analysis for herbicides or insecticides that might be in the water? If so, for anything in particular?

5. Do you conduct tests for bacteria such as total coliform or fecal coliform? How often?

6. Do you conduct analysis for toxic or heavy metals that might be in the water? If so, for anything in particular?

7. Do you remove suspended and/or dissolved solids as part of the treatment process? If so, how much is normal for Stone Creek and are they a problem?

8. Has Stone Creek ever had any environmental health related issues in the past? If so, please describe.

9. What do you think is the most serious threat to maintaining the water quality of Standing Stone Creek for both a cold water fishery and a source of potable water?

10. Is the supply of water from Standing Stone sufficient to meet the Huntingdon Borough's needs in the future?

Please provide any additional information that you think would be beneficial in completing a comprehensive watershed assessment of Standing Stone Creek.

Thank you for your time and consideration in answering these questions.

Margo Wilson **Amy Slicker** **Kaleigh Felisberto**

Macroinvertebrates

Analyses of the collected organisms supported our hypothesis that Standing Stone Creek had excellent water quality as it supported a higher ratio and number of "good" (sensitive to pollution organisms-Taxa 1) and "fair" (somewhat sensitive to pollution organisms-Taxa 2) quality insects compared to "poor" (tolerant of pollution organism-Taxa 3) macroinverte-brates. Taxa 1 organisms were the predominant species found at all research sites.

Seventy-seven percent of organisms (367 of 475) were Taxa 1, nineteen percent (90 of 475) were Taxa 2, and less than 4 percent (18 of 475) were Taxa 3. Aquatic organisms are listed on the chart that follows.

Aquatic Organisms in Stone Creek 2000 Pre-Assessment

Classification	Aquatic Organism	Number	Percent
Taxa 1 (Pollution Sensitive Organisms Found in Good Quality Water)			
	Caddisfly	**31**	
	Gilled Snail	**2**	
	Hellgrammite	**21**	
	Mayfly	**190**	
	Riffle Beetle	**25**	
	Stonefly	**25**	
	Water Penny	**73**	
	TOTAL	**367**	**77%**
Taxa 2 (Somewhat Pollution Sensitive Organisms Found in Fair Water Quality)			
	Clam	**5**	
	Crane Fly	**2**	
	Crayfish	**3**	
	Damselfly	**3**	
	Dragonfly	**4**	
	Fishfly Larva	**70**	
	Watersnipe	**3**	
	TOTAL	**90**	**19%**

Taxa 3 (Pollution Tolerant Organisms Found in Poor Water Quality)		
Aquatic Worm	**3**	
Blackfly larva	**5**	
Midgefly Larva	**10**	
TOTAL	**18**	**4%**

Note: Total of all specific organisms may not equal 100% because percentage is rounded off.

Biodiversity of benthos organisms was high, too. A total of twenty-one (21) different species of benthos organisms (macroinvertebrates) were netted, identified, and released. We identified 10 species of pollution sensitive species (three species of mayflies), 8 species of somewhat pollution sensitive organisms, and 3 pollution tolerant species.

All stream sites evaluated scored excellent on the Cumulative Stream Quality Index Assessment, earning higher than the 23 and above range, an indication of excellent water quality. The Stream Quality Score is derived by multiplying each different Taxa 1 species by 3, multiplying each different Taxa 2 species by 2, multiplying each different Taxa 1 species by 1 and adding the total points to obtain your Macroinvertebrate Score. The number indicates water quality as demonstrated in the scale that follows.

Cumulative Stream Quality Index Assessment	
23 and above =	**Excellent**
17 - 22 =	**Good**
11 - 16 =	**Fair**
10 or less =	**Poor**

Detwiler Field had the highest Stream Quality Score, forty-five (45). Ten (10) sensitive to pollution organisms, seven (7) somewhat sensitive to pollution organisms and only one (1) tolerant of pollution organism were discovered.

