Little Conestoga Creek

Watershed Assessment and Restoration Plan

Prepared by:

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Prepared for:

Little Conestoga Watershed Alliance
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Funded by:

Pennsylvania is Growing Greener — Growing Greener Program — DEP

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January 2003

Little Conestoga Watershed Alliance

"Restoring & Preserving Our Water & Wildlife"

P.O. Box 6355
Lancaster, Pennsylvania 17607

www.littleconestoga.org

THE MISSION

To preserve and enhance the watershed for its citizens and the environment through education and restoration projects

OBJECTIVES

Restore Little Conestoga Creek and its tributaries by:

1. Providing watershed education to citizens
2. Involving municipal and county officials in restoration endeavors
3. Assisting agricultural professionals with streambank fencing and water management programs
4. Securing funding for restoration activities and projects
5. Utilizing native plant species in restoration projects

The Little Conestoga Water Alliance (LCWA) is a non-profit Pennsylvania organization founded in October 2000. The LCWA is a group of citizens, businesses, non-profit conservation organizations, academic institutions, and local, state and federal government representatives that have joined together and are committed to a common purpose:

A comprehensive approach to continual enhancement of water quality, stream restoration, and preservation of natural resources within the Little Conestoga Creek Watershed.

2002 OFFICERS AND BOARD MEMBERS

LITTLE CONESTOGA CREEK WATERSHED ALLIANCE

Belted King Fisher

Great Blue Heron

THE MISSION

To preserve and enhance the watershed for its citizens and the environment through education and restoration projects

Municipalities: *East Hempfield Township, East Petersburg Borough, Lancaster City, Lancaster Township, Lititz Borough, Manheim Township, *Manor Township, Millersville Borough, Mountville Borough, *Penn Township, *Warwick Township, West Hempfield Township (*=Predominantly Agricultural)

Little Conestoga Tributaries: Bachman Run, Swarr Run, Millers Run, Brubaker Run, West Branch, Indian Run

Size: 65.5 square miles (41,920 acres)

Location: State Water Plan - Basin 07J

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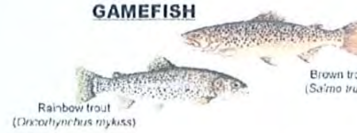
COMMON FISH

Species Found in the Little Conestoga Creek Watershed

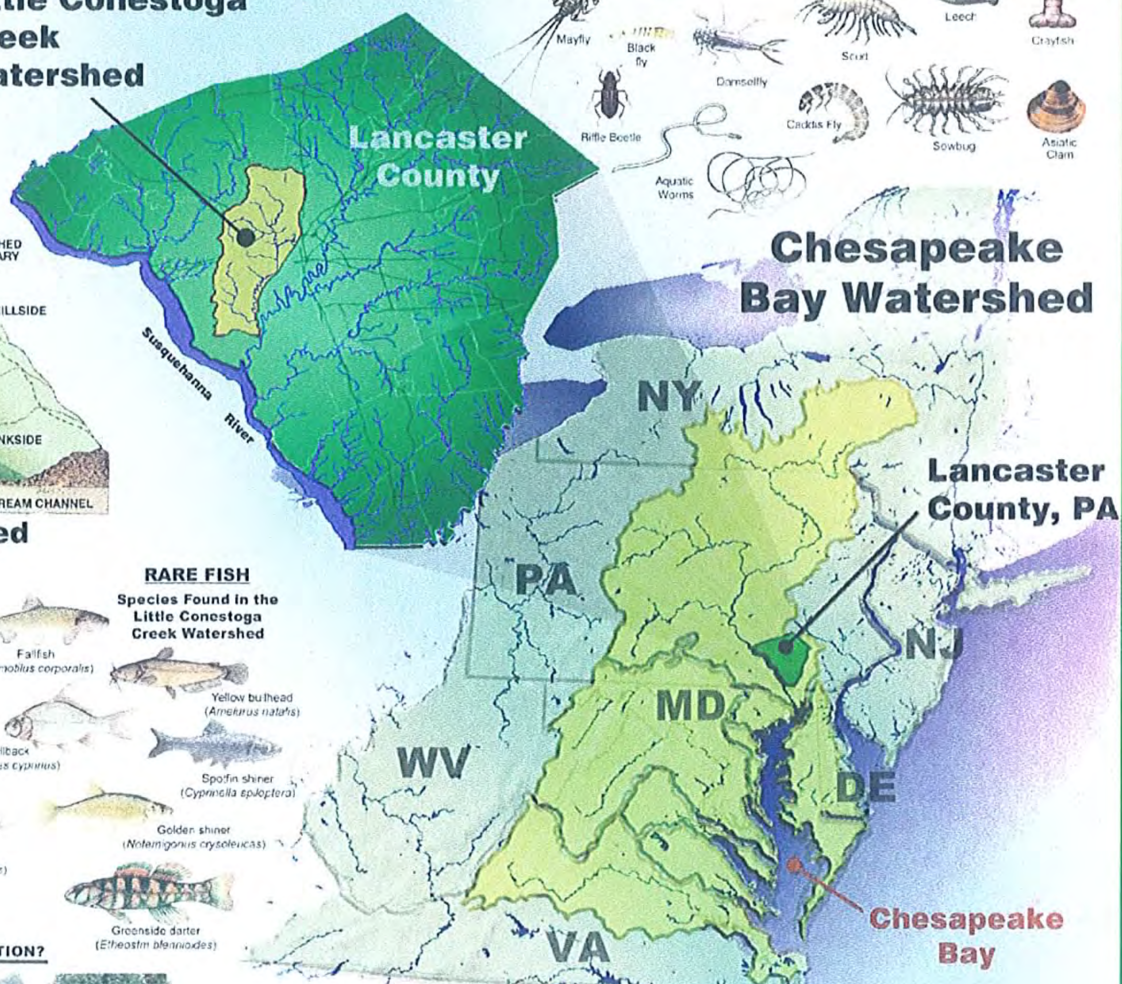
ABUNDANT FISH

Species Found in the Little Conestoga Creek Watershed

STOCKED GAMEFISH



Typical Benthic Macroinvertebrates in the Little Conestoga Creek Watershed



WHAT IS A WATERSHED ?

A watershed is an area of land that draws water, sediment and dissolved materials to a common outlet at some point along a stream channel or waterbody.

Conceptual Watershed Cross Section

RARE FISH

Species Found in the Little Conestoga Creek Watershed

WHAT IS STREAM RESTORATION?

BEFORE

AFTER

Little Conestoga Watershed Alliance

Growing Greener Program

RETTEW ASSOCIATES INC

EXECUTIVE SUMMARY

The Little Conestoga Creek watershed is located in the east-central portion of Lancaster County, Pennsylvania. Forty different stream segments within this 65.5-mi² drainage are listed as impaired waters (Commonwealth of Pennsylvania - 303 (d) List of Impaired Waters). The 40 segments collectively include some 53 linear miles of impaired water. Nutrients and siltation are listed as the two main causes of impairment and are identified as resulting from poorly managed agricultural practices. Industrial and residential landuse are also credited as sources of impairment, but to a lesser degree.

In March of 2000, a handful of people concerned with the ailing health of the Little Conestoga Creek met for the first time in the interest of possibly forming a watershed organization. As a result, the **Little Conestoga Watershed Alliance** was founded as a non-profit Pennsylvania organization in October of 2000.

The Alliance had a general awareness and understanding of the problems facing their namesake and was indeed aware of various water quality studies performed by others, but a holistic watershed assessment necessary for supporting the development of a restoration plan on a watershed basis did not exist. There were various studies that explored certain interests to quite respectable detail, but none captured the complete view sought by the Alliance. The Alliance needed a guidance tool, a "road map" of sorts, to help them organize and prioritize their energies and efforts.

With the above in mind, the Little Conestoga Watershed Alliance proposed the development of a **watershed assessment and restoration plan**. The assessment was to focus on discovering site specific sources and causes of stream impairment to the degree of detail necessary for developing a restoration plan. The restoration plan would in turn serve as the Alliance's road map, steering and guiding the group through coming years and future projects. In March of 2001, the Alliance applied to the Commonwealth of Pennsylvania for a Growing Greener Grant to fund the study and in August of 2001 received word that the grant request in the order of $95,000.00 had been approved.

This resulting report, appropriately titled "Little Conestoga Creek – Watershed Assessment and Restoration Plan", discusses the findings and brings conclusion to the Growing Greener funded study.

The assessment portion of the study involved the following:

1) Investigation of the sub-watersheds and specifically the 40 stream segments identified on the 303 (d) List of Impaired Waters
   a) Identification of the type and severity of impairments
   b) Identification of specific on-site causes/sources of impairments

c) Level I Fluvial Geomorphology Classification determination (only for impairments relating to stream bank stability)

2) Investigation of the status and composition of the fish and macroinvertebrate community for the entire watershed on a sub-watershed sampling basis to be used as baseline data for tracking future recovery progress and possible development of a greater sport fishery

3) Investigation of local stormwater management, zoning and comprehensive landuse planning and/or the lack thereof for each municipality within the watershed with an emphasis on water quality, water quantity and water usage

4) Collection of polling data from stakeholders regarding their thoughts, concerns and objectives as related to the watershed and its protection

5) Identification of critical habitats and ecosystems including known Pennsylvania Natural Diversity Inventory (PNDI) sites, wetlands and forestlands

6) Identification and investigation of other known or likely causes/sources of impairment outside those generally described in the 303 (d) List – i.e., localized flooding, thermal pollution sources, point sources, etc.

7) Investigation of established "wellhead protection programs" within the watershed and assimilation of any relevant information

8) Further investigation of all relevant data from previously known and discovered sources and assimilated as appropriate – i.e., Pennsylvania Fish and Boat Commission studies

9) Exploration and discovery of other restoration type endeavors undertaken from outside groups –develop working relationship and share data as appropriate – i.e., Chesapeake Bay Foundation, Lancaster Healthy Communities, Donegal Chapter of Trout Unlimited, etc.

The restoration plan portion of the study includes the following:

1. A description and prioritization of the discovered problem areas (with emphasis on non-point source water quality related problems)

2. Solutions and alternatives for correcting the discovered problems

3. Estimation of costs associated with correcting the discovered problems

4. Fishery management options

5. Ideas for building public support

6. Suggested plan for engaging municipalities in regards to lacking stormwater management, zoning and land development ordinances

7. A means of monitoring progress

RETTEW Associates, Inc. was selected as the environmental consulting firm to oversee and conduct the majority of the study. Volunteer expertise was also utilized, most notably the spring 2002 "Environmental Problems" class from Franklin and Marshall College under the direction of Dr. Philip J. Nyhus. The advanced class of junior and senior environmental students divided into four research teams consisting of a social science, biological science, physical science and spatial science team. The class compiled their data and presented their findings in both a public presentation and written report. Findings from the Franklin and Marshall research were then given to RETTEW for incorporation into this very report.

Research began in August of 2001 and concluded in September of 2002, with the majority of the field investigations being performed between April and August of 2002.

The following pages of this report detail the findings of the various assessment investigations and suggested restoration priorities. Any questions regarding the content of this report can be asked of:

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LITTLE CONESTOGA CREEK ASSESSMENT AND RESTORATION PLAN FINAL REPORT

Little Conestoga Watershed Alliance

Executive Summary

General Location Map

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INTRODUCTION

The Little Conestoga Creek watershed is located in the east-central portion of Lancaster County, Pennsylvania. Forty different stream segments within this 65.5-mi^2 drainage are listed as impaired waters (Commonwealth of Pennsylvania - 303 (d) List of Impaired Waters). The 40 segments collectively include some 53 linear miles of impaired water. Nutrients and siltation are listed as the two main causes of impairment and are identified as resulting from poorly managed agricultural practices. Industrial and residential landuse are also credited as sources of impairment, but to a lesser degree.

In September 1998, the United States Geological Survey and the Alliance for the Chesapeake Bay completed a water quality study within the Little Conestoga Creek watershed. The general landuse survey revealed that the basin is predominantly comprised of agricultural lands. Water quality was evaluated taking into account the existing agricultural influences. Water samples from 15 different sites were evaluated for nitrate and sulfate concentrations. No significantly high concentrations of sulfates were found in the watershed, but nitrate levels were a different matter. The greatest concentrations of nitrates were found in streams in the lower basin where agriculture comprises nearly 80% of the landuse. Nitrate concentrations often exceeded the United States Environmental Protection Agency "maximum contaminant level" of 10-mg/L, while ammonia concentrations were found at levels known to be acutely toxic to aquatic life.

As part of this same study, Lancaster County Academy, Millersville University and the United States Geological Survey also collected aquatic insects using the United States Environmental Protection Agency's "rapid bioassessment protocols". The results of those studies, along with additional benthic macroinvertebrate studies conducted by the United States Environmental Protection Agency, found it difficult if not nearly impossible to locate healthy streams in the Lowlands ecoregion because of past and present farming practices. Sadly, the completed biometric studies revealed that among the sampling locations, not one produced more than three pollution-sensitive benthic macroinvertebrate varieties within the Little Conestoga Creek basin.

In March of 2000, a handful of people concerned with the ailing health of the Little Conestoga Creek met for the first time in the interest of possibly forming a watershed organization. As a result, the **Little Conestoga Watershed Alliance** was founded as a non-profit Pennsylvania organization in October of 2000.

The Little Conestoga Watershed Alliance's membership consists of a diverse cross-section of watershed stakeholders. Citizens, landowners, businesses, conservation organizations, academic institutions and local and state government representatives comprise the Alliance body and in turn bring specific interests and expertise to bear thus complimenting and completing the group.

As are most watershed organizations, the Little Conestoga Watershed Alliance was anxious to see some actual restoration work performed in and along the creek. Some problems and problem areas are quite evident and the solution obvious. In these situations, the Alliance has chosen to move ahead and address each on an independent basis provided the effort doesn't pose potential complications to future up and downstream projects.

The Alliance had a general awareness and understanding of the problems facing their namesake and was indeed aware of various water quality studies performed by others, but a holistic watershed assessment necessary for supporting the development of a restoration plan on a watershed basis did not exist. There were various studies that explored certain interests to quite respectable detail, but none captured the complete view sought by the Alliance. The Alliance needed a guidance tool, a "road map" of sorts, to help them organize and prioritize their energies and efforts.

Likewise, factors that influence watershed health simply change with time; thus details of past studies may or may not be relevant in the present day. Indeed this is often the case in Lancaster County where rapid land development has been the norm since the mid '80s (prior to most municipalities adopting land development and stormwater management ordinances in Lancaster County). This certainly was and is the case within two watershed municipalities - Manor and East Hempfield Townships. It's understandable these two municipalities often experience public outcry for relief after sizable storm events. Case in point – the following newspaper article:

E. Hempfield offers little hope for victims of flooding, erosion

Residents of East Hempfield's Chestnut Valley development want the township to help them solve flooding and erosion problems that have plagued them for years.

But township officials said Wednesday there's little they can do, since the development near Centerville was approved by the county, and East Hempfield had little input on where the homes were built.

A dozen residents attended Wednesday's township supervisors meeting to vent their gripes about flooding and soil erosion linked to Millers Run, a stream that winds through the upscale housing development between Spring Valley and Nolt roads.

One resident said flooding has become worse since the township installed new storm sewers last year along Spring Valley that drain into the stream.

Another man said he has lost 10 feet of his property on Chestnut Valley Drive to erosion in the past 10 years. The stream now is eight feet deep and 18 feet wide after heavy rains.

Plans for Chestnut Valley were approved in the mid-1980s, before East Hempfield adopted a land-development ordinance. The county Planning Commission approved the project, after the developer decided the location of the homes.

The supervisors on Wednesday agreed to look at the issue again after the county and the county conservation district become involved.

It is not coincidental the area discussed in the above article just happens to correspond with a certain stream segment identified in the 303 (d) List of Impaired Waters (one which notes stormwater sewers as a source of impairment).

Though the 303 (d) List of Impaired Waters identified this stream segment as being impaired, it doesn't clarify who the 40 plus landowners are, details about an existing sewer easement within the floodway that limit possible restoration practices, municipal plans to reconstruct a bridge and realign a portion of road, details regarding a vacant tract of land perfect for retrofitting stormwater retention into a subdivision that never had any and other such pertinent details necessary for developing a restoration plan - nor does any other existing study for that matter!

With the above in mind, the Little Conestoga Watershed Alliance proposed the development of a **watershed assessment and restoration plan**. The assessment was to focus on discovering site specific sources and causes of stream impairment to the degree of detail necessary for developing a restoration plan. The restoration plan would in turn serve as the Alliance's road map, steering and guiding the group through coming years and future projects. In March of 2001, the Alliance applied to the Commonwealth of Pennsylvania for a Growing Greener Grant to fund the study and in August of 2001 received word that the grant request in the order of $93,100.00 had been approved.

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RETTEW began its research in August of 2001 and concluded in September of 2002, with the majority of the field investigations being performed between April and August of 2002. One of the larger undertakings took place in March of 2002 and involved the aerial video-logging of the impaired stream segments as identified by the Commonwealth of Pennsylvania – 303 (d) List of Impaired Waters. A pre-flight plan was prepared and a test flight was taken prior to the main video-logging flight day. As part of the flight plan preparation, coordinates for the impaired stream segments were determined using available Geographic Information System

(GIS) mapping. Once in the air, an onboard Global Positioning System (GPS) unit was used to locate the subject stream segments. The GPS unit and the onboard video camera are connected and work together in such fashion that it's easy to determine exactly where and what segment of stream one is looking at when back in the lab. Recorded images were then analyzed and used to help determine stream conditions.

Field investigation of the fish and macroinvertebrate communities took place between April and June of 2002. Sampling took place at 23 different sites strategically located through the entire watershed. The United States Environmental Protection Agency's (EPA) "rapid bioassessment protocols" were utilized during this investigation. Aquatic habitat assessments were also completed at these same 23 sites between April and July of 2002, again using the EPA rapid bioassessment protocols. Five additional sites had been previously assessed in July of 2001 (in the same fashion) and their data was considered as part of this study.

During the spring of 2002, RETTEW had several interactions with the previously mentioned "Environmental Problems" class from Franklin and Marshall College. RETTEW staff made several trips to the college campus in order to communicate and coordinate assessment efforts. Likewise several of the students found their way to RETTEW's office.

During the assessment process, RETTEW gave several updates and status reports to the Little Conestoga Watershed Alliance at their monthly meetings. Both the Pennsylvania Department of Environmental Protection's Regional Watershed Manager (Ms. Jineen K. Boyle) and the Lancaster County Conservation District's Watershed Specialist (Mr. Matthew W. Kofroth) were normally present at these meetings and had opportunity to comment and aid in the assessment process.

Aside from the actual fieldwork, much of the assessment involved some form of communication and/or research of already available information – the task being the discovery and assimilation of it. A variety of sources, such as municipalities, Lancaster County GIS Department, Lancaster County Engineers Office and the Pennsylvania Fish and Boat Commission to name a few, were questioned and probed for sought information.

Desired outcomes as a result of this study include the following:

- Preparation of an assessment and restoration plan
- Improved public awareness and education
- Improved communication and cooperation between the Little Conestoga Watershed Alliance and the municipalities
- Growth of the Little Conestoga Watershed Alliance membership

- Data/information made available to the Pennsylvania Department of Environmental Protection for Total Maximum Daily Load preparation

WATERSHED ASSESSMENT AND RESTORATION PLANNING

A stream evolves in response to changes within its watershed. In natural, pristine conditions, stream systems operate within a unique balance of flow, sediment transportation, temperature, chemical composition and the indigenous aquatic life therein among other things. This unique, natural balancing act is referred to as "dynamic equilibrium". Such a balanced stream system is not static, but is ever changing at a natural pace. Though elements within the watershed (physical, chemical or biological) change and therefore effect and cause a reaction in the stream, these changes to the watershed occur at nature's pace and the stream in turn can keep up with the changes at nature's prescribe pace.

But when physical, chemical or biological changes occur in the watershed at an accelerated rate determined by man's activities, a stream system will surely loose its ability to keep up with the rapidly changing set of watershed influencing factors it has been dealt. Mankind's successful, rapid alteration of the watershed in most circumstances cannot be successfully counter-balanced by a stream system making counter-adjustments at Nature's prescribed pace. Simply put, mankind can alter a watershed faster than a stream can adequately adjust for it – equilibrium is lost and the stream's health compromised.

In the past (as well as the present and future), humans generally have a poor reputation for considering how their activities on land may negatively effect water resources both in quantity and quality. All to often, projects are completed on the landscape without proper consideration of possible impact to water resources.

Watershed assessment and restoration planning therefore is an effort to recognize, avoid, abate and reverse the above. "Restoration is a complex endeavor that begins by recognizing natural or human-induced disturbance that are damaging the structure and functions of the ecosystem or preventing its recovery to a sustainable condition." (Pacific Rivers Council 1996)

Restoration "requires an understanding of the structure and functions of stream corridor ecosystems and the physical, chemical and biological processes that shape them." (Dunster and Dunster 1996)

It is important to recognize that no two stream systems are alike, and likewise no two restoration endeavors are identical. Attempting to "pigeon hole" a stream into one particular type or force its dimension into a chosen mold is to exhibit a total lack of understanding for the complexity of the task. There are unfortunate examples of well-intended restoration projects that address a particular interest while at the same time create, increase and/or ignore other stream ailments. In the end, the initial concern has possibly been addressed, but a new problem has risen to take its place and/or previous problems still exist which in of their own account are able of rendering the stream impaired. The more complex and diverse the landuse, the more troublesome and complex the restoration endeavor.

It is with these thoughts in mind, the Little Conestoga Creek assessment and restoration plan was conducted and prepared (as best could be given the limitations of funding and available time).

The conducted assessment was intended to be holistic in its gathering and consideration of all the possible elements shaping and influencing the Little Conestoga Creek. The restoration plan was in turn developed around the findings of the assessment and is intended to provide a strategy for protecting and enhancing valued components (flora, fauna and habitats) and correcting discovered problems serving to damage the stream's well-being.

Greenside darter *(Etheostoma blennioides*)
Pollution intolerant fish species found in the main stem of the Little Conestoga Creek near its confluence with the Conestoga River

SUB-WATERSHEDS

The Little Conestoga Creek drains a total of 65.5-square miles. Major sub-watersheds within the basin include Brubaker Run, Indian Run, Millers Run, Swarr Run, West Branch and the main stem of the Little Conestoga Creek (including the headwaters and Bachman Run tributary). Millers Run is actually a sub-watershed of Swarr Run.

SUB-WATERSHED LANDCOVER/LANDUSE IN ACRES

LANDCOVER & LANDUSE	BRUBAKER RUN	INDIAN RUN	MILLERS RUN	SWARR RUN	WEST BRANCH	MAIN STEM
Total area	**1,845-acres** *(2.879-sq. miles)*	**2,054-acres** *(3.206-sq. miles)*	**791-acres** *(1.236-sq. miles)*	**4,891-acres** *(7.630-sq. miles)*	**7,893-acres** *(12.310-sq. miles)*	**24,541-acres** *(38.272-sq. miles)*
Commercial & Services	135.9	3.2	6.0	63.9	57.2	885.5
Coniferous Forest		0.3			0.4	17.8
Cropland	420.8	**1371.1**	143.5	**1572.4**	**5153.8**	**8755.7**
Deciduous Forest	29.5	296.9	51.2	183.0	210.6	934.2
Farmsteads	12.7	27.1	7.3	25.1	81.5	241.8
Forested Wetland		1.5			0.06	17.9
Herbaceous	82.3	34.2	37.7	268.1	239.8	1457.0
Industrial	8.7	1.4		154.2	20.6	227.0
Industrial & Commercial Complex	**467.5**			74.4	291.7	1406.2
Institutional	44.2	5.0	25.9	109.8	77.2	438.1
Large Confined Feeding	1.2	41.8		17.1	130.4	126.8
Mines, Quarries, Pits						267.5
Mixed Barren & Vegetated	21.9			4.2	2.1	30.2
Mixed Cover		6.8			41.4	93.8
Mixed Forest					1.6	27.3
Mixed Urban, Built-up Land						105.7
Non-Forested Wetlands	10.3	1.7		20.2	3.6	97.8
Open Water	1.0	3.5	0.2	13.7	24.8	174.3
Orchards, Horticultural		2.2		60.3	19.7	264.0
Other		0.1			1.0	1.4
Other Agricultural		0.7			1.5	1.9
Pasture	31.7	150.8	8.3	123.4	509.1	500.5
Recreational	15.2	0.4	35.7	270.0	80.5	936.9
Residential 2.1 – 7 units/acre	464.6	53.6	**430.8**	1505.1	741.5	5463.7
Residential < 2 units/acre	2.5	37.0	39.7	246.4	113.5	721.0
Residential > 7 units/acre	34.7			47.9	31.4	391.0
Scrub/Brush	6.8	14.4	4.5	50.4	12.9	137.2
Transitional (construction)	2.4			6.7	10.4	246.3
Transportation & Utilities	51.0			74.8	34.2	571.5

Large floodplain valleys and moderately sloped hills sides comprise the Little Conestoga Creek Watershed. The lowest point in elevation within the watershed is at the Little Conestoga Creek / Conestoga River confluence approximately 185-feet above sea level USGS datum. The highest point in elevation is on an unnamed hill near Manheim at 560-feet. The Little Conestoga Creek is by no means a fast moving, white water stream. Rather the stream bed averages a nearly flat 0.5 % slope.

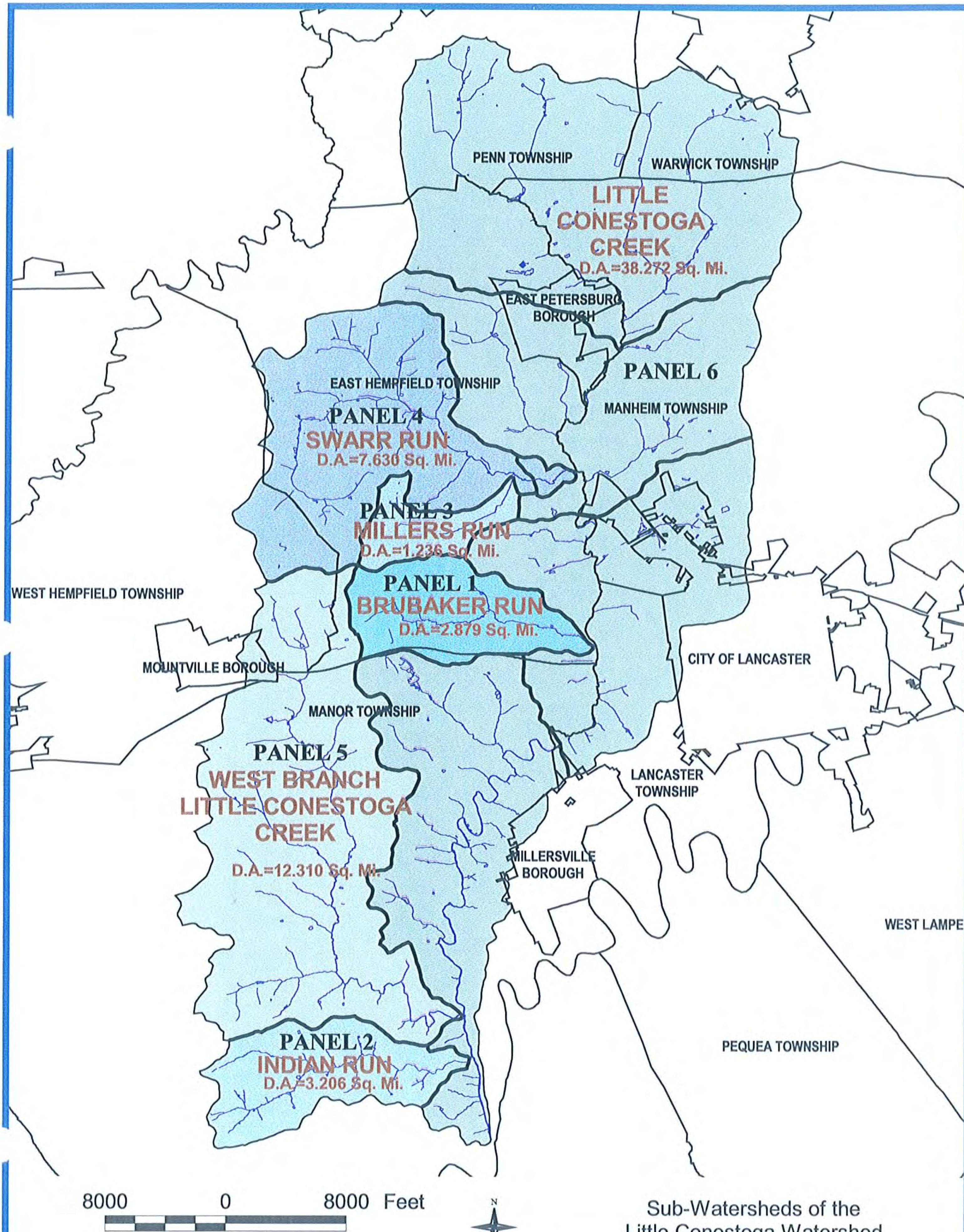
According to D.L. Rosgen's 1994 *"A Classification of Natural Rivers"*, much of the Little Conestoga Creek can be classified into the three following stream types:

Stream Type "C" (C4 and C5)
Type "C' streams are riffle/pool streams with a well-developed floodplain, meanders, and point bars. These streams are wide with a width/depth ratio greater than 12. Type "C" streams are moderately entrenched, and therefore use their floodplains during large storm events.

Stream Type "F" (F4 and F5)
Type "F" streams are deeply entrenched, often meandering stream with a high width/depth ratio (greater than 12). These stream types are typically working to create a new floodplain at a lower elevation and will often evolve into "C" type streams. The micro-evolutionary process leads to very high levels of bank erosion, bar developments, and sediment transport.

Stream Type "G" (G4 and G5)
Type "G" streams or gully stream types are similar to the "F" types but with low width/depth ratios. With a few exceptions, "G" streams possess high rates of bank erosion as they try to widen into an "F". "G" streams are found in a variety of landforms, including meadows, urban areas, and new channels within relic channels.

Approximately 95% of the Little Conestoga Creek Watershed has underlying carbonate geology and is comprised of "Letort-Pequea-Conestoga" and "Duffield-Hagerstown" soil types. These rich limestone soils are prime for farming and are typically well drained. "Manor-Chester-Glenelg" soils account for the other 5% and are formed from mica schist, schist, gneiss and quartzite. This soil is found in western East Hempfield Township and most of West Hempfield Township. A small area of "Bedington" exists on the ridge tops in Penn and Warwick Townships. Bedington soils are formed in the residuum of acid shale.



Sub-Watersheds of the Little Conestoga Watershed

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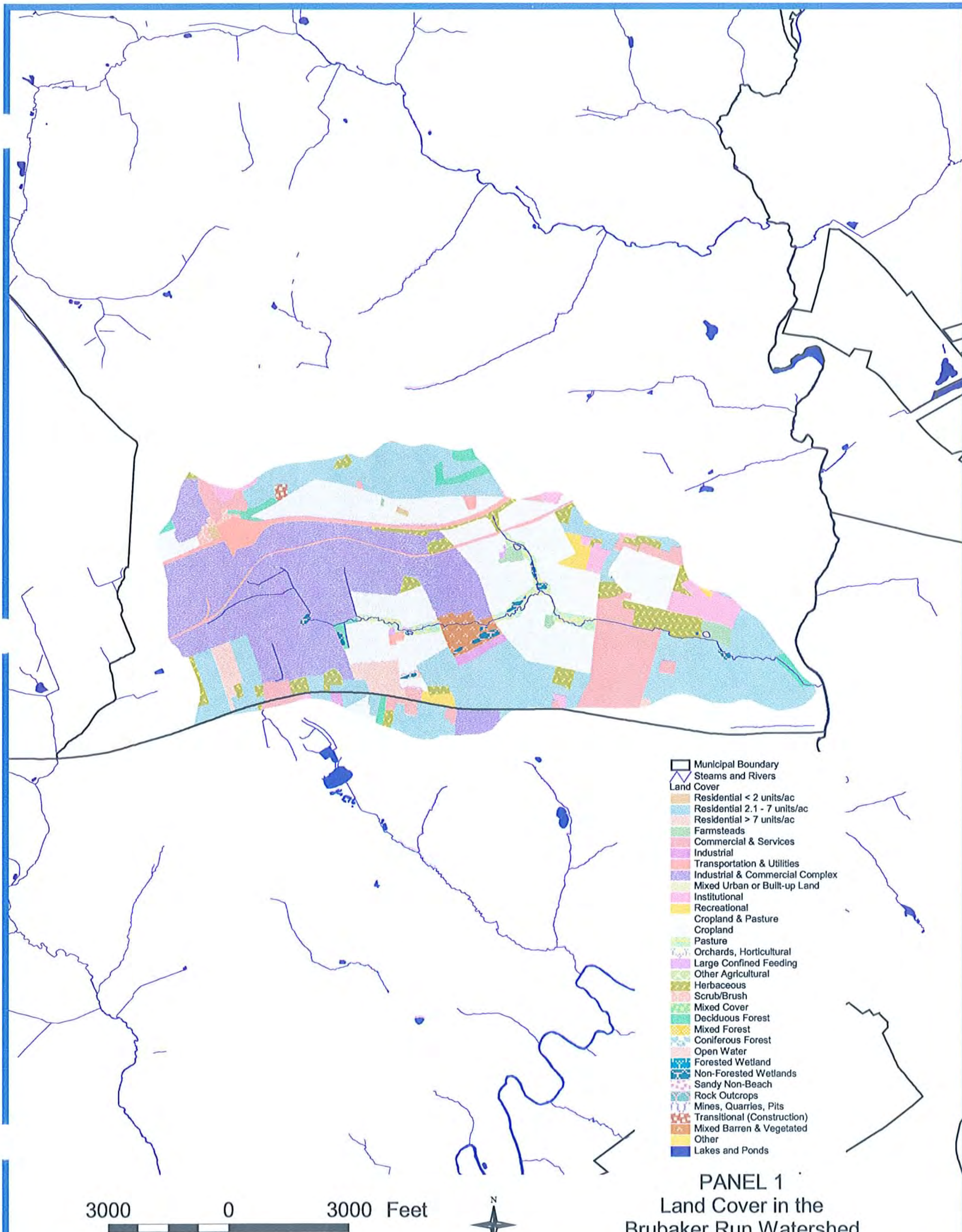

PANEL 1
Land Cover in the
Brubaker Run Watershed

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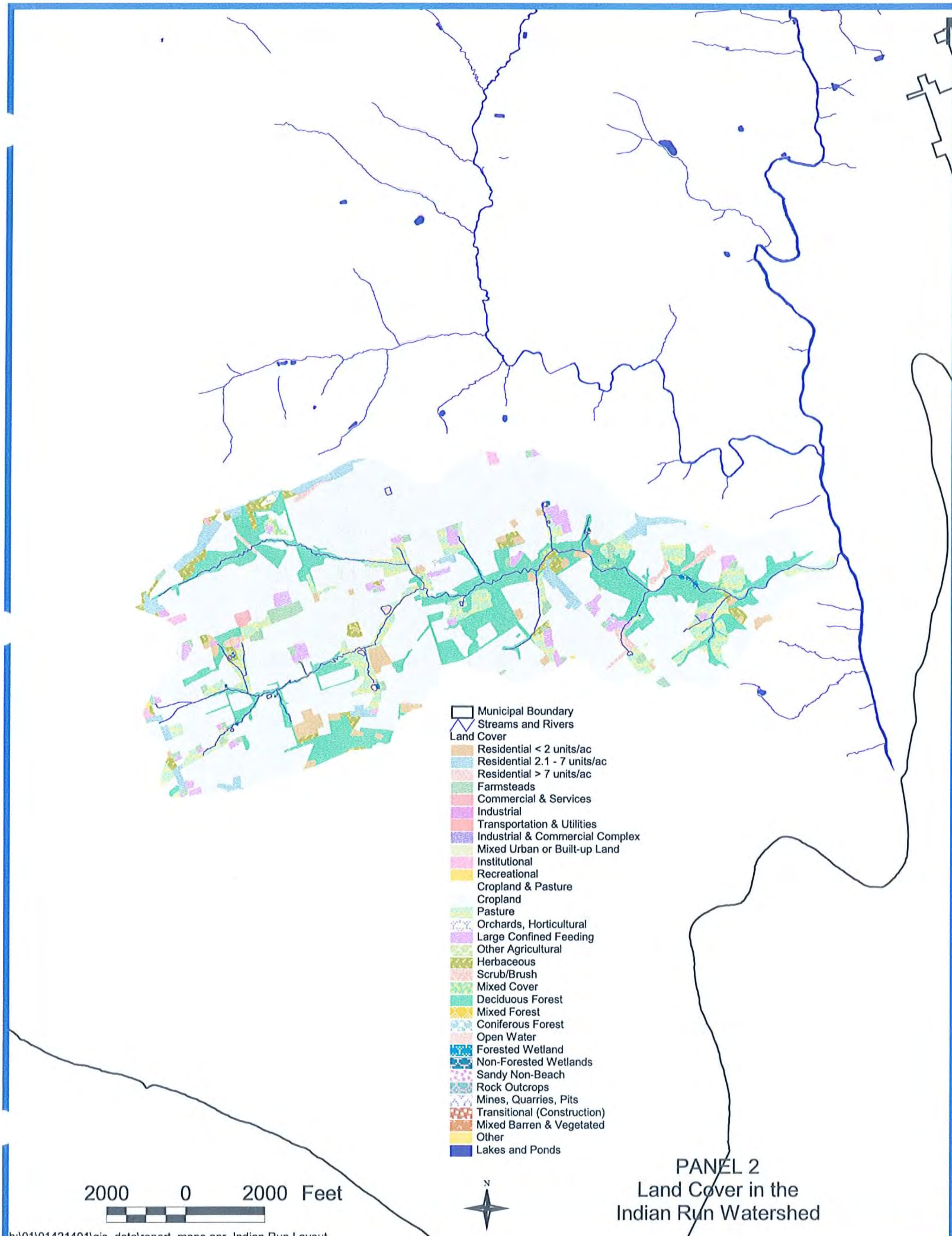
Municipal Boundary
Streams and Rivers
Land Cover
Residential < 2 units/ac
Residential 2.1 - 7 units/ac
Residential > 7 units/ac
Farmsteads
Commercial & Services
Industrial
Transportation & Utilities
Industrial & Commercial Complex
Mixed Urban or Built-up Land
Institutional
Recreational
Cropland & Pasture
Cropland
Pasture
Orchards, Horticultural
Large Confined Feeding
Other Agricultural
Herbaceous
Scrub/Brush
Mixed Cover
Deciduous Forest
Mixed Forest
Coniferous Forest
Open Water
Forested Wetland
Non-Forested Wetlands
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2000 0 2000 Feet
N
PANEL 2
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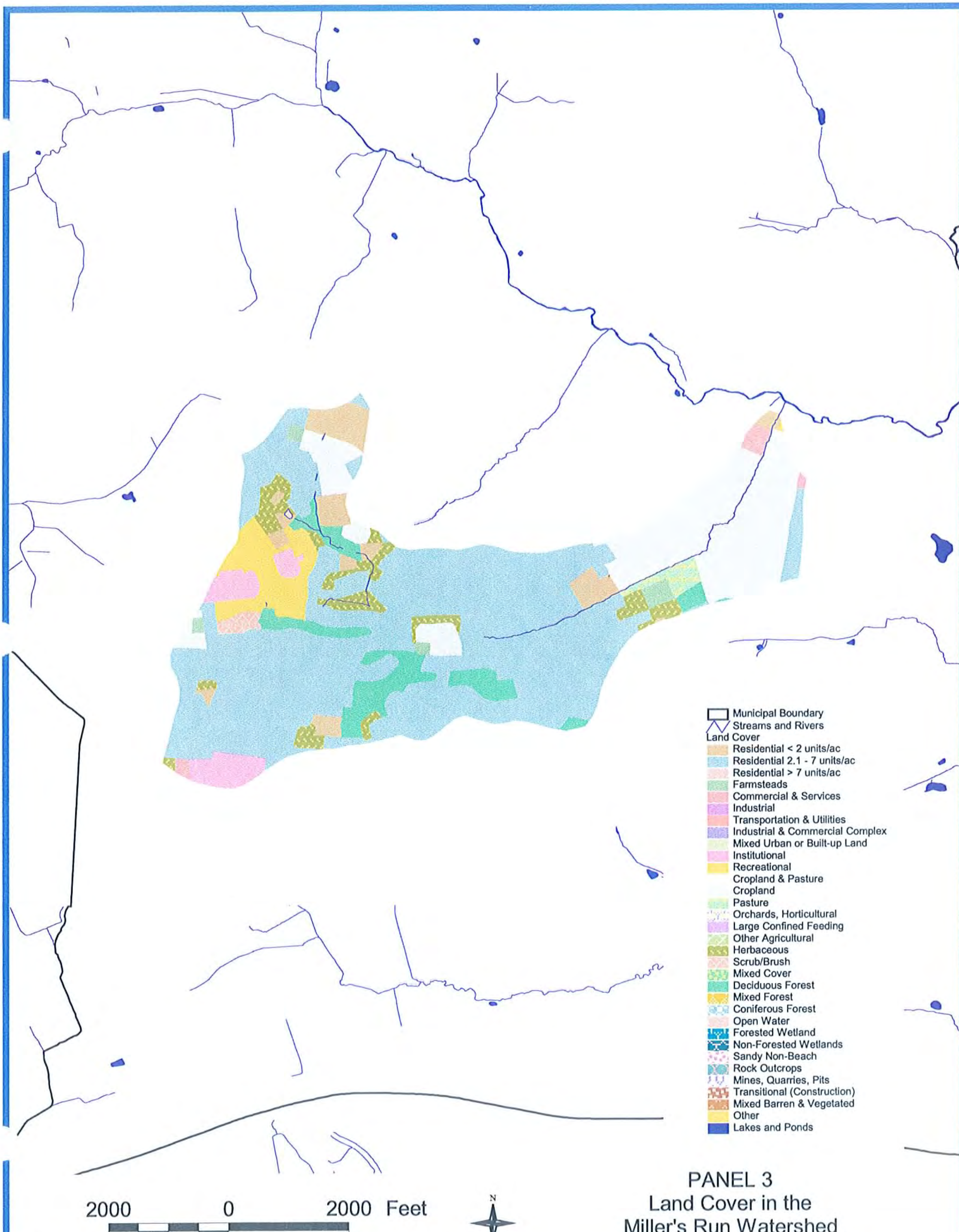
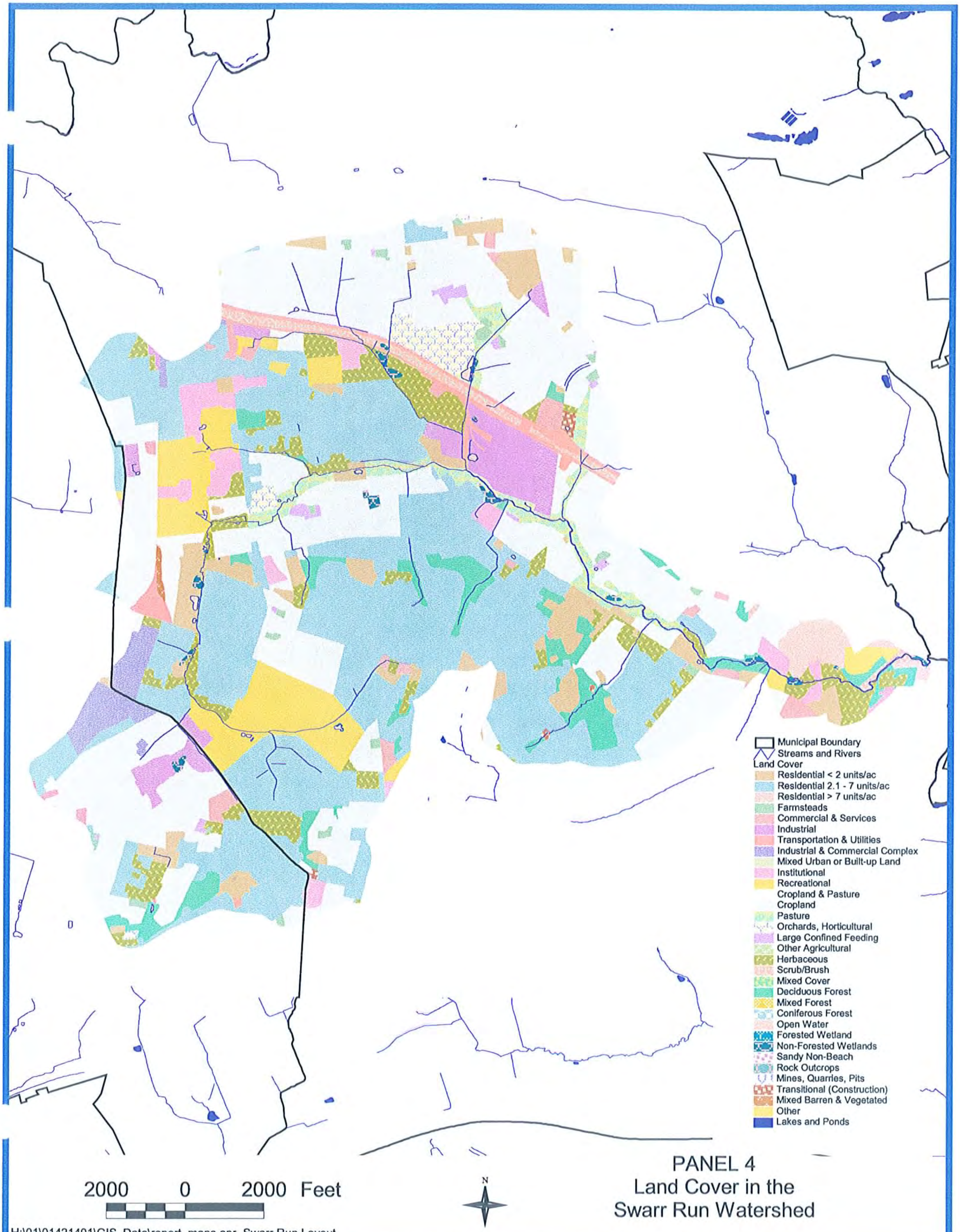
Indian Run Watershed
h:\01\01421401\gis_data\report_maps.apr, Indian Run Layout