The second highest Stream Quality Score was at Reeses Corner. It earned an excellent macroinvertebrate assessment score of thirty-six (36) based on the identification of nine (9) Taxa 1 organisms, four (4) Taxa 2 organisms, and one (1) Taxa 3 organism.

The lower of the excellent macroinvertebrate scores were in the agricultural areas of Cunningham and Black's bridges. Cunningham Bridge had a score of thirty-three (33, where we identified eight (8) Taxa 1, three (3) Taxa 2, and three (3) Taxa 3 organisms. Black's Bridge had a score of thirty-one (31), where we found eight (8) Taxa 1, three (3) Taxa 2, and one (1) Taxa 3 organisms.

The chart below shows the different benthos species identified at each location that was used to obtain the macroinvertebrate score.

Location	**Taxa 1 (Good)**	**Taxa 2 (Fair)**	**Taxa 3 (Poor)**	**Points**
Reeses Corner)	9	4	1	36
Cunningham Bridge	8	3	3	33
Black's Bridge	8	3	1	31
Detwiler Field	10	7	1	45

Our analysis is supported by macroinvertebrates identified over the seven-year period between 1993 and 1999 at the confluence of Stone Creek with the Juniata River and at Cunningham Bridge. Eighty-four percent (84%) of the aquatic organisms were "good" water quality organisms, fifteen percent (15%) were "fair" quality organisms, and less than one percent (1%) of "poor" water quality organisms. Stone Creek supported 19 different species of macroinvertebrates ("Good"-7, "Fair"-8, "Poor"-4). See the Aquatic Organisms in Standing Stone Creek 1993-1999 chart below.

Aquatic Organisms in Standing Stone Creek 1993-1999

Classification	Aquatic Organism	Number	Percent
Taxa 1 (Pollution Sensitive Organisms Found in Good Quality Water)			
	Caddisfly	**175**	**5%**
	Gilled Snail	**236**	**7%**
	Hellgrammite	**270**	**8%**
	Mayfly	**777**	**23%**
	Riffle Beetle	**382**	**11%**
	Stonefly	**383**	**11%**
	Water Penny	**682**	**20%**
	TOTAL	**2905**	**(84%)**
Taxa 2 (Somewhat Pollution Sensitive Organisms Found in Fair Water Quality)			
	Alderfly	**47**	**1%**
	Beetle Larva	**7**	**<1%**
	Clam	**1**	**<1%**
	Crane Fly	**3**	**<1%**
	Crayfish	**145**	**4%**
	Damselfly	**22**	**1%**
	Dragonfly	**63**	**2%**
	Fishfly Larva	**218**	**6%**
	Watersnipe	**8**	**<1%**
	TOTAL	**514**	**(15%)**
Taxa 3 (Pollution Tolerant Organisms Found in Poor Water Quality)			
	Aquatic Worm	**25**	**<1%**
	Pouch Snail	**4**	**<1%**
	Leech	**1**	**<1%**
	Midgefly Larva	**1**	**<1%**
	TOTAL	**31**	**(1%)**

Note: Total of all specific organisms may not equal 100% because percentage is rounded off.

pH
Water Quality Monitoring Results

The pH levels were slightly different from the headwater to mouth. The pH levels were between 6.9 and 8.1, which have little effect on most water organisms. The more acidic water was in the headwater near Reeses Corner in the Alan Seeger Forest area, having a 6.9 reading. This is because acid precipitation (rain) is buffered less here. Downstream, below McAlevey's Fort at Cunningham Bridge, the average was 8.1. At Black's Bridge, near Center Union, the average was 7.6 (two days after a rain event). Closer to Huntingdon, at Detwiler Field, the average was 8.1. The water is not acidic downstream, toward the stream mouth, because of the presence of a limestone bottom and more water entering the stream from tributaries and groundwater.