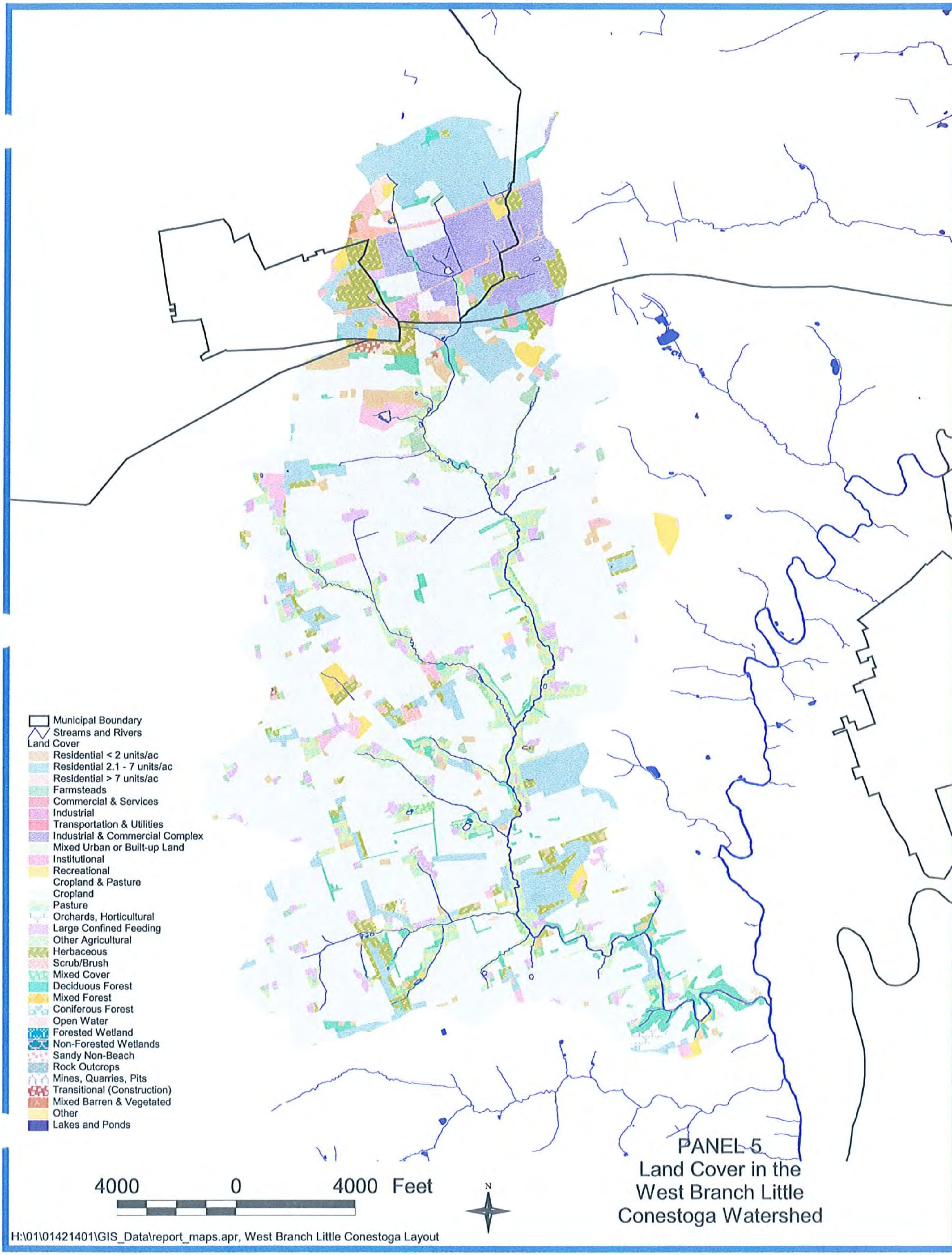
PANEL 3
Land Cover in the
Miller's Run Watershed

H:\01\01421401\GIS_Data\report_maps.apr, Millers Run Layout



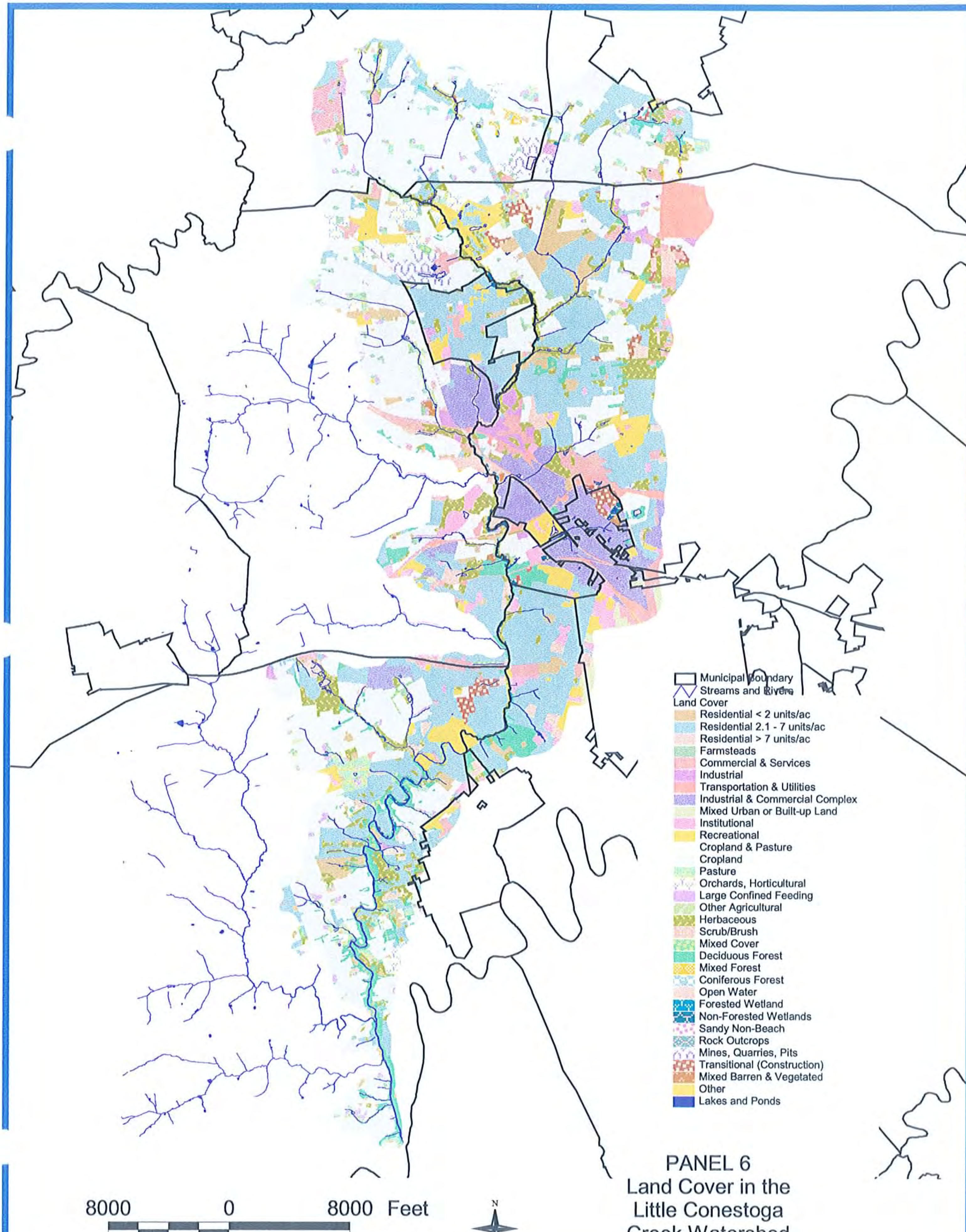
PANEL 4
Land Cover in the
Swarr Run Watershed

H:\01\01421401\GIS_Data\report_maps.apr, Swarr Run Layout



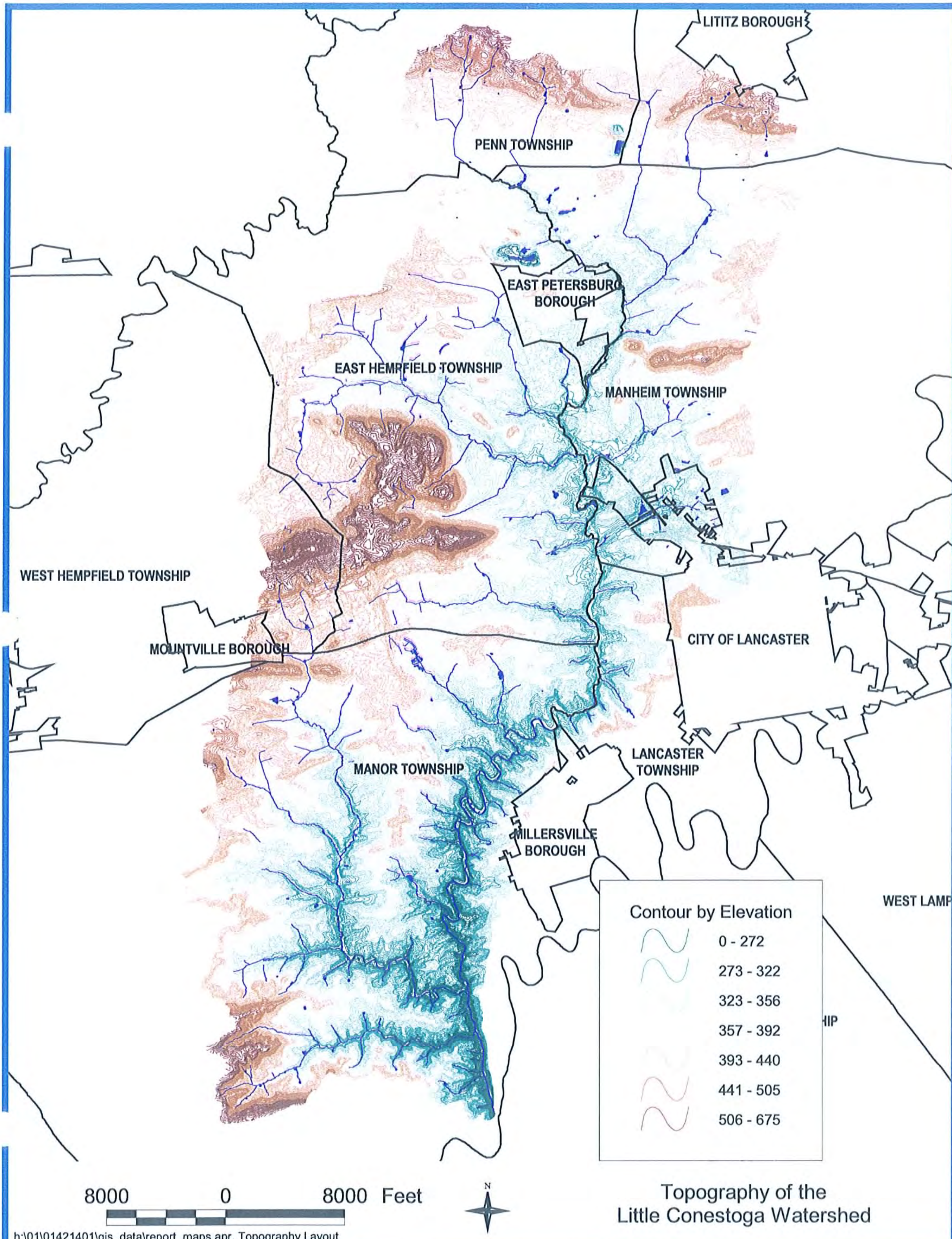
PANEL 5
Land Cover in the West Branch Little Conestoga Watershed

H:\01\01421401\GIS_Data\report_maps.apr, West Branch Little Conestoga Layout



PANEL 6
Land Cover in the
Little Conestoga
Creek Watershed

h:\01\01421401\gis_data\report_maps.apr, Little Conestoga Creek Layout



Topography of the Little Conestoga Watershed

IMPAIRED STREAM SEGMENTS

It is necessary to understand the meaning of "impaired" in order to appreciate the remainder of this report writing. Impaired, in the context of discussing water quality and stream health, refers to a less than desirable state of water chemistry and aquatic habitat condition in a particular section or length of stream, or possibly an entire stream. By proclaiming a section of stream impaired, one is stating that the water chemistry and/or habitat conditions are not ideal for promoting the health and well-being of the aquatic life, terrestrial animals and/or humans that in some way, shape or form interact and depend on the water resource.

In the case of aquatic life, species diversity will change and adjust with the present stream condition. In its pristine condition (before impact by man or otherwise), a stream will support a certain aquatic community consisting of both pollution tolerant and intolerant macroinvertebrate and fish species populations. In a pristine condition, there is the right mix and balance of these aquatic organisms; every fish and bug performing its natural function and the stream's habitat in turn successfully supporting and sustaining its aquatic life.

But this natural balancing act can be "knocked off balance" by outside impacts not commonly known to the stream and beyond the stream's ability to absorb. At some point, this outside influence becomes too much, too fast and too long a persisting condition that the stream is altered to the point the change brings about a chemical or physical condition beyond the tolerance range of certain aquatic life. The stream's habitat is no longer suitable for a particular species and so it vanishes. What was once present, no longer exists. An impact has occurred, thus the stream is now impaired (at least to a certain degree).

However, this matter of stating that a stream is impaired can be rather subjective because of the value placed upon various stream aspects or elements differ from person to person. In reality, man has somehow impacted every stream in Pennsylvania. Air pollution and the resulting acid rain, along with dam construction, land development, agriculture, timber harvesting, mining and other modern day landuses have occurred in every corner of the Keystone State. The environmental community would readily admit every stream has been or is impacted by man to a certain degree, but it would not automatically state that every stream is impaired.

Therefore considering all the above, it becomes necessary to establish threshold limits or some basis on which to judge stream health. The federal Clean Water Act (CWA) forms the basis for most of the water pollution control programs in the United States. The CWA requires that every state monitor surface water quality (which includes streams). Pennsylvania's program for monitoring surface waters is known as Pennsylvania's "Surface Waters Assessment Program" (SWAP).

The SWAP assessment process first involves having a qualified biologist perform reconnaissance of the subject stream and watershed, looking particularly at land cover, landuses, abandoned mine drainages and known point discharges such as sewer treatment plants. This reconnaissance allows the biologist the opportunity to see the watershed and stream first hand and helps them understand the watershed complexities. The biologist then takes a closer look at the stream's biological and physical condition at strategically selected locations determined during the reconnaissance process.

Pennsylvania's in-stream biological assessments are mirrored after the US Environmental Protection Agency's "rapid bioassessment protocols" (the same protocols RETTEW biologists used during this very study). The biologist collects and identifies aquatic macroinvertebrates (aquatic insects, worms, snails and such) to the taxonomic "family" level. The sampling protocols include the usage of assigned pollution tolerance values for the various collected organisms. Conclusions as to the stream's health can then be derived when taking into account the various collected organisms, their relative abundances and their tolerance ratings. A stream with an over abundance of pollution tolerant species and a lack of pollution intolerant species is considered impaired. Streams of the same stream type and of known unimpaired quality are used as a reference for comparison purposes. The reference stream is in fact the yardstick used in measuring the subject stream.

At the same time, the biologist completes a habitat evaluation that considers the physical condition of the stream and riparian corridor. Such things as substrate composition, streambank erosion, water depth, sediment deposition, available in-stream cover for fish, vegetative cover and riparian buffer zones are considered.

Ultimately a decision is made as to whether the subject stream is impaired or not and for what reasons - biological and/or physical habitat short comings. Pennsylvania is then required, through the CWA, to list such impaired streams or stream segments. This listing is commonly referred to as the "303(d) List of Impaired Waters"; named so because of section 303(d) of the CWA that requires such a listing be prepared and maintained.

Currently, the Little Conestoga Creek Watershed contains forty different stream segments totaling over 53 miles listed as being impaired. The impairments exist in all six sub-watersheds.

LITTLE CONESTOGA CREEK WATERSHED – 303(d) LISTED IMPAIRMENTS

SUB-WATERSHED	DRAINAGE AREA (Square Miles)	MILES IMPAIRED	SOURCE/CAUSE OF IMPAIRMENT
Brubaker Run	2.879	2.92	Nutrients and siltation from agricultural related grazing – urban runoff and stormwater impacts
Indian Run	3.206	2.36	Nutrients and siltation from agricultural related crops
Millers Run	1.236	1.94	Nutrients and siltation from agricultural related grazing and crops – urban runoff and stormwater impacts
Swarr Run (and unnamed tributaries)	8.88	7.90	Nutrients and siltation from agricultural related grazing and crops – urban runoff and stormwater impacts
West Branch	12.310	2.45 main stem and 1.97 for one unnamed tributary	Nutrients and siltation from agricultural related grazing and crops
Main Stem (and unnamed tributaries)	65.5	18.11 main stem and 16.01 for 12 unnamed tributaries	Nutrients and siltation from agricultural related grazing – urban runoff and stormwater impacts

Findings from RETTEW field investigations concur and support the Pennsylvania Department of Environmental Protection's 303(d) listing shown above. In addition, RETTEW biologists believe the two following stream segments should also be considered impaired.

Bachman Run –(A tributary to the Main Stem)

The entire tributary should be considered impaired beginning at its confluence with the Main Stem located northeast of East Petersburg Borough just south of Graystone Road (Rte. 722) and continuing upstream to Waters Edge Road and West Woods Drive southwest of Lititz Borough. The lower reaches of Bachman Run are residentially developed, while the upper reaches are mostly in agricultural production. Rohrer's Quarry (a limestone quarry) is also located in the headwaters of Bachman Run. Nutrients and siltation from agricultural related crop production and flashy stormwater/flooding events resulting from land development leading to accelerated streambank erosion and mass wasting of soils are obvious detrimental impacts. Rohrer's Quarry is also a concern. The quarry is in the midst of restructuring the way in which they deal with water seepage into the quarry pit. They currently pump accumulated water from the pit, through a sediment basin, and into the Bachman Run headwaters. This "on again – off again" water supply is of sufficient volume to dramatically alter the baseflow within the stream. Planned upgrades including enlarging the sediment basin, which in turn should allow for a more consistent flow of water to the stream over a 24-four period.

West Branch

Currently the Pennsylvania Department of Environmental Protection considers the West Branch impaired beginning just downstream of Blue Rock Road (Rte. 999) upstream to Rohrer Road just south of Mountville. RETTEW would contend that the impaired status should continue upstream and downstream, thus including the entire West Branch Sub-watershed.

In addition to maintaining the 303(d) List of Impaired Waters, the Pennsylvania Department of Environmental Protection is also responsible for establishing and maintaining water uses for each stream within the Commonwealth. These water uses are listed in the Pennsylvania Code, Title 25 Environmental Protection, Chapter 93 Water Quality Standards. The Department is to consider each stream and assign various "protected water uses", the purpose of which is to make sure a stream receives adequate protection so that its offered water use is preserved and maintained. For example, a stream may serve as a migratory route for anadromous fish like American shad. In this case, the water use "MF" standing for "Migratory Fishes" would be assigned thus assuring this attribute of the stream is protected when various encroachment activities (such as a bridge, dam, dike, levee) are proposed for construction.

The following protected water uses are applicable and assigned to various stream segments and tributaries within the Little Conestoga Creek Watershed. The listing is ordered beginning at the headwaters of the Little Conestoga Creek and continuing downstream to the confluence with the Conestoga River.

Little Conestoga Creek (Main Stem)

Beginning in the headwaters downstream to the confluence with Swarr Run
TSF – Trout Stocking – Maintenance of stocked trout from February 15 to July 31 and maintenance and propagation of fish species and additional flora and fauna which are indigenous to a warm water habitat.

Swarr Run

TSF – Trout Stocking – Maintenance of stocked trout from February 15 to July 31 and maintenance and propagation of fish species and additional flora and fauna which are indigenous to a warm water habitat.

All Unnamed Tributaries to Swarr Run

CWF – Cold Water Fishes – Maintenance and/or propagation of fish species including the family Salmonidae (trout and salmon) and additional flora and fauna which are indigenous to a cold water habitat.

Millers Run

CWF – Cold Water Fishes – Maintenance and/or propagation of fish species including the family Salmonidae (trout and salmon) and additional flora and fauna which are indigenous to a cold water habitat.

Little Conestoga Creek (Main Stem)

Between the Swarr Run confluence and the West Branch confluence.

WWF – Warm Water Fishes – Maintenance and propagation of fish species and additional flora and fauna which are indigenous to a warm water habitat.

West Branch

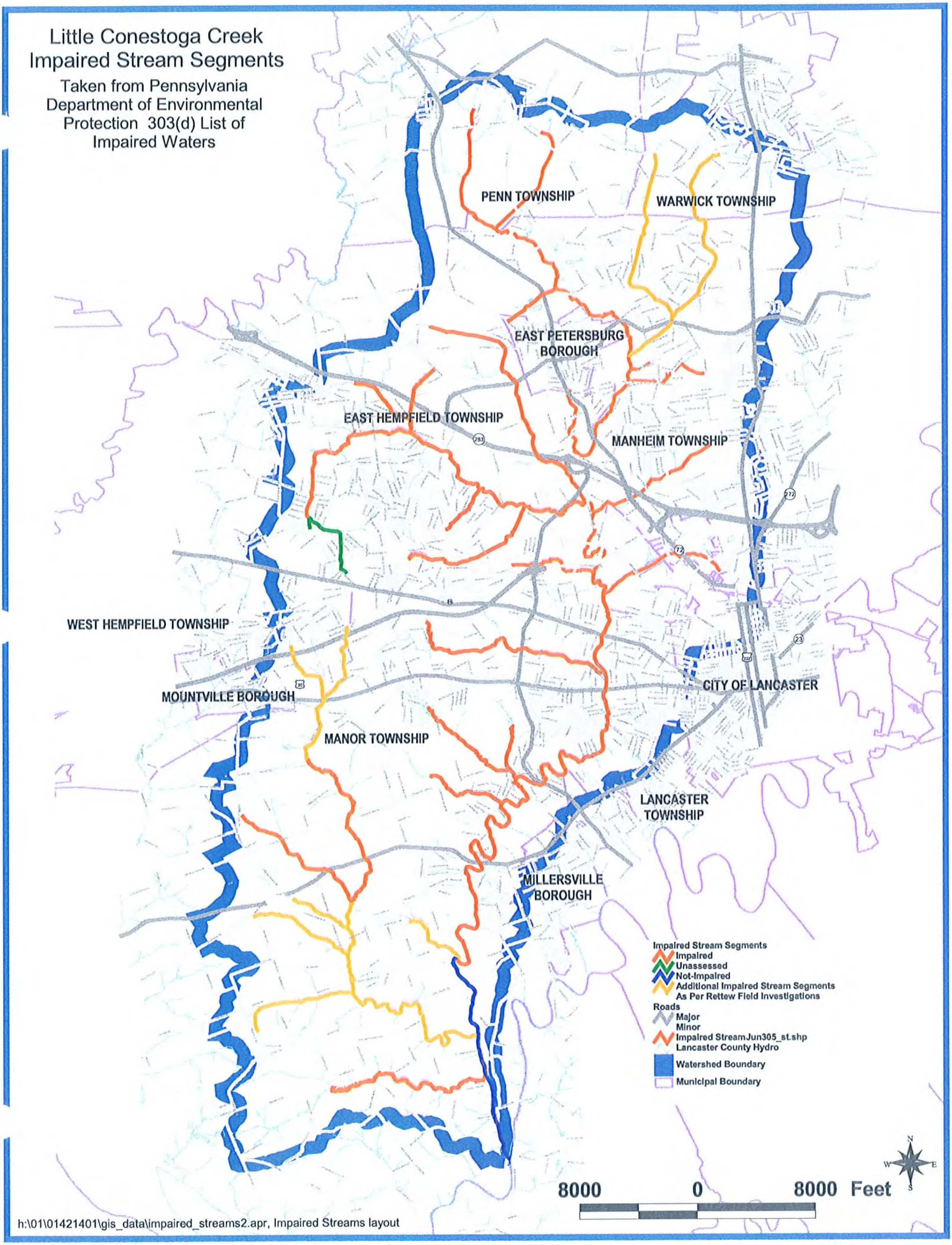
TSF – Trout Stocking – Maintenance of stocked trout from February 15 to July 31 and maintenance and propagation of fish species and additional flora and fauna which are indigenous to a warm water habitat.

Little Conestoga Creek (Main Stem)

Between the West Branch confluence and the Conestoga River confluence.

WWF – Warm Water Fishes – Maintenance and propagation of fish species and additional flora and fauna which are indigenous to a warm water habitat.

Findings from RETTEW field investigations revealed some of the stream segment protected water uses listed above are not being adequately maintained and protected. Specifically, all unnamed tributaries to Swarr Run and Millers Run are listed as being CWF Cold Water Fishes. However habitat conditions are far from being that of supporting the maintenance and/or propagation of fish species including the family Salmonidae (trout and salmon) and additional cold water flora and fauna. The Millers Run sub-watershed consists mainly of residential landuse/land cover. The stream suffers from urban runoff and flashy uncontrolled stormwater flooding events – likewise with the unnamed tributaries to Swarr Run. The 303(d) Listing of Impaired Waters lists these same waters as being impaired; thus there is a conflict between what the streams actually are and what they are supposedly protected as being.



Little Conestoga Creek
Impaired Stream Segments
Taken from Pennsylvania Department of Environmental Protection 303(d) List of Impaired Waters
PENN TOWNSHIP
WARWICK TOWNSHIP
EAST PETERSBURG BOROUGH
EAST HEMPFIELD TOWNSHIP
MANHEIM TOWNSHIP
WEST HEMPFIELD TOWNSHIP
MOUNTVILLE BOROUGH
MANOR TOWNSHIP
CITY OF LANCASTER
LANCASTER TOWNSHIP
MILLERSVILLE BOROUGH
283
272
72
23
222
30
Impaired Stream Segments
Impaired
Unassessed
Not-Impaired
Additional Impaired Stream Segments As Per Rettew Field Investigations
Roads
Major
Minor
Impaired StreamJun305_st.shp
Lancaster County Hydro
Watershed Boundary
Municipal Boundary
N
E
S
W
8000
0
8000 Feet
h:\01\01421401\gis_data\impaired_streams2.apr, Impaired Streams layout

SOURCES AND CAUSES OF IMPAIRMENT

The preceding chapter defined what is meant by the term "impairment" in regards to this writing. This chapter focuses on the sources and causes of impairment within the Little Conestoga Creek Watershed.

In the environmental and biological fields of study, sources and causes of pollution (leading to impairment) are typically categorized into two broadly defined categories:

- Point Source Pollution
- Non-point Source Pollution

The terms "point source pollution and non-point source pollution" refer not to a specific polluting substance or practice, but rather describe the means by which it is introduced. By using the term "point source pollution", one is simply referring to any number of pollutants that can be traced back to one location of introduction, such as a pipe or a ditch. Raw sewage piped to a stream could be broadly referred to as point source pollution.

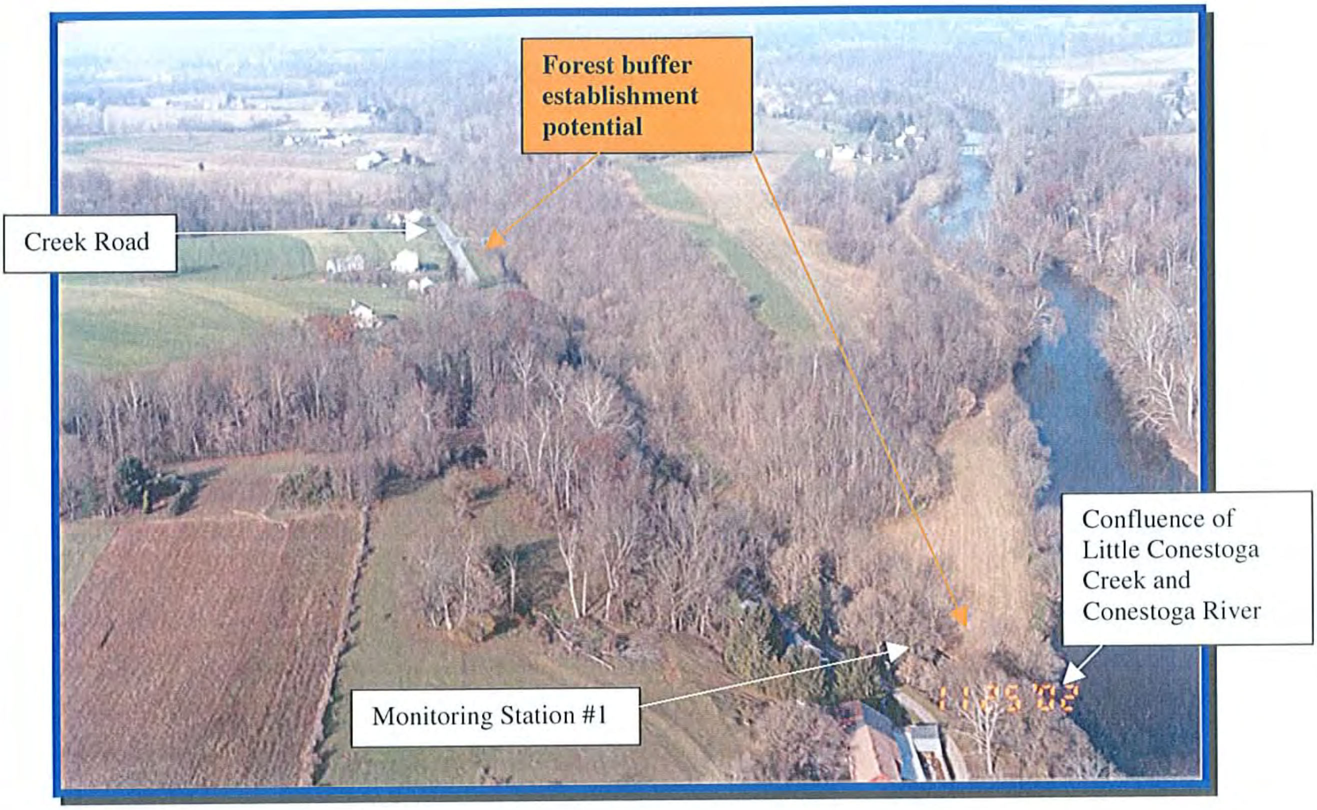
"Non-point source pollution" refers to any number of pollutants that are washed from the land surface – there being no one specific point of discharge. Non-point source pollution includes air pollution and harmful runoff containing any number of substances generated by any number of landuses.

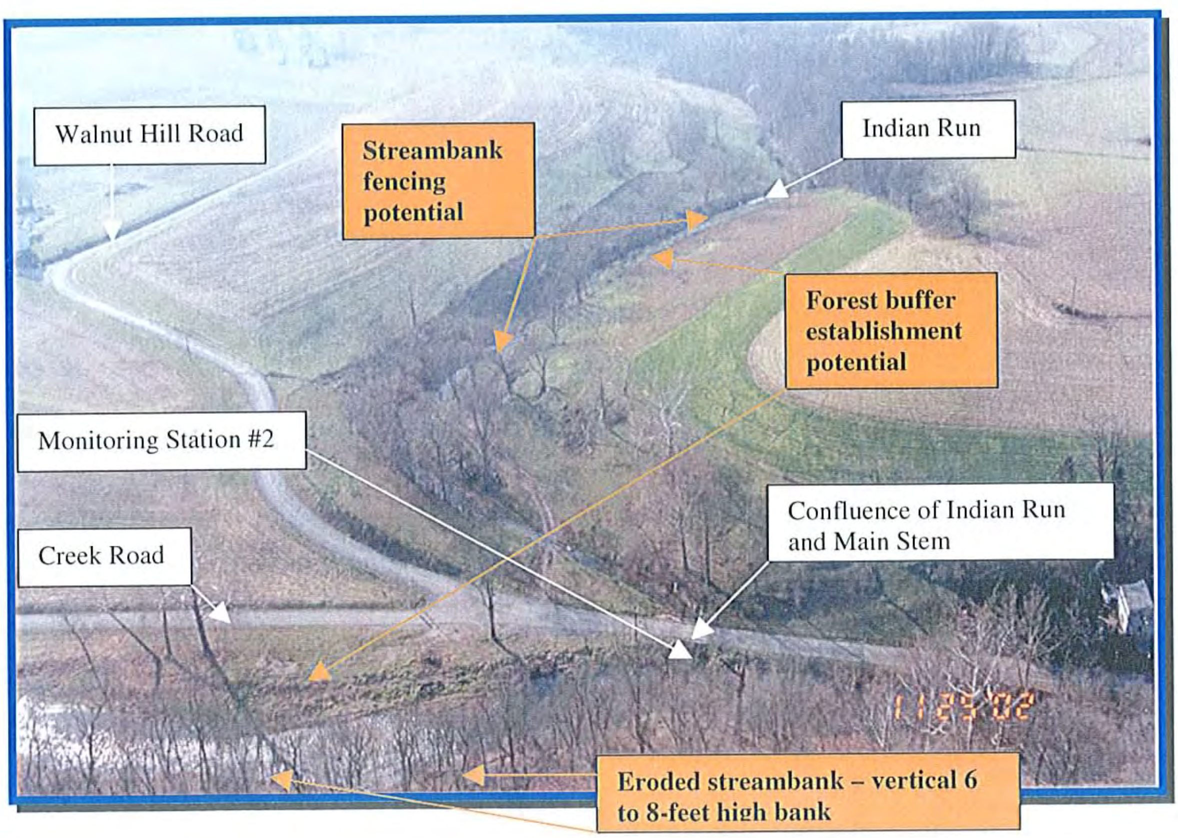
The removal of vital habitat components is also a cause of impairment. The destruction of forested riparian corridors for example can lead to impairment.

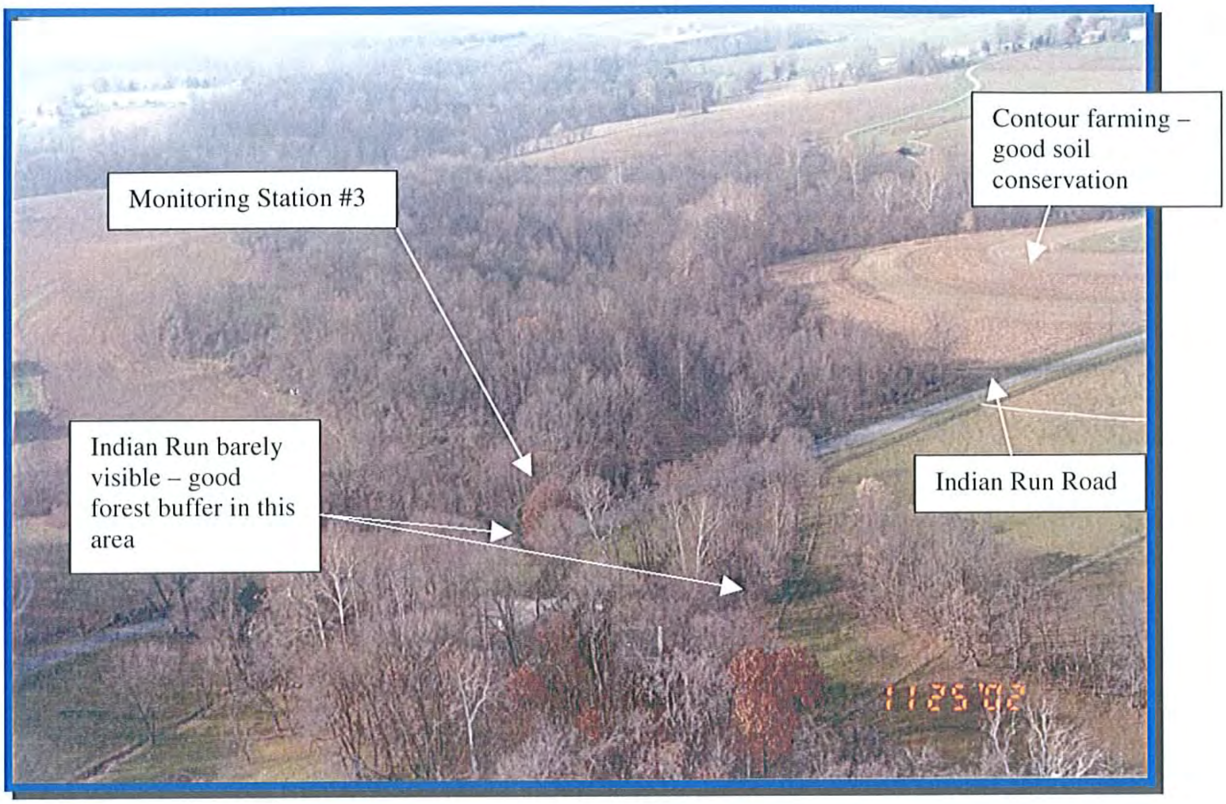
The remainder of this chapter includes aerial photographs taken by RETTEW via helicopter at an altitude ranging from 300 to 500-feet. The photographs are captioned and arranged in sub-watershed order for easy understanding and comparison with the other chapters of this writing.

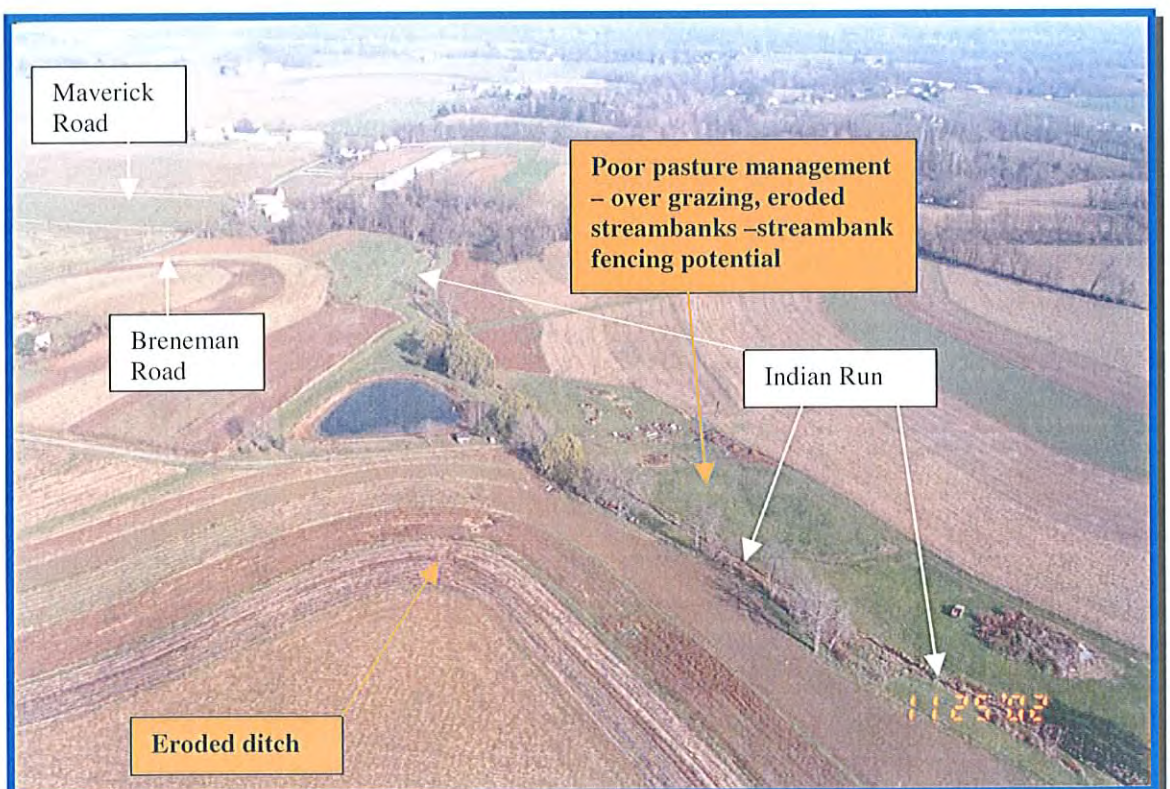
Additionally, RETTEW has provided a CD containing all collected aerial video footage. "Quicktime" 6.0 or higher is required for viewing. The CD too is organized more or less in sub-watershed fashion. A particular stream segment can be viewed by double-clicking the chosen segment on the menu listing.

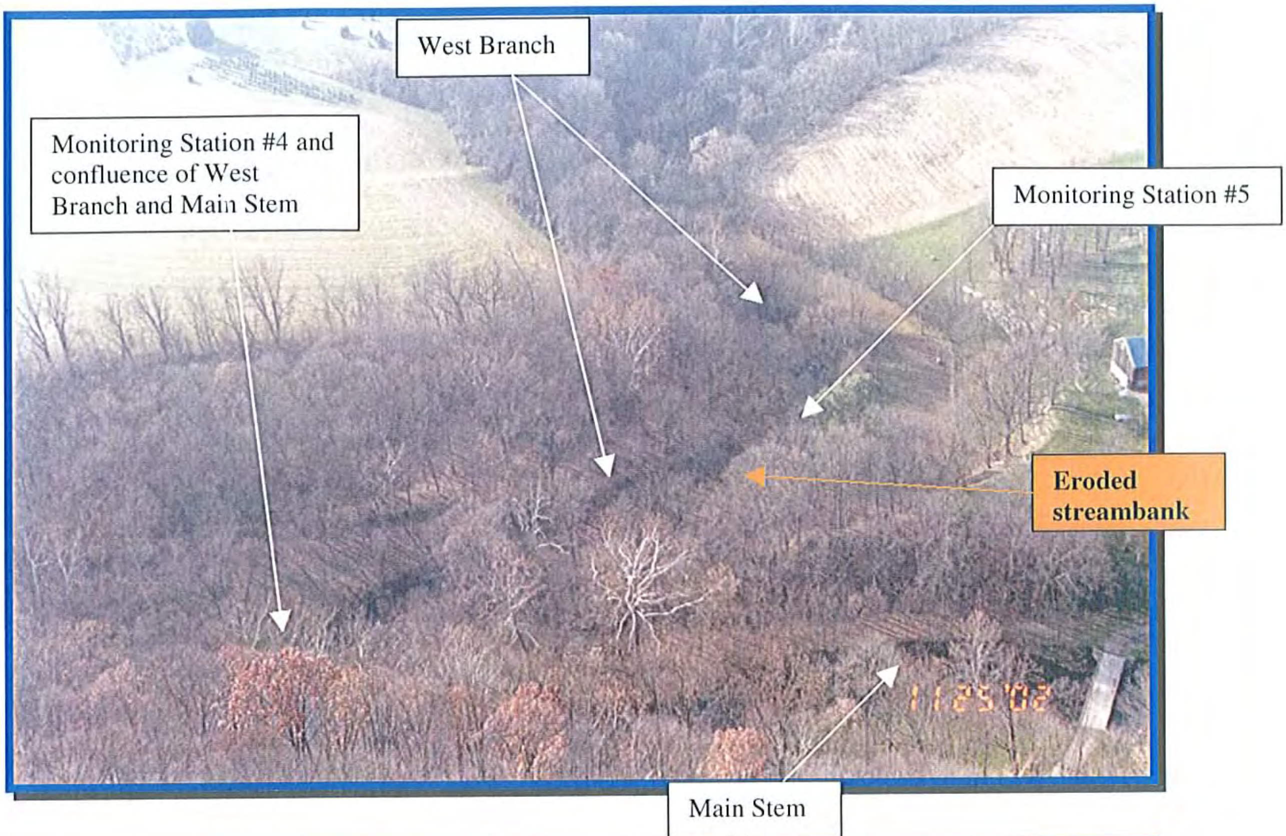
By viewing the aerial video footage and looking at the enclosed pictures, one can begin to develop a good understanding of the various landuses within the watershed and the various point and non-point pollution sources leading to impairment. Such information when coupled with actual field reconnaissance is invaluable in the development of a restoration plan and restoration strategy.