These numbers indicate that Standing Stone Creek is capable of supporting a wide variety of aquatic life because water with a pH range from 6.5 and 8.6 will have little effect on life processes of aquatic organisms. The maximum tolerance range extends from 5.0 to 9.0. Readings less than 5.0 and greater than 9.0 have a dramatic affect or influence on aquatic life.

Location	**Average**
Alan Seeger Forest (Reeses Corner)	6.9
Cunningham Bridge	8.1
Black's Bridge	7.6
Detwiler Field	8.1
Average	**7.7**

Note: The chart results are the average of the following number of tests conducted at each site: Reeses Corner-13, Cunningham Bridge-10, Black's Bridge-5, Detwiler Field-6, for a total of 34 pH tests. Tests were conducted with two battery operated pH meters and two pH pens.

Alkalinity
Water Quality Monitoring Results

The average level for the alkalinity tests conducted at the creek was 68.5 ppm. Levels were between a low of 25 ppm at Reeses Corner in the headwater mountain area to 113 ppm near Huntingdon. The lowest reading (25 ppm) was in the headwater area and the highest (113 ppm) downstream. Black and Cunningham Bridges both had 68 ppm. However, water tested at Black's Bridge was three days after a significant rain event in central Pennsylvania, resulting in over 1 inch of rain (Pennsylvania's average rainfall has a pH of 4.7 in this area) and was probably being buffered by the stream's alkalinity, causing a temporary lower alkaline level.

These test results indicate the stream is able to buffer acidity. One of the primary reasons is because the stream substrata or bottom is limestone (a natural alkaline substance). Abnormal streams have less than 20 ppm and greater than 200 ppm. An optional range is 100 to 200 ppm. Standing Stone Creek falls in the typical range of 20 to 200 ppm, averaging consistently between 60 and 120 ppm for 8 years at Huntingdon.

Location	Average
Alan Seeger Forest (Reeses Corner)	25 ppm
Cunningham Bridge	68 ppm
Black's Bridge	68 ppm
Detwiler Field	113 ppm
Average	**68.5 ppm**

Note: The chart results are the averages of the following number of tests conducted at each site: Reeses Corner-3, Cunningham Bridge-2, Black's Bridge-2, Detwiler Field-3, for a total of 10 alkalinity tests. Tests were conducted with a chemical alkalinity kit, using a count the drop method.

Dissolved Oxygen
Water Quality Monitoring Results

The dissolved oxygen level was fairly constant at all testing sites along Standing Stone Creek, between 10.3 ppm and 12.0 ppm. The results of each site were as follows: the headwater in the Alan Seeger Forest near Reeses Corner had a 10.9 ppm, Cunningham Bridge had 12.0 ppm, Black's Bridge had 11.4, and the average at Detwiler Field was 10.3 ppm.

The higher the oxygen level (the amount of gaseous oxygen in the water) the better the water quality. For example, trout need cold water with 10 ppm, bass need 8 ppm, while bottom feeding fish can live on less. Less than 5 ppm is considered unacceptable for most aquatic organisms. The stream is known to be an excellent cold water fishery.

Most of Standing Stone Creek has stretches of shallow to medium depth pockets of fast moving water, moving over a predominantly gravel and rocky stream bottom which provide an abundant supply of dissolved oxygen required by most aquatic animals for cellular functions, which sustains life.

Location	Average
Alan Seeger Forest (Reeses Corner)	10.9 ppm
Cunningham Bridge	12.0 ppm
Black's Bridge	11.4 ppm
Detwiler Field	10.3 ppm
Average	**11.2 ppm**

Note: The chart results are the averages of the following number of tests conducted at each site: Reeses Corner-2, Cunningham Bridge-5, Black's Bridge-7, Detwiler Field-9, for a total of 23 dissolved oxygen tests. Tests were conducted with an oxygen meter and chemical kit, using a titration method.