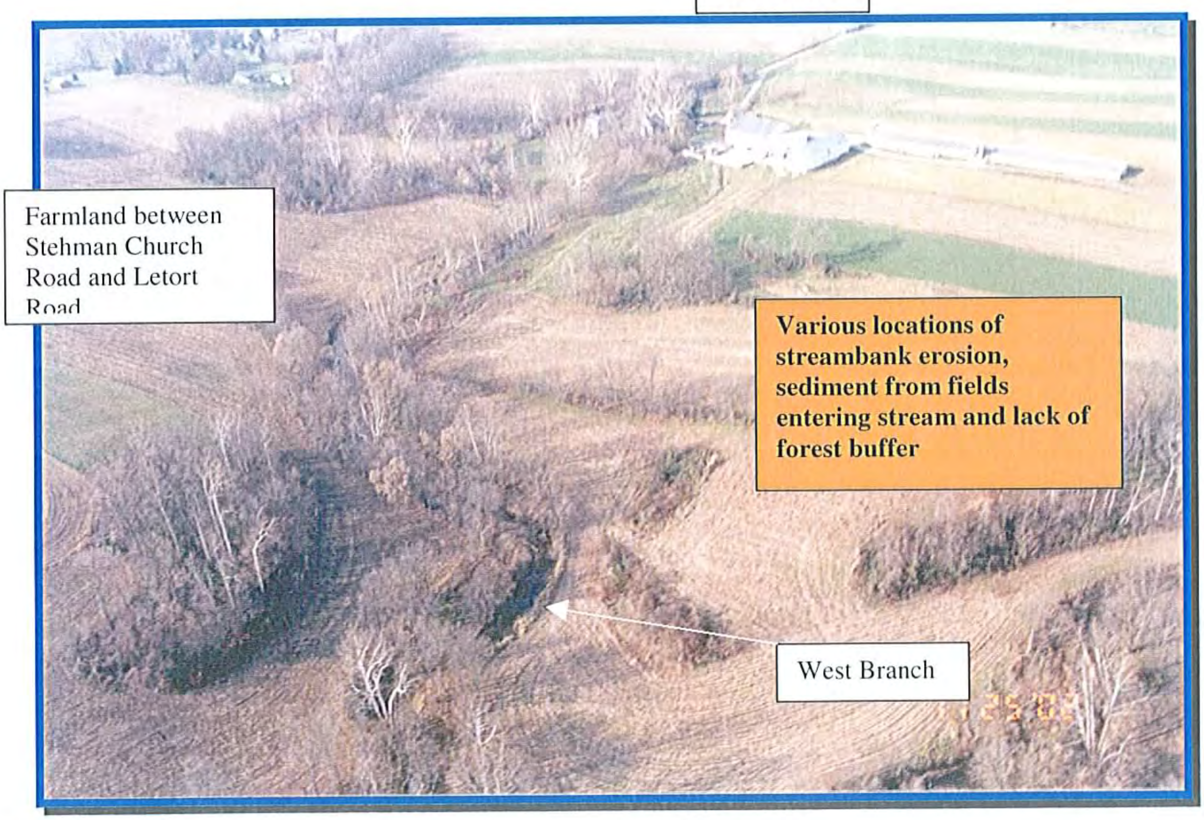

Forest buffer establishment potential
Creek Road
Confluence of Little Conestoga Creek and Conestoga River
Monitoring Station #1

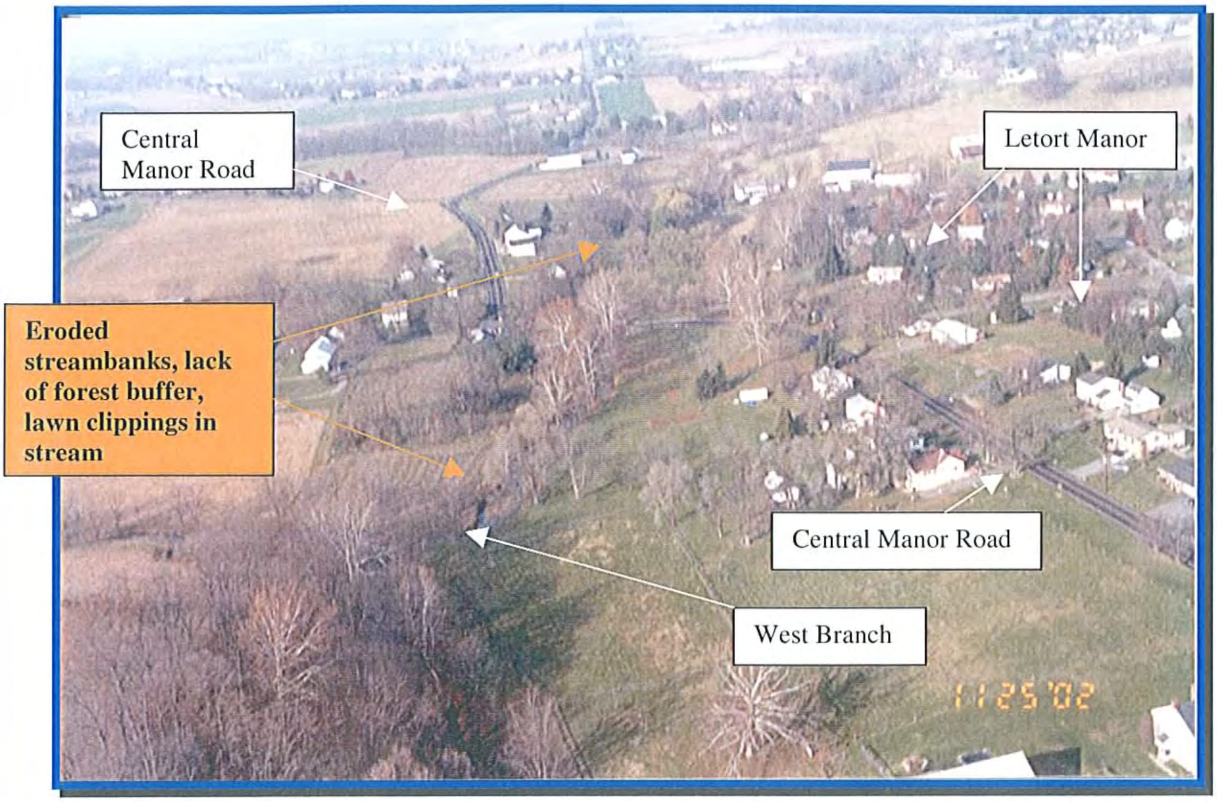

Walnut Hill Road
Streambank fencing potential
Indian Run
Forest buffer establishment potential
Monitoring Station #2
Confluence of Indian Run and Main Stem
Creek Road
Eroded streambank – vertical 6 to 8-feet high bank

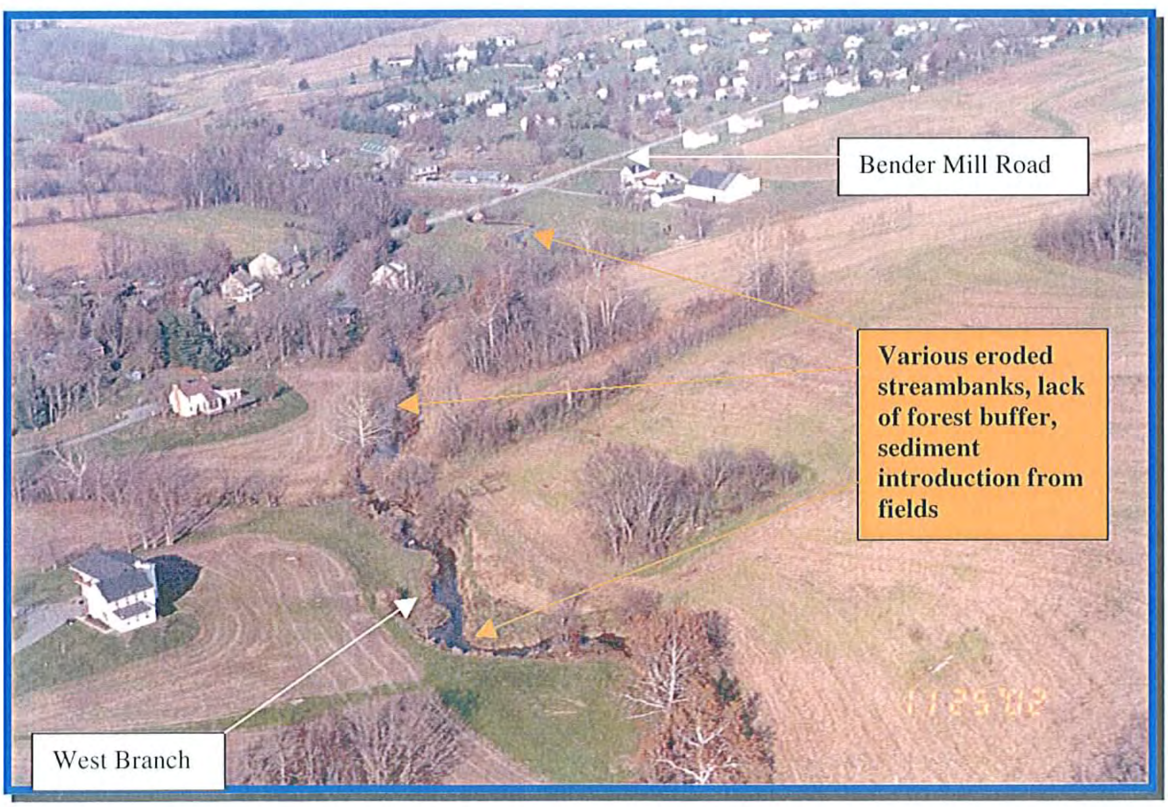

Monitoring Station #3
Contour farming – good soil conservation
Indian Run barely visible – good forest buffer in this area
Indian Run Road
11 25 '02


Maverick Road
Poor pasture management – over grazing, eroded streambanks –streambank fencing potential
Breneman Road
Indian Run
Eroded ditch
11 25 '02

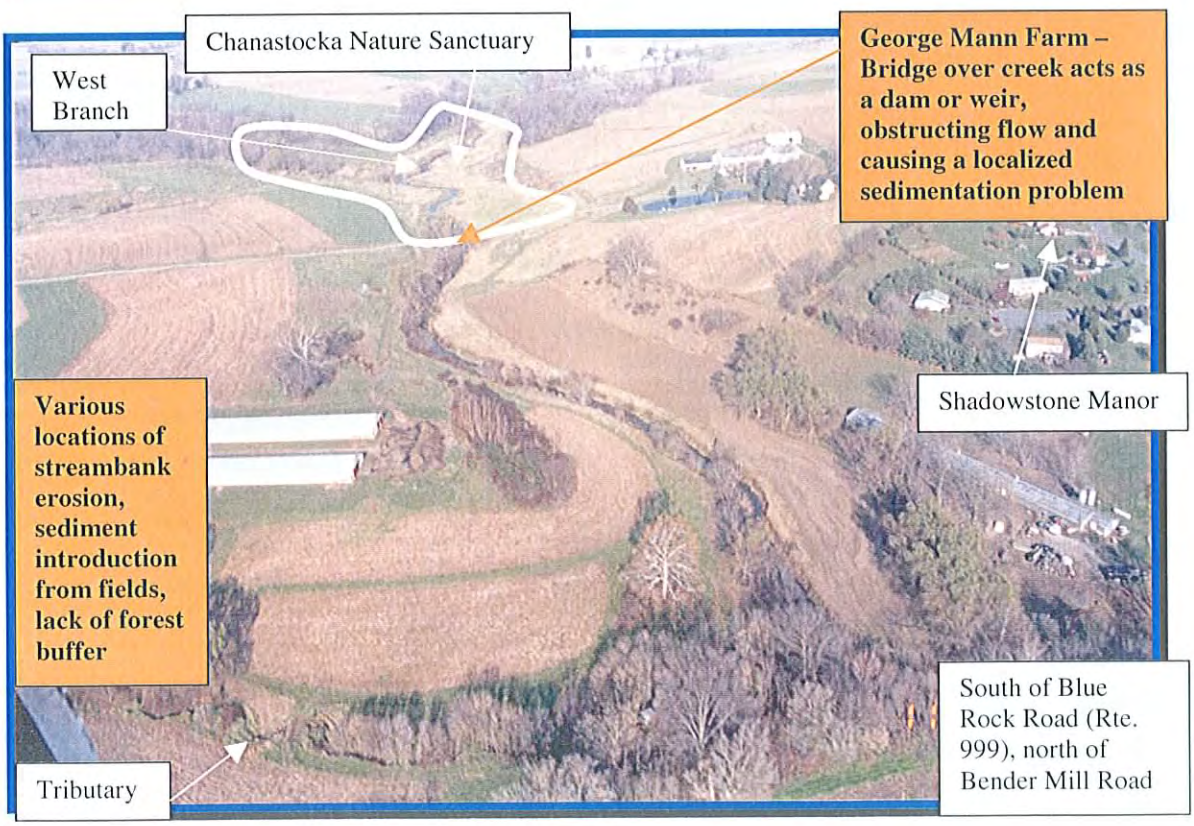

West Branch
Monitoring Station #4 and confluence of West Branch and Main Stem
Monitoring Station #5
Eroded streambank
11 25 '02
Main Stem


Farmland between Stehman Church Road and Letort Road
Various locations of streambank erosion, sediment from fields entering stream and lack of forest buffer
West Branch

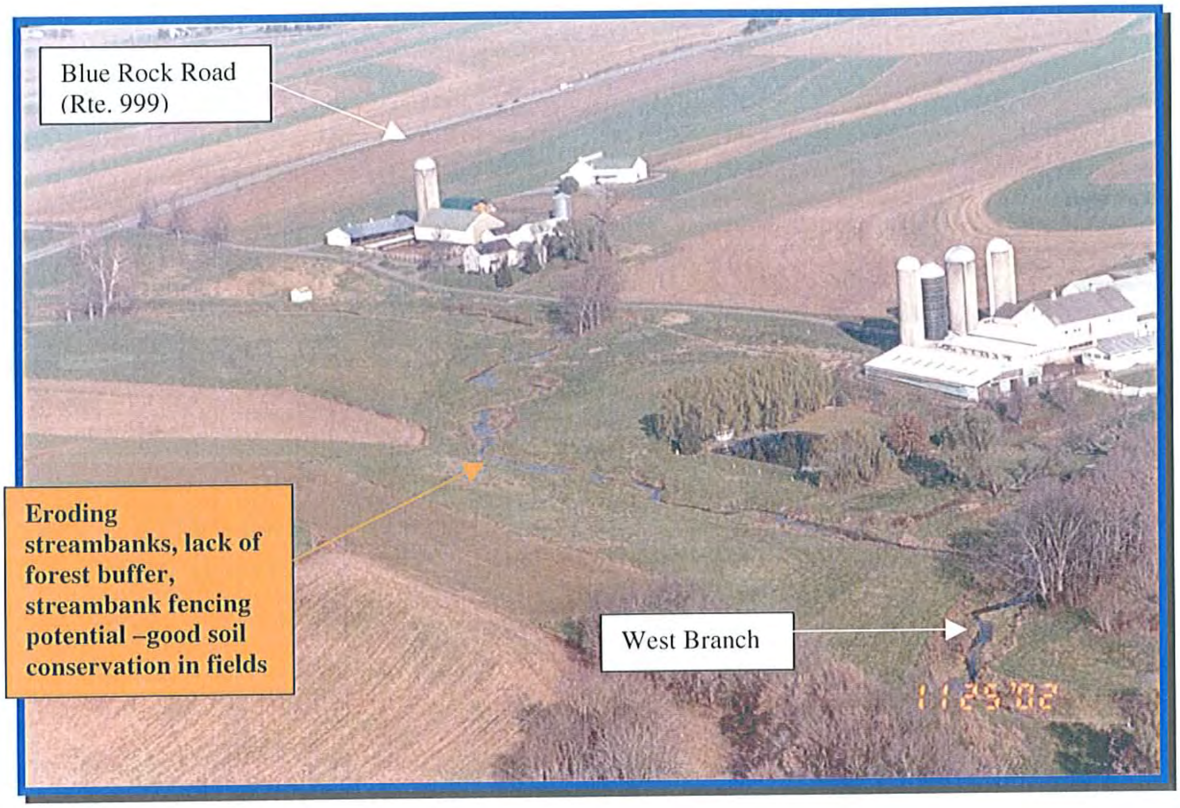

Central Manor Road
Letort Manor
Eroded streambanks, lack of forest buffer, lawn clippings in stream
Central Manor Road
West Branch
11 25 '02

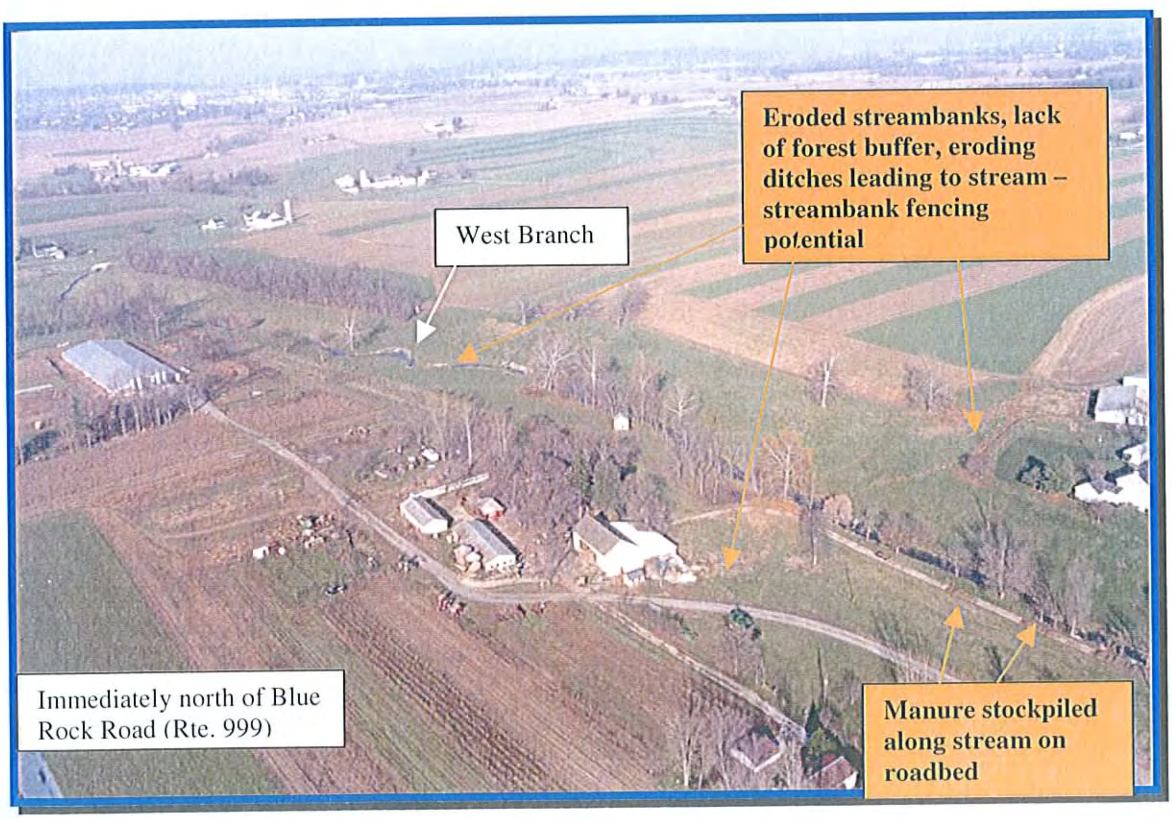

Bender Mill Road
Various eroded streambanks, lack of forest buffer, sediment introduction from fields
West Branch
11 25 '02

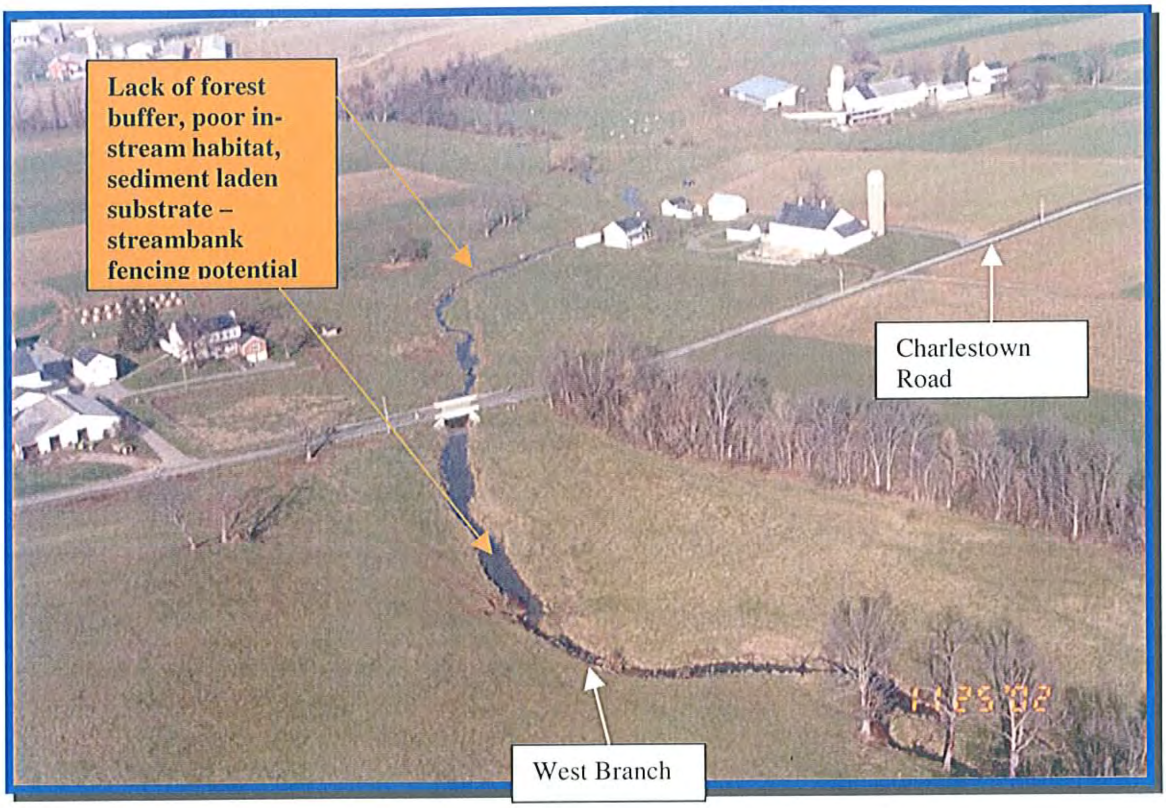
Raleigh Ridge
Bender Mill Road
Streambank erosion
Extreme streambank erosion, lack of forest buffer
Monitoring Station #6
West Branch
11 25 '02

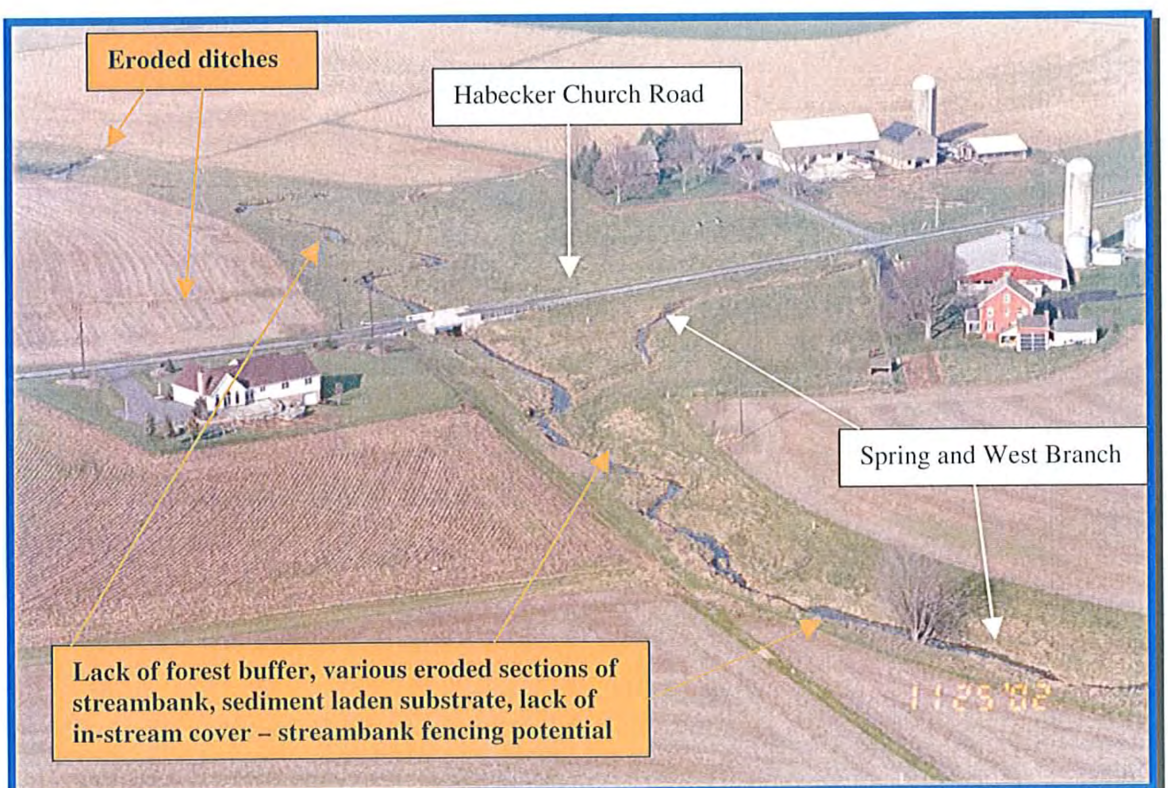


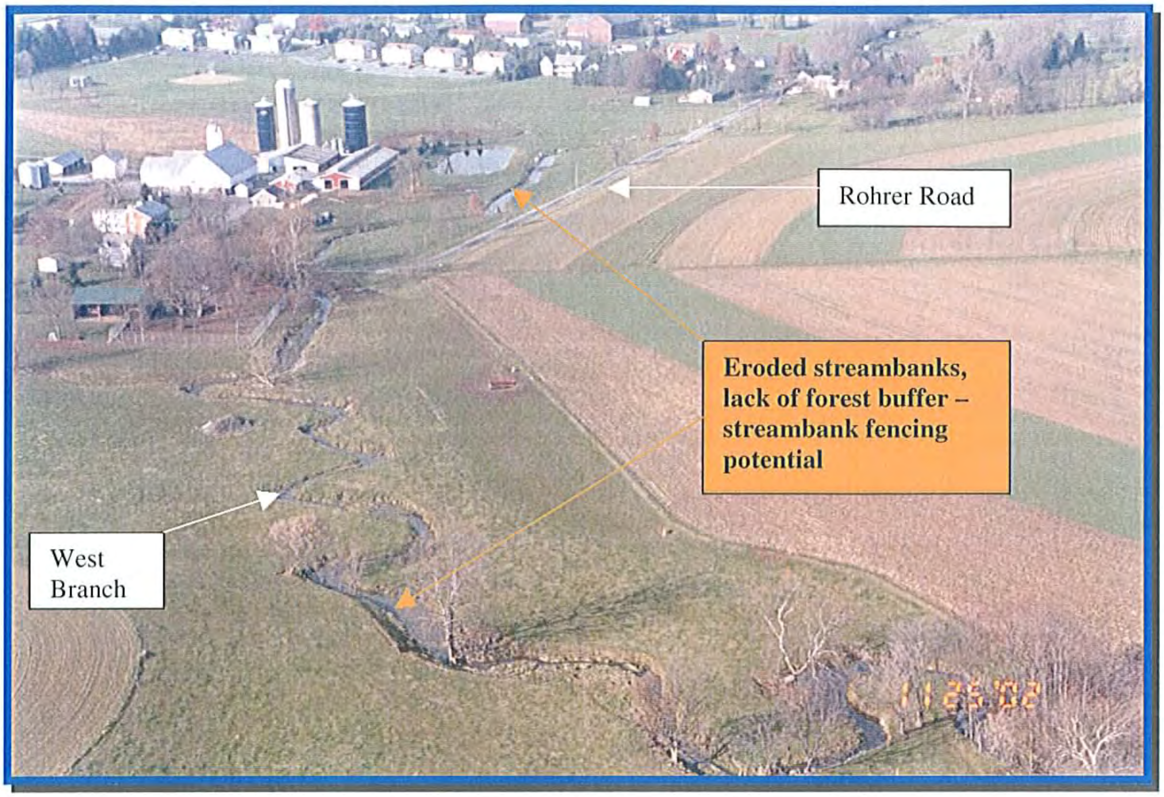
Chanastocka Nature Sanctuary
West Branch
George Mann Farm – Bridge over creek acts as a dam or weir, obstructing flow and causing a localized sedimentation problem
Shadowstone Manor
Various locations of streambank erosion, sediment introduction from fields, lack of forest buffer
Tributary
South of Blue Rock Road (Rte. 999), north of Bender Mill Road

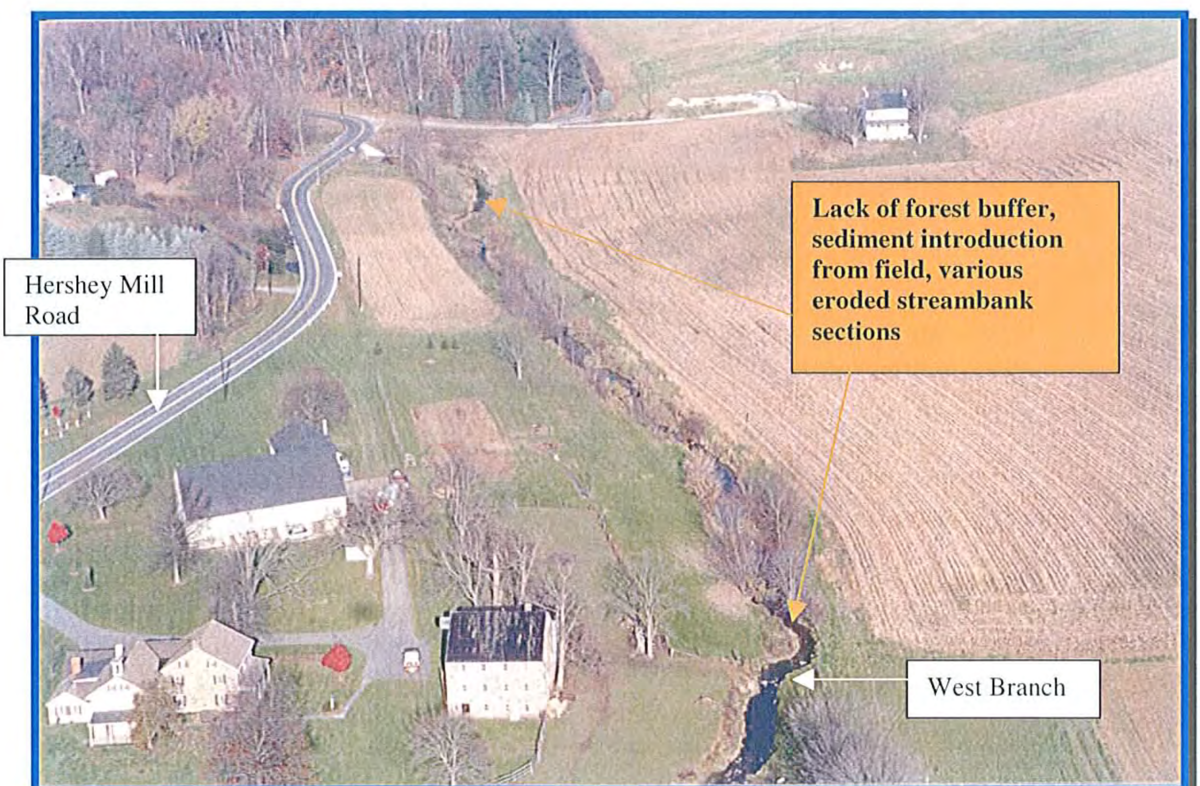

Blue Rock Road
(Rte. 999)
Eroding streambanks, lack of forest buffer, streambank fencing potential –good soil conservation in fields
West Branch
11 25 '02

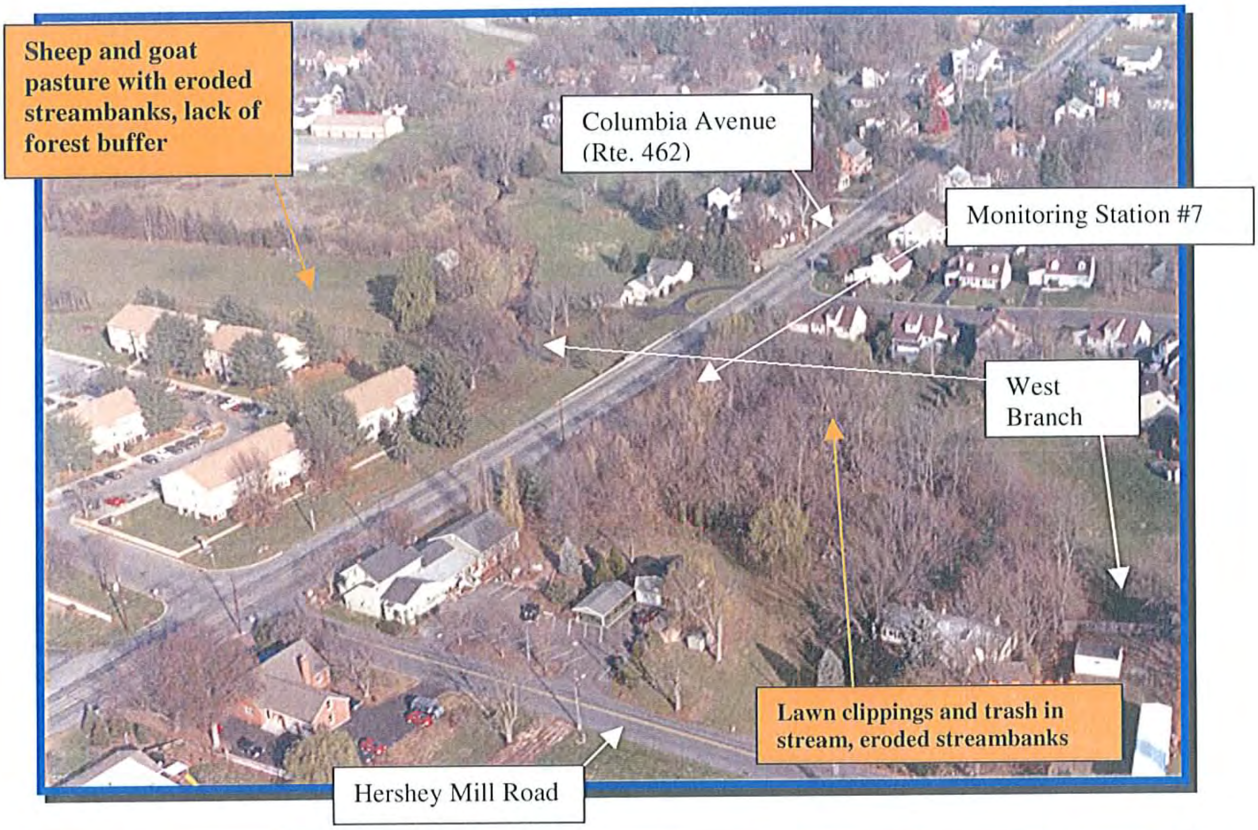

Eroded streambanks, lack of forest buffer, eroding ditches leading to stream – streambank fencing potential
West Branch
Immediately north of Blue Rock Road (Rte. 999)
Manure stockpiled along stream on roadbed


Lack of forest buffer, poor in-stream habitat, sediment laden substrate – streambank fencing potential
Charlestown Road
1 1 25 '02
West Branch

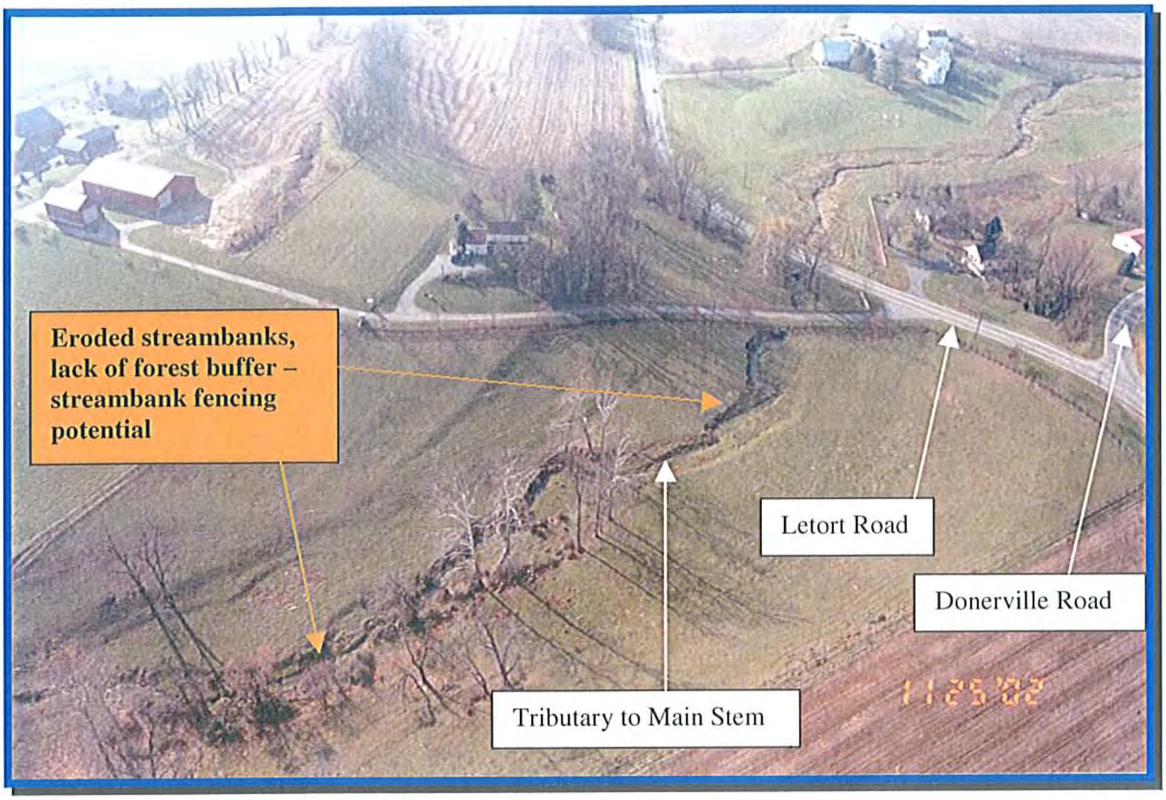

Eroded ditches
Habecker Church Road
Spring and West Branch
Lack of forest buffer, various eroded sections of streambank, sediment laden substrate, lack of in-stream cover – streambank fencing potential
1 1 25 '02

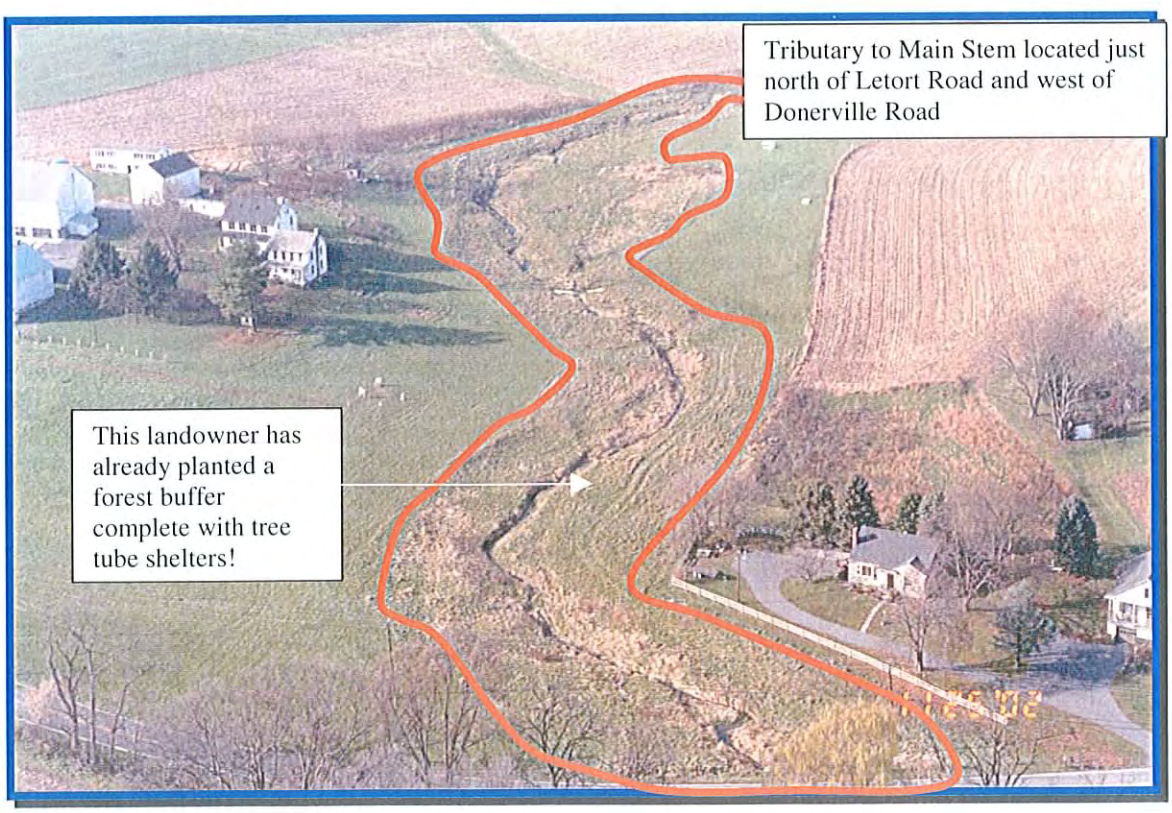

Rohrer Road
Eroded streambanks, lack of forest buffer – streambank fencing potential
West Branch
11 25 '02

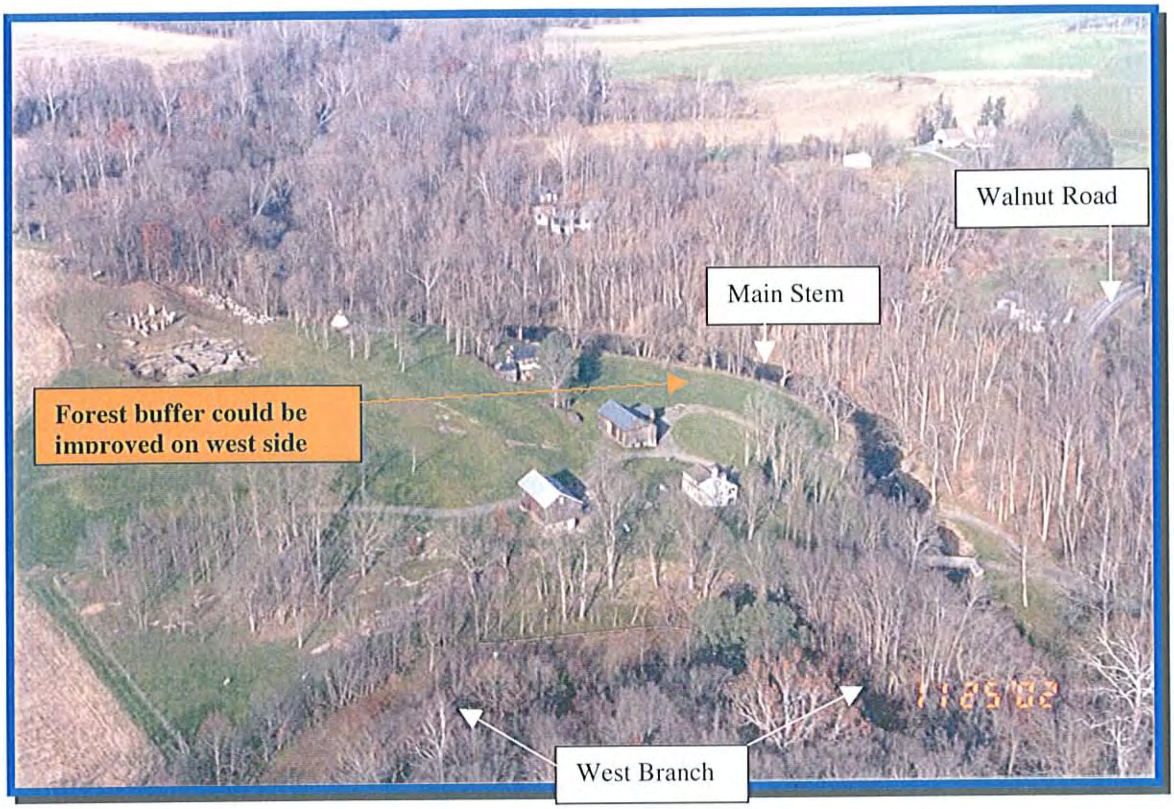

Lack of forest buffer, sediment introduction from field, various eroded streambank sections
Hershey Mill Road
West Branch

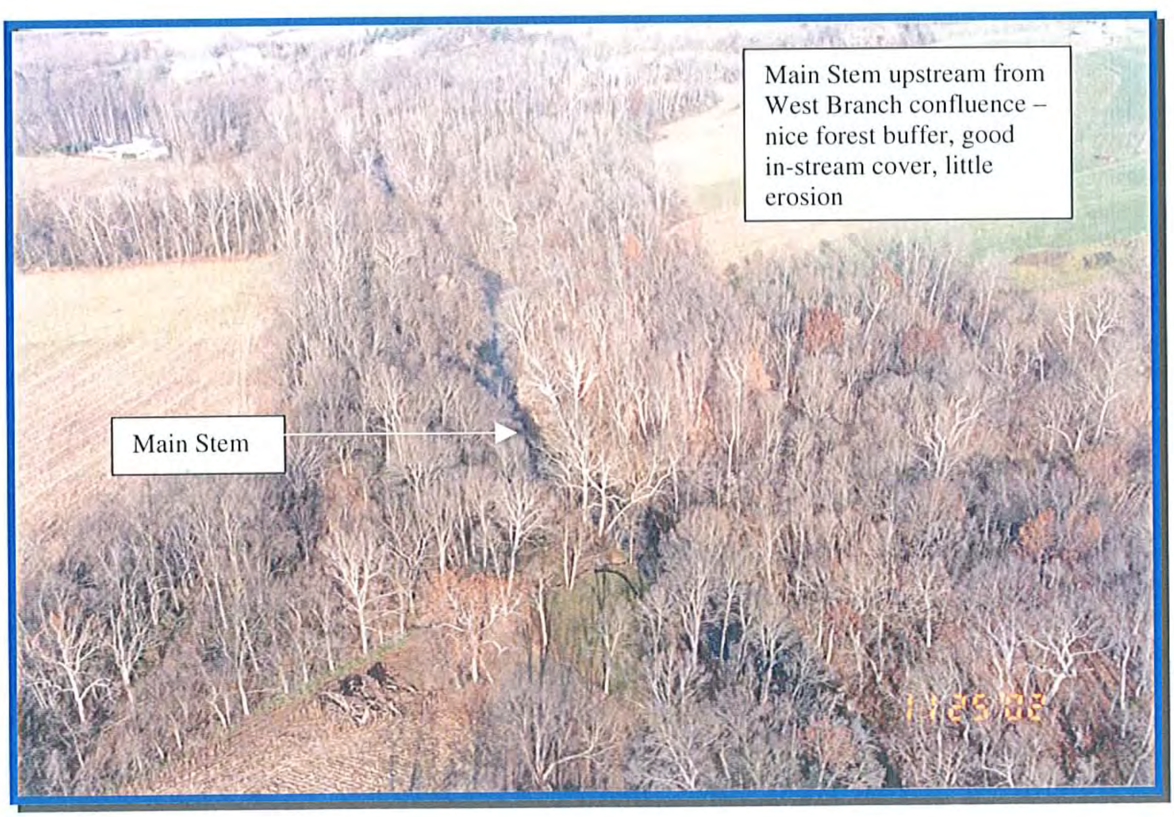

Sheep and goat pasture with eroded streambanks, lack of forest buffer
Columbia Avenue (Rte. 462)
Monitoring Station #7
West Branch
Lawn clippings and trash in stream, eroded streambanks
Hershey Mill Road