Total Hardness
Water Quality Monitoring Results

The water hardness test results were between 23 ppm and 105 ppm. The results of each site were as follows: the headwater in the Alan Seeger Forest near Reeses Corner had a 60 ppm, Cunningham Bridge had 23 ppm, Black's Bridge had 105 ppm, and the average at Detwiler Field was 86 ppm.

Soft water is between 0 and 60 ppm. Hard water is between 120 and 180 ppm. This shows that the water ranged from being soft too just below hard. The water hardness average is closer to soft than hard. This means that there is not much calcium or magnesium in the stream. Acceptable drinking water is a value below 250 ppm. Therefore, this water is good for human consumption, not hazardous to health, and for sustaining aquatic creatures.

Location	Average
Alan Seeger Forest (Reeses Corner)	60 ppm
Cunningham Bridge	23 ppm
Black's Bridge	105 ppm
Detwiler Field	86 ppm
Average	**69 ppm**

Note: The chart results are the averages of the following number of tests conducted at each site: Reeses Corner-3, Cunningham Bridge-3, Black's Bridge-2, Detwiler Field-4, for a total of 12 total hardness tests. Tests were conducted with a chemical kit, using titration method.

Total Dissolved Solids
Water Quality Monitoring Results

The total dissolved solids (TDS) gradually increased from the headwater (23.2 ppm) at Reeses Corner to the mouth (113 ppm) at Detwiler Field. This would be considered typical as the volume of water increases as it flows toward the stream mouth picking up more dissolved solids in the forms of erosion and runoff. Specific averages were as follows: Reeses Corner had a 23.2 ppm, Cunningham Bridge had 42.5 ppm, Black's Bridge had 85 ppm, and Detwiler Field had a 113 ppm.

Clean water has low amounts of dissolved solids, less than 50 ppm. Water having between 50 and 150 ppm is considered not bad. Unacceptable drinking water would have over 500 ppm.

Overall, these TDS levels indicated there is not a total dissolved solid problem in Standing Stone Creek. However, it is a concern, given the observed vertical banks.

Location	Average
Alan Seeger Forest (Reeses Corner)	23.2 ppm
Cunningham Bridge	42.5 ppm
Black's Bridge	85 ppm
Detwiler Field	113 ppm
Average	**65.9 ppm**

Note: The chart results are the averages of the following number of tests conducted at each site: Reeses Corner-6, Cunningham Bridge-4, Black's Bridge-5, Detwiler Field-4, for a total of 19 dissolved solids tests. Tests were conducted with a dissolved solid pen.

Nitrates
Water Quality Monitoring Results

The nitrate levels in the creek showed two distinct results in specific areas. In the more agricultural areas near Cunningham and Black's Bridges the levels were slightly above .10 ppm, which is considered to be nutrient loading. Cunningham Bridge, which is the most agricultural area in the watershed, had a nitrate average of .32 ppm. Black's Bridge had a .22 ppm average. However, these are not extremely alarming levels. Implementation of Best Management Practices could eliminate some of this problem.

Reeses Corner, located in the forest headwater, had a reading of .06 ppm. This could be attributed to decomposing leaves. Detwiler Field had a 0 ppm reading, due to the nitrate levels being too low for the DREL 2000 Spectrophotometer to pick up.

Nitrates are found in most fertilizers and many pesticides. They increase eutrophication (a process affecting waters that are rich in mineral and organic nutrients, whereby plant life grows, eventually reducing the dissolved oxygen content and often killing off of other organisms).

Location	Average
Alan Seeger Forest (Reeses Corner)	.06 ppm
Cunningham Bridge	.32 ppm
Black's Bridge	.22 ppm
Detwiler Field	.0 ppm
Average	**.15 ppm**

Note: The chart results are the averages of the following number of tests conducted at each site: Reeses Corner-5, Cunningham Bridge-5, Black's Bridge-5, Detwiler Field-5, for a total of 20 nitrate tests. Tests were conducted with a DREL 2000 Spectrophotometer.