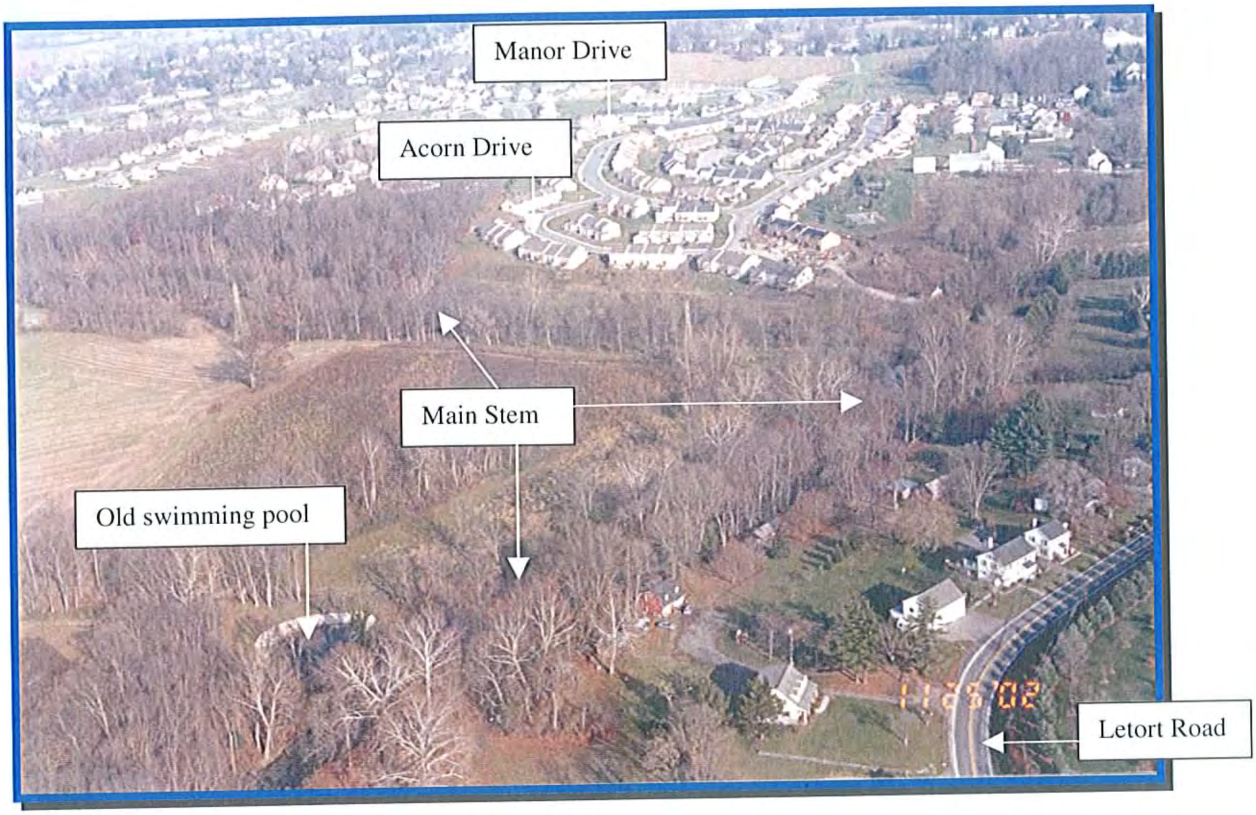

Eroded streambanks, lawns mowed right up to edge of bank, lack of forest buffer
Columbia Avenue (Rte. 462)
Sheep and goat pasture with eroded streambanks, lack of forest buffer
West Branch - headwater tributaries


Eroded streambanks, lack of forest buffer – streambank fencing potential
Letort Road
Donerville Road
Tributary to Main Stem

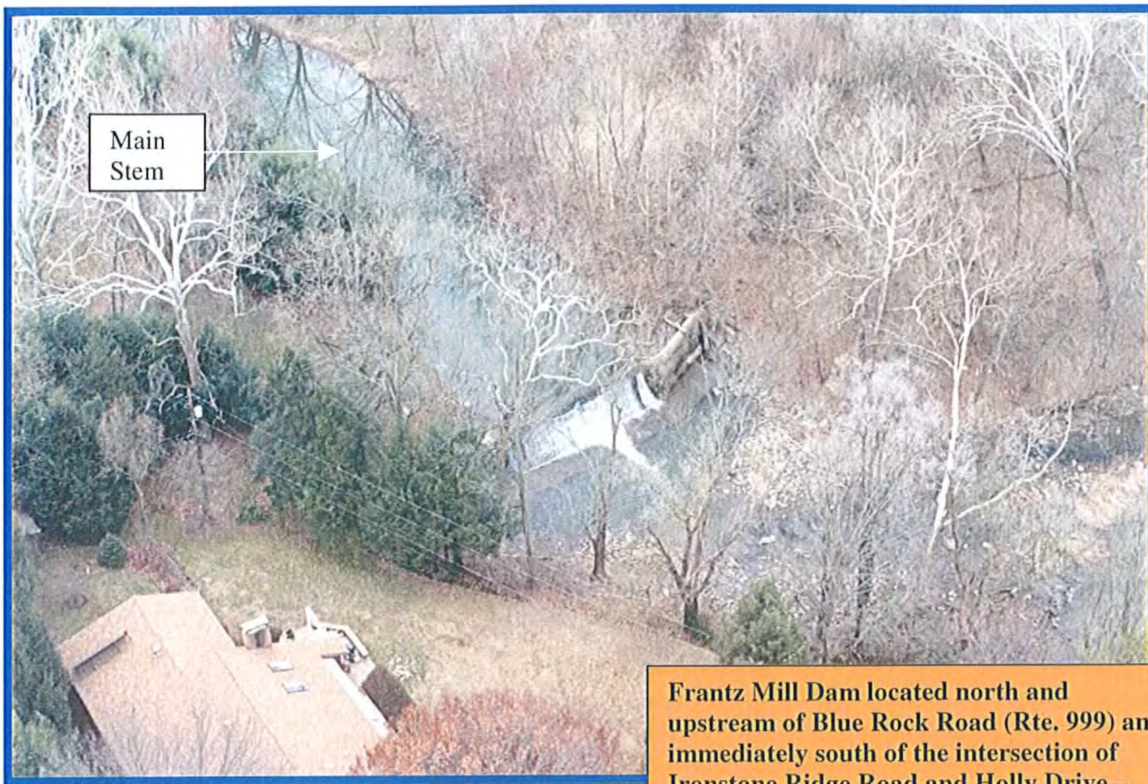

Tributary to Main Stem located just north of Letort Road and west of Donerville Road
This landowner has already planted a forest buffer complete with tree tube shelters!


Walnut Road
Main Stem
Forest buffer could be improved on west side
West Branch
11 25 '02

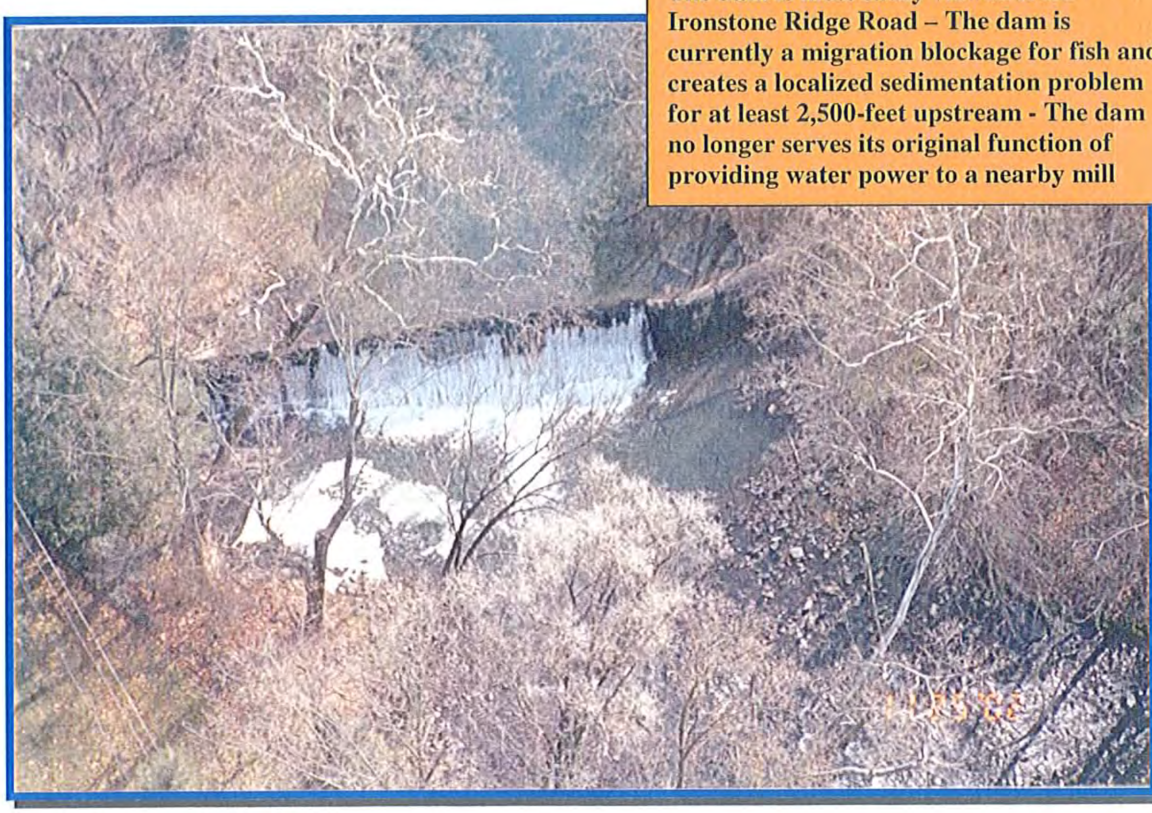

Main Stem upstream from West Branch confluence – nice forest buffer, good in-stream cover, little erosion
Main Stem
11 25 '02

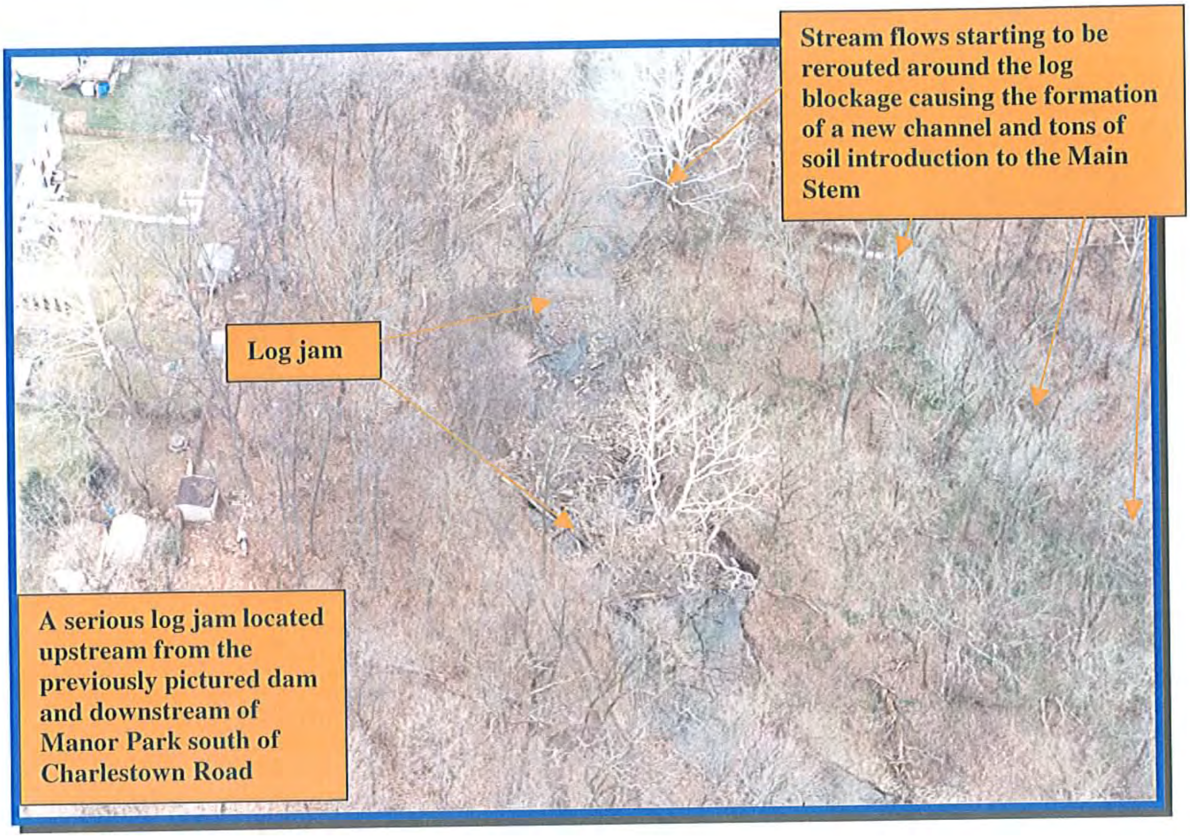

Manor Drive
Acorn Drive
Main Stem
Old swimming pool
11 25 02
Letort Road

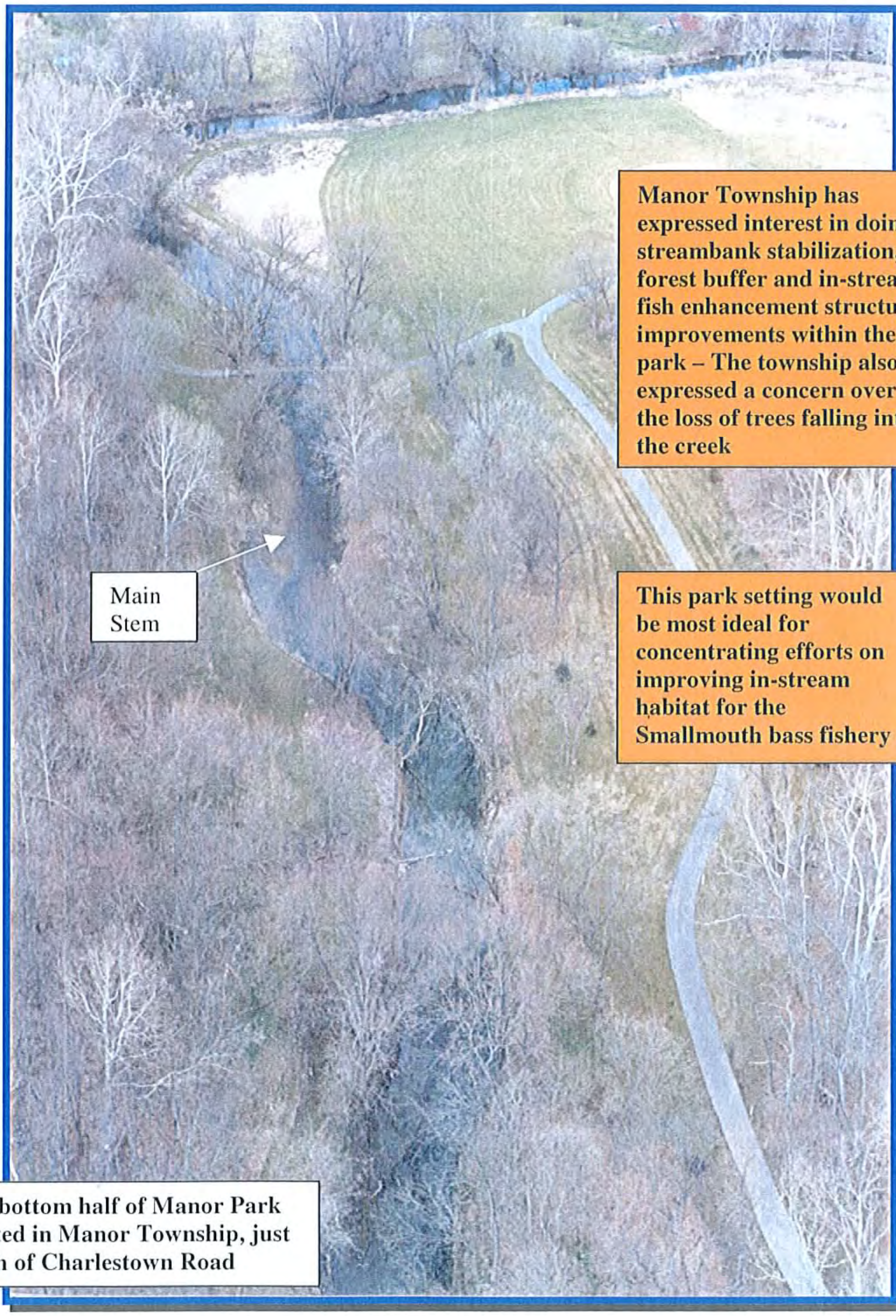

Blue Rock
Road (Rte.999)
Monitoring Station #8
Swedesford Lane
11 25 02
Powerline



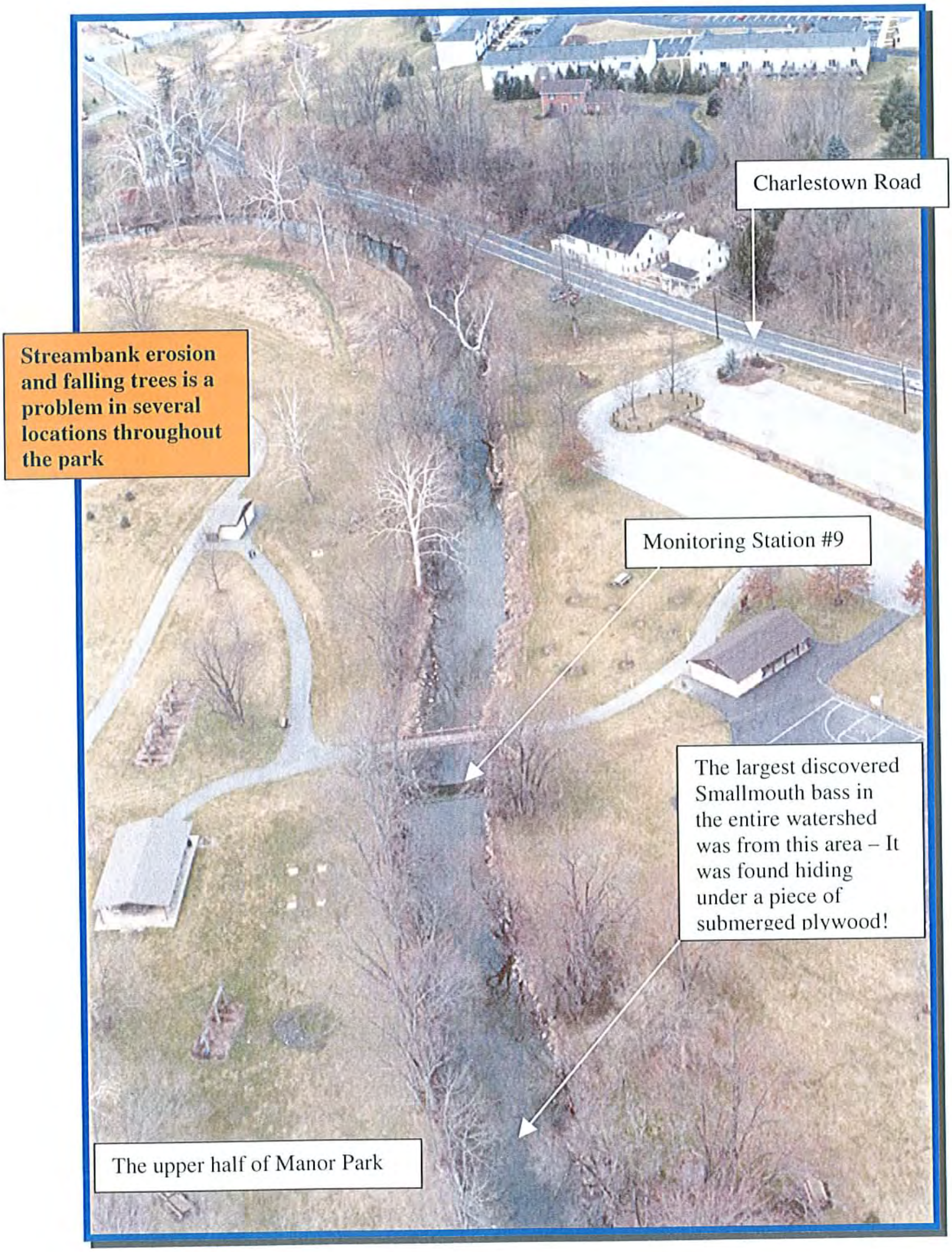
Frantz Mill Dam located north and upstream of Blue Rock Road (Rte. 999) and immediately south of the intersection of Ironstone Ridge Road and Holly Drive – The dam is most easily viewed from Ironstone Ridge Road – The dam is currently a migration blockage for fish and creates a localized sedimentation problem for at least 2,500-feet upstream - The dam no longer serves its original function of providing water power to a nearby mill

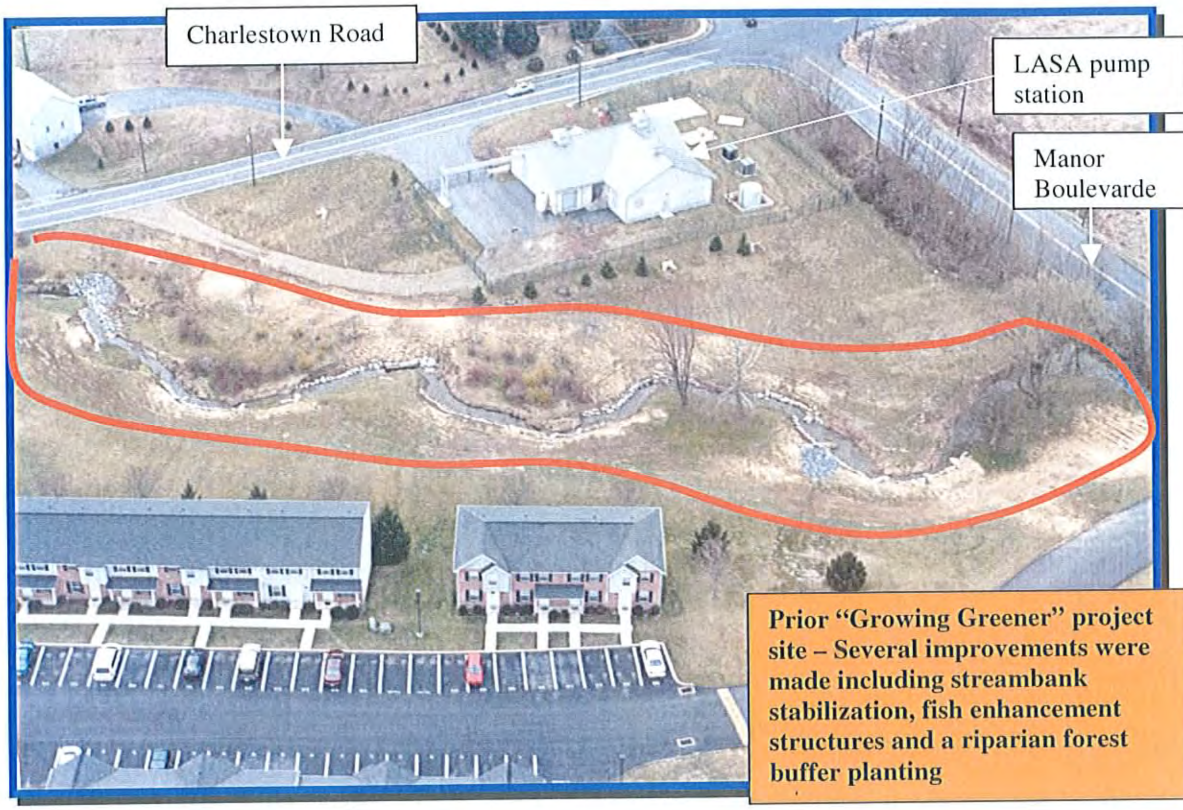


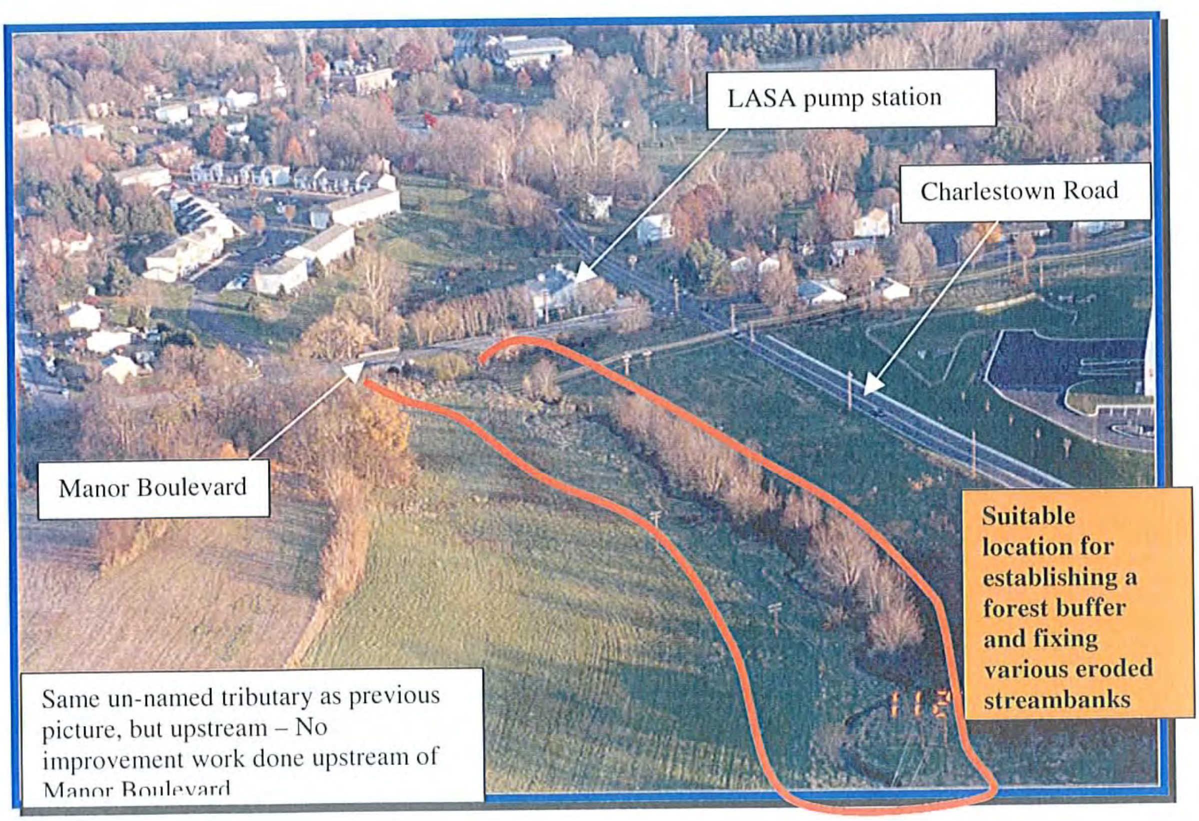

Stream flows starting to be rerouted around the log blockage causing the formation of a new channel and tons of soil introduction to the Main Stem
Log jam
A serious log jam located upstream from the previously pictured dam and downstream of Manor Park south of Charlestown Road