Phosphates
Water Quality Monitoring Results

The phosphate levels in the creek revealed a nutrient loading problem in all four tested sites. Reeses Corner had a very slight enrichment level of .11 ppm. Cunningham Bridge had a .66 ppm. Black's Bridge had a .15 level. Detwiler had a .48 ppm. Much like the nitrate levels, while considered to be nutrient loading, these are not overly high.

One source of the phosphate nutrient enrichment is from the agriculture, specifically, pesticides, e.g., diazinon, malathion. Again, implementation Best Management Practices could eliminate some of this nutrient loading problem, specifically, streambank fencing to restrict livestock from entering or coming to close to the stream and reestablishing riparian buffers—vegetation, most commonly trees and shrubs located along streambanks of moving water that prevent erosion— along the waterway.

Location	Average
Alan Seeger Forest (Reeses Corner)	.11 ppm
Cunningham Bridge	.66 ppm
Black's Bridge	.15 ppm
Detwiler Field	.48 ppm
Average	**.35 ppm**

Note: The chart results are the averages of the following number of tests conducted at each site: Reeses Corner-5, Cunningham Bridge-5, Black's Bridge-5, Detwiler Field-5, for a total of 20 phosphate tests. Tests were conducted with a DREL 2000 Spectrophotometer.

Water Quality Chart of Results

Water Test	Place	Day	Result
pH	Alan Seeger	10/7/00	6.9
	Cunningham	9/30/00	8.1
	Black's Bridge	10/21/00	7.6
	Detwiler Field	9/23/00	8.1
Alkalinity	Alan Seeger	10/7/00	25 ppm
	Cunningham	9/30/00	68 ppm
	Black's Bridge	10/21/00	68 ppm
	Detwiler Field	9/23/00	86 ppm
Dissolved Oxygen	Alan Seeger	10/7/00	10.9 ppm
	Cunningham	9/30/00	12.0 ppm
	Black's Bridge	10/21/00	11.4 ppm
	Detwiler Field	9/23/00	10.3 ppm
Hardness	Alan Seeger	10/7/00	60 ppm
	Cunningham	9/30/00	23 ppm
	Black's Bridge	10/21/00	105 ppm
	Detwiler Field	9/23/00	86 ppm
TDS	Alan Seeger	10/7/00	23 ppm
	Cunningham	9/30/00	43 ppm
	Black's Bridge	10/21/00	85 ppm
	Detwiler Field	9/23/00	113 ppm
Nitrates	Alan Seeger	10/7/00	.06 ppm
	Cunningham	9/30/00	.32 ppm
	Black's Bridge	10/21/00	.22 ppm
	Detwiler Field	9/23/00	0 ppm
Phosphates	Alan Seeger	10/7/00	.11 ppm
	Cunningham	9/30/00	.66 ppm
	Black's Bridge	10/21/00	.15 ppm
	Detwiler Field	9/23/00	.48 ppm

The chart shows the average water quality test results for each site and the date of our research.

Stream Habitat

Standing Stone Creek has predominately good to excellent stream habitat, scoring a very good or high suboptimal average of 136.5. Each site also had a cumulative score in the high optimal range, the low being 131 at Cunningham Bridge and the high of 147 at Black's Bridge. Reeses Corner had 132 and Detwiler Field had 136.

For the most part the waterway areas studied were consistently in the optimal or high suboptimal range. The exception being parameters related to bank vegetation protection and riparian buffer zones. While most areas along the waterway have adequate riparian zones and bank stabilization, there is obvious erosion caused by vertical and over-hanging banks in numerous sections, a significant problem needing remediation or restoration.

Three of the ten habitat parameters were in the most favorable optimal condition category, scoring between 16-20. They were Embeddedness (18), Shelter for Fish and macroinvertebrates (17), and Sediment Deposition (17). The parameters and descriptions follow:

- Embedddness: Fine sediment surrounds and fills in 0-25% of the living spaces around and in between the gravel, cobble, and boulders.
- Shelter for Fish and Macroinvertebrates: Snags, submerged logs, undercut banks, cobble and large rocks, or other stable habitat are found in over 50% of the site(s). All stream sites earning an excellent rating in the macroinvertebrate assessment verified this.
- Sediment Deposition: Little or no enlargement of islands or point bars and less than 5% of the bottom affected by sediment deposition (even though we found many eroded banks along the stream).

Scoring in the good or suboptimal category, between 11-15, were Attachment Sites for Macroinvertebrates (14), Channel Alteration (14), and Channel Flow Status (14). Stream Velocity and Depth Combinations scored between marginal (adequate) and subopitmal with an average of 10.3.

The parameters and descriptions follow:

- Attachment Sites for Macroinvertebrates: Riffle is as wide as the stream but less than 2 times its width; cobbles less abundant (than in the optimal range); boulders and gravel were common.
- Channel Alteration: Some stream straightening, dredging, artificial embankments or dams were present, usually in areas of bridge abutments; no evidence exist of recent channel alteration activity.
- Channel Flow Status: Water filled greater than 75% of the available channel and that less than 25% of the channel substrate (bottom) is exposed.
- Stream Velocity and Depth Combinations: Average was between 3 of the 4 velocity/depth combinations are present; fast current areas generally dominate and only 2 of the 4 velocity/depth combinations present.

Each side of the stream received a parameter score associated with Bank Vegetative Protection, Conditions of Banks, and Riparian Vegetative Zone Width. These varied, ranging from poor (0-2) to optimal (9-10). Condition of Banks (6.5) and Bank Vegetative Protection (6.0) were in the low suboptimal range of 6-8, while Riparian Vegetative Zone Width (5.7) was between the marginal range of 6-8 and marginal range of 3-5.

Detwiler Field, a residential dominant zone, had poor bank and riparian vegetative areas on the left side. Cunningham Bridge, an agricultural area, had very poor riparian vegetative zones on left and right banks. Habitat along the left bank, closer to Pennsylvania Route 26 where more developments exist, had more streambank related problems. The right side, adjacent to Standing Stone Creek Ridge, was more stable.

Riparian areas along Stone Creek Ridge were more established.

The parameters and category (average of the four sites for each side of the stream) descriptions follow:

- Condition of Banks: lower suboptimal

  (Left) and (Right) Moderately stable: infrequent, small areas of erosion mostly healed over.

Eroded vertical banks as illustrated in the two pictures taken near Black's Bridge, about 4 miles north of Huntingdon, were discovered in several areas of the stream.

- Bank Vegetative Protection: upper marginal (left), lower suboptimal (right)

  (Left) 50-70% of the streambank surfaces covered by natural vegetation; patches of bare soil or closely cropped vegetation common; less than one-half of the potential plant stubble height remaining. Note: The poor, eroded area at Detwiler Field lowered this average.

(right) 70-90% of the streambank surfaces covered by natural vegetation, but one class of plants is not well-represented; some vegetative disruption evident; more than one-half of the potential plant stubble height remaining.

• Bank Vegetative Protection: marginal (left), suboptimal (right)

(Left) Width of riparian zone 20-40 feet; no evidence of human activities, e.g., parking lots, roadbeds, clearcuts, mowed areas, or crops) within the riparian zone. Note: Agricultural activity near Cunningham Bridge lowered average.

(right) Width of riparian zone 35-40 feet; no evidence of human activities, e.g., parking lots, roadbeds, clearcuts, mowed areas, or crops) within the riparian zone. Note: Agricultural activity near Cunningham Bridge lowered average.

Bank vegetative protection in agricultural areas throughout the watershed is limited as seem in the adjacent picture taken south of Cunningham Bridge about 15 miles north of Huntingdon.

The parameter, score for each site, and parameter stream average are illustrated in the Stone Creek Stream Habitat chart on the next page.

Stone Creek Stream Habitat

Parameter	Reeses Corner	Cunningham Bridge	Black's Bridge	Detwiler Field	Stream Average
1. Attachment Sites	16	13	15	10	**13.5**
2. Embedded-ness	18	12	15	19	**16.8**
3. Shelter	17	14	13	20	**16**
4. Channel Alteration	11	13	14	16	**13.5**
5. Sediment Deposition	17	17	19	14	**16.8**
6. Velocity & Depth	6	11	14	10	**10.3**
7. Channel Flow	7	19	18	12	**14**
8. Vegetation					
Left	7	8	6	1	**5.5**
Right	7	8	4	10	**6.5**
9. Condition of Banks					
Left	8	7	6	4	**6.3**
Right	7	5	4	9	**6.3**
10. Riparian Vegetative					
Left	8	2	7	1	**4.5**
Right	6	2	9	10	**6.8**
Total	**132**	**131**	**147**	**136**	**136.5**

The ten habitat parameters used to assess the stream habitat were 1) Attachment Sites for Macroinvertebrates, 2) Embeddedness, 3) Shelter for Fish and Macroinvertebrates, 4) Channel Alteration, 5) Sediment Deposition, 6) Stream Velocity and Depth Combinations, 7) Channel Flow Status, 8) Bank Vegetative Protection, 9) Condition of Banks, and 10) Riparian Vegetative Zone Width.

Water Treatment Plant

Dan Heffner, Plant Manager, of the Water treatment Plant provided the following responses to our questions.

Question # 5: Do you conduct tests for bacteria such as total coliform or fecal coliform? How often? The plant conducts 10 samples per month for total coliform and has found nothing exceptional to indicate a health issue.

Question # 7: Do you remove suspended and/or dissolved solids as part of the treatment process? If so, how much is normal for Stone Creek and are they a problem?" "No Problem's" with suspended and or dissolved solids.

Question # 8: Has Stone Creek ever had any environmental health related issues in the past? If so, please describe. "No," Stone Creek has never had any environmental health issue.

Question # 9: What do you think is the most serious threat to maintaining the water quality of Standing Stone Creek for both a cold water fishery and a source of potable water? He considers the most serious threat to the water quality of the stream to be an oil spill or chemicals.

Questions #10: Is the supply of water from Standing Stone sufficient to meet the Huntingdon Borough's needs in the future? The supply of water is sufficient as Huntingdon Borough uses about 1 and one-half million gallons of water per day. Stone Creek can supply 4 million gallons per day.

Huntingdon's water filtration plant received an award from the American Waterworks Association and the Department of Environmental Protection for providing treatment and safe drinking water in the fall of 2000. Only a small number of water treatment plants earn this recognition.

The plant monitors seven contaminant categories on a regular basis. They are microbiological (coliform bacteria), inorganic (e.g., arsenic, cadmium, mercury), nitrate/nitrite, volatile organic, synthetic organic, TTHM (total trinalomethanes) and radiological. No problems exist in any of these contaminant grouping.

"Over 2,800 households depend on Standing Stone Creek for their drinking water supply. That amount to approximately 6,800 residents, as well as a large transient population of school students and workers who visit Huntingdon Borough on a daily basis." The presence of this White Egret is a positive sign that Standing Stone Creek is currently a healthy stream.

Physical

We obtained the temperature, width, depth, speed and volume of water flowing at the selected sites. However, we learned that we could not make an interpretative analysis about the stream because we lacked long-term data. We do know that the stream is a high quality cold water fishery and that Huntingdon could draw 4 million gallons a day for its use. Currently, the borough uses an average of 1 and 1/2 millions gallons of water a day. The average stream flow for our locations in the fall was over 20,000,000 gallons per day.

The physical results, e.g., water temperature, width, depth, speed, volume of water (stream flow) are illustrated in the chart below.

Parameter	**Reeses Corner**	**Cunningham Bridge**	**Black's Bridge**	**Detwiler Field**	**Stream Average**
1. Date	10/7/2000	9/30/2000	10/21/2000	9/30/2000	**NA**
2. Water Temp	54 F	55 F	53 F	72 F	**58.5**
3. Width	5.82 m	16.6 m	27.55 m	32.0	**20.5 m** **(67 feet)**
4. Depth	.123 m	.37 m	.184 m	.135 m	**.20 m** **(7.86 in)**
5. Speed	.395 m/s	.126 m/s	.33 m	.42 m	**.318 m** **12.5 ft/sec**
6. Volume	.23 cubic meters/sec 3,646 gallons/min	.62 cubic meters/sec 9,827 gallons/min	1.34 cubic meters/sec 21,239 gal/min	1.45 cubic meters/sec 22,983 gal/min	**.91 cubic meters/sec** 14,424 gallons/min

Note: Cubic meter/second equals 15,850 gallons of water per minute

Recommendations

Our macroinvertebrates assessment and evaluation of water quality tests and habitat parameters demonstrate that Stone Creek has good water quality. Biodiversity of aquatic macroinvertebrates is abundant. Water quality tests show the stream has a high level of dissolved oxygen, an excellent pH level, and an alkalinity level (80.5 ppm) that can buffer acidity. The water is not hard and thus not hazardous to aquatic organisms or human health and the dissolved solid average is moderate.

An area of concern is that the nitrate and phosphate levels are a slightly high and problems related to streambanks, e.g., vertical, undercut, overhanging, no vegetation and insufficient riparian vegetative buffer zone width.

Therefore, we recommend to:

1) Complete a full-scale watershed assessment to obtain a more thorough and accurate picture of water quality than that obtained from this pre-assessment.
2) Decrease the levels of nitrates and phosphates entering the watershed from agriculture (e.g., cows, fertilizers) and domestic (e.g., possible malfunctioning home septic systems) sources — see Best Management Practices for Agriculture Available in Huntingdon County in appendices.
3) Implement Best Management Practices Stream Protection Systems to reduce streambank erosion and to maintain and improve riparian buffers along stream, e.g., Channel Vegetation, Fencing, Filter Strip, Streambank and Shoreline Protection, Tree Planting.
4. Continue to educate public about water-related issues in the watershed.
5) Establish a Standing Stone Creek Watershed Association.

To achieve these goals we suggest the following:

- Work at stabilizing high erosion bank areas e.g., re-vegetation of stream banks, build cattle crossings, corridor off sections of bank to cattle.

- Increase monitoring activities in unchecked areas for nonpoint sources of nutrient loading and to ascertain the level pollution, e.g., agricultural, residential, natural—acid precipitation.
- Promote Implementation Best Management Programs with a nutrient management plan in areas needing more than traditional Best Management Practices (e.g., contour farming, terracing, and no-till) to successfully protect or improve water quality.
- Target farms nearest Standing Stone Creek first for Best Management Practices, e.g., install streambank fencing or vegetation barriers near the waterway where necessary.
- Implement immediate Nutrient Management plans in areas found to be sources of nutrient loading to the watershed.
- Set animal unit thresholds for farmers, with assistance of the state can develop and implement best management systems for animal facilities.
- Have the county work at integrating and developing a market for animal waste with its sludge program.
- Have county agencies more aggressively enforce effective management of animal waste and use of pesticides with nitrates and phosphates.
- The state should encourage the maintenance of forest and agricultural land in this watershed e.g., control/reduce deforestation, develop more economic incentives for farmer to properly maintain land.
- Continue efforts to educate the public by private and public means.
- Enforce stringently the newer standards for septic tank design, installation, and maintenance as most homes in this watershed have septic systems.
- Restrict over residential development in this watershed in the future.
- Check the immediate area near the stream for illegal dumps and sink holes that have debris place in them.

A complete list of Best Management Practices available in Huntingdon County can be viewed in the Appendices.