The bottom half of Manor Park located in Manor Township, just south of Charlestown Road

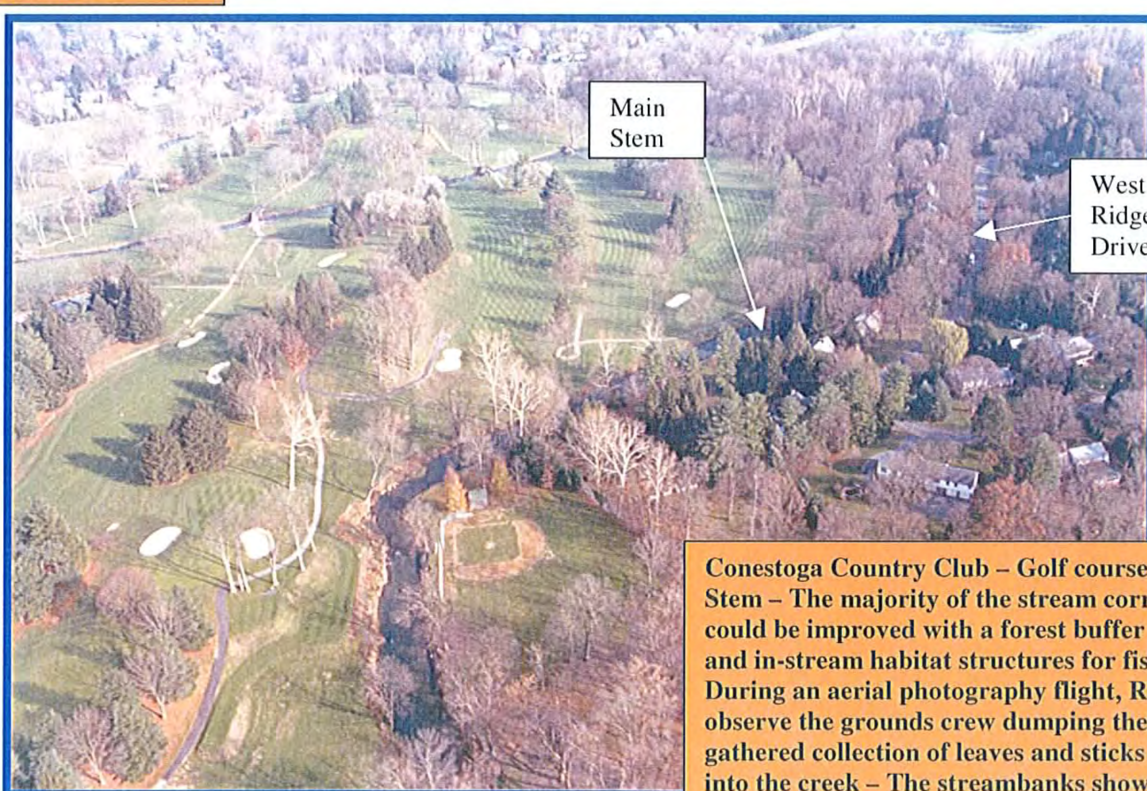

Charlestown Road
Streambank erosion and falling trees is a problem in several locations throughout the park
Monitoring Station #9
The largest discovered Smallmouth bass in the entire watershed was from this area – It was found hiding under a piece of submerged plywood!
The upper half of Manor Park


Charlestown Road
LASA pump station
Manor Boulevarde
Prior "Growing Greener" project site – Several improvements were made including streambank stabilization, fish enhancement structures and a riparian forest buffer planting

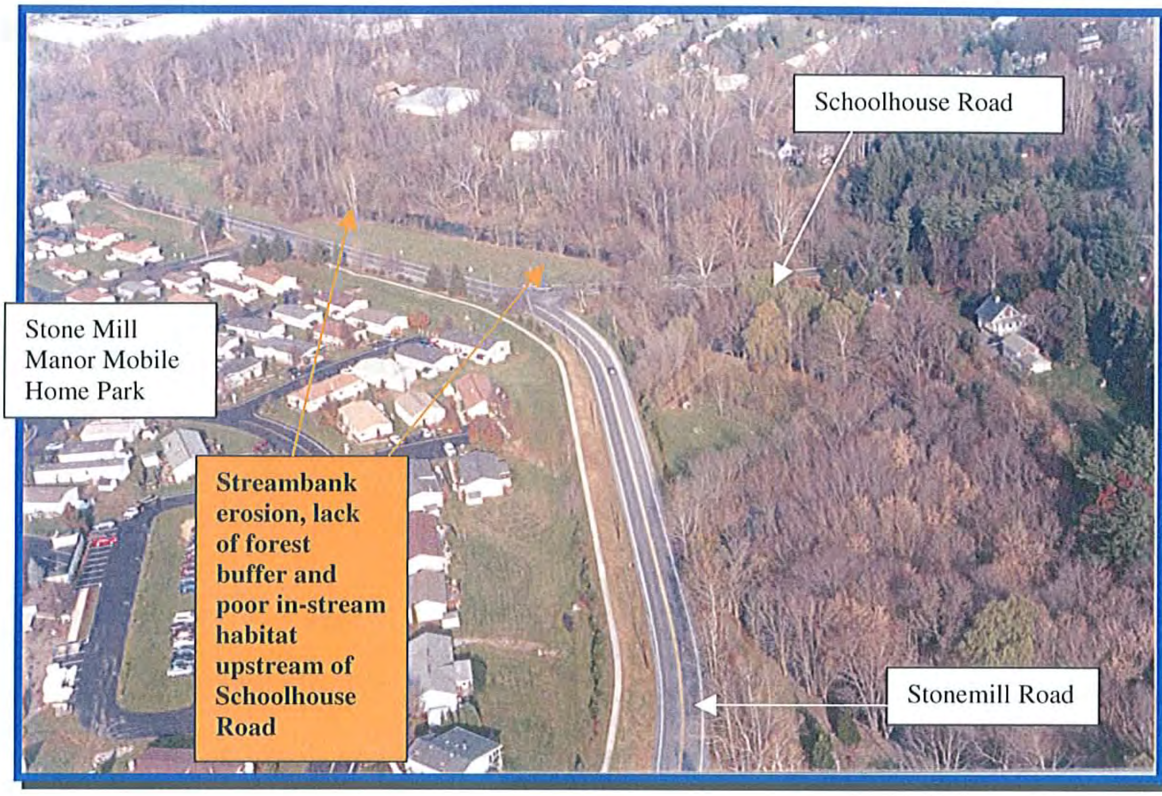

LASA pump station
Charlestown Road
Manor Boulevard
Suitable location for establishing a forest buffer and fixing various eroded streambanks
Same un-named tributary as previous picture, but upstream – No improvement work done upstream of Manor Boulevard

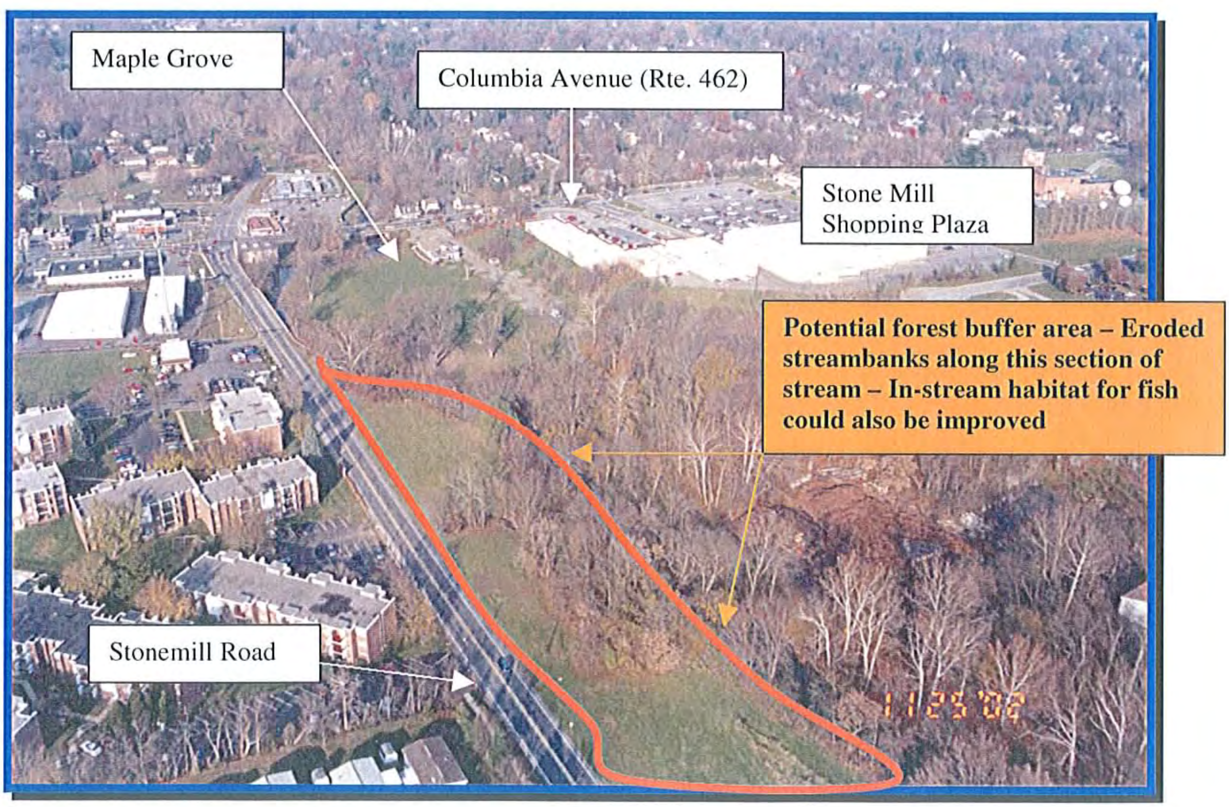
Lack of forest buffer, sediment introduction from fields at various locations, eroded streambanks in various locations – Two wetlands located just east of Centerville Road (near the beginning of this tributary) have fairly good plant diversity and serve as valuable habitats in the headwater area – Wood's Edge development and a large wetland complex are located on the west side of Centerville Road – The Armstrong property supports a White-tailed deer population

Un-named tributary to Main Stem within the Armstrong property east of Centerville Road – Manor Boulevard is located further downstream (as shown in the preceding pictures)

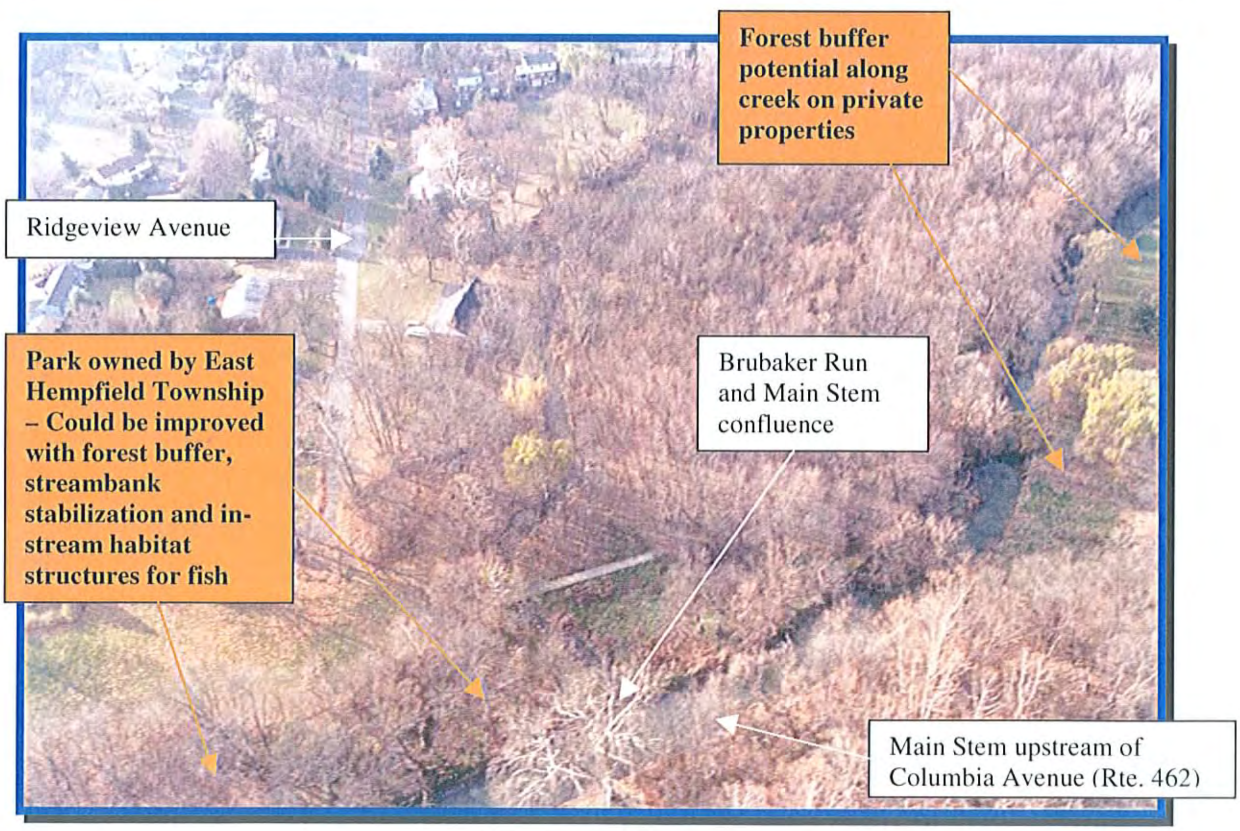


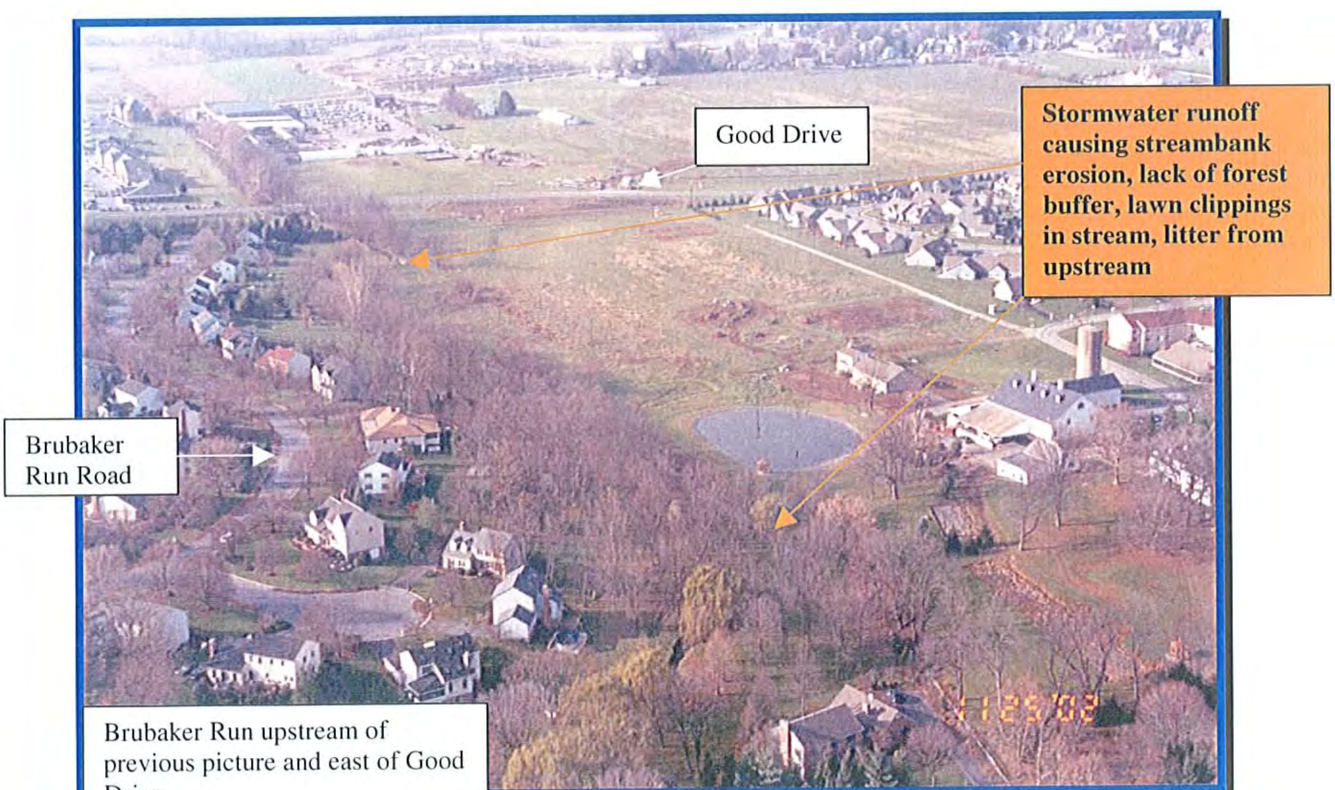
Conestoga Country Club – Golf course on Main Stem – The majority of the stream corridor could be improved with a forest buffer planting and in-stream habitat structures for fish – During an aerial photography flight, RETTEW observe the grounds crew dumping their gathered collection of leaves and sticks directly into the creek – The streambanks show signs of routine mowing and spraying


Schoolhouse Road
Stone Mill Manor Mobile Home Park
Streambank erosion, lack of forest buffer and poor in-stream habitat upstream of Schoolhouse Road
Stonemill Road

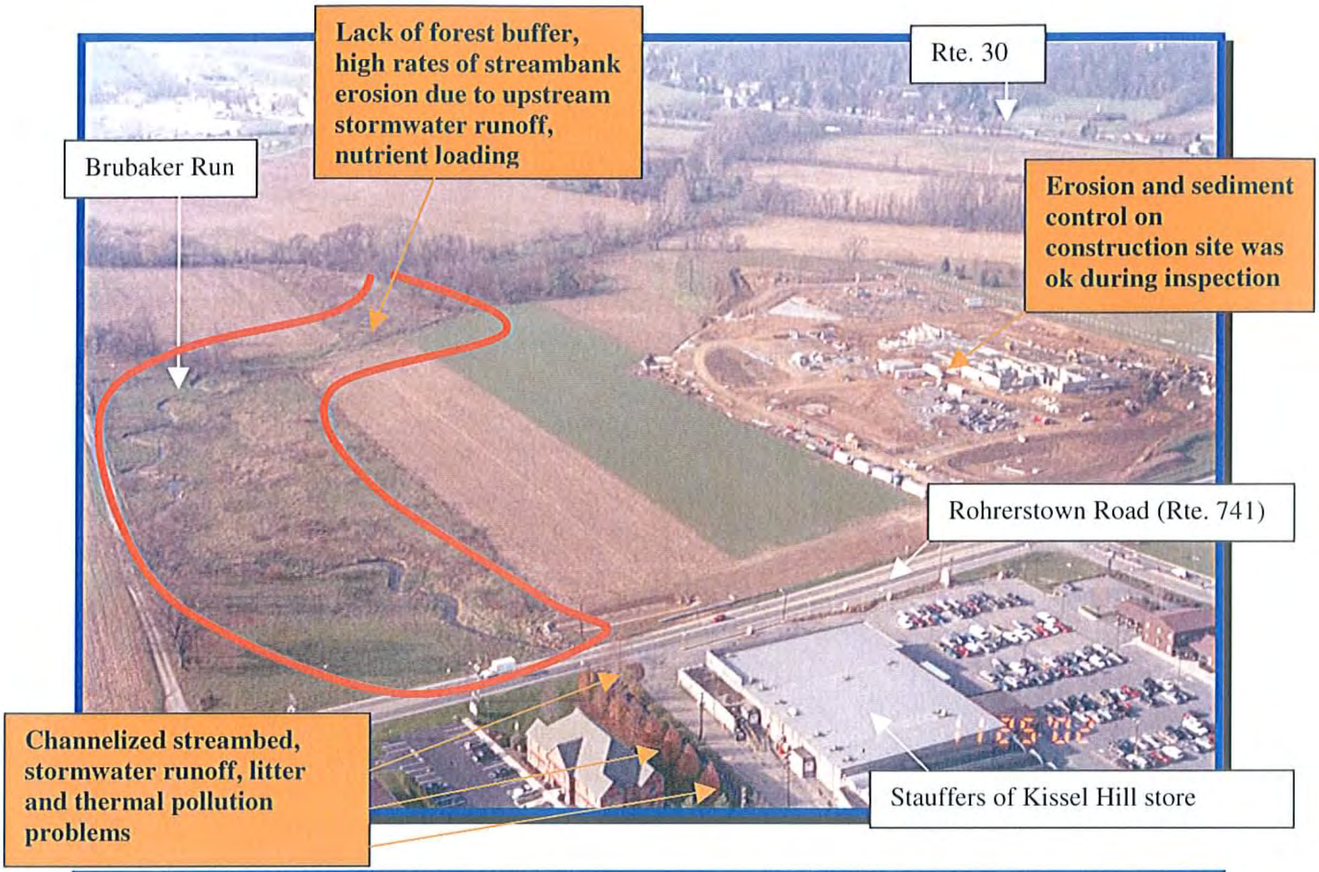

Maple Grove
Columbia Avenue (Rte. 462)
Stone Mill Shopping Plaza
Potential forest buffer area – Eroded streambanks along this section of stream – In-stream habitat for fish could also be improved
Stonemill Road
11 25 02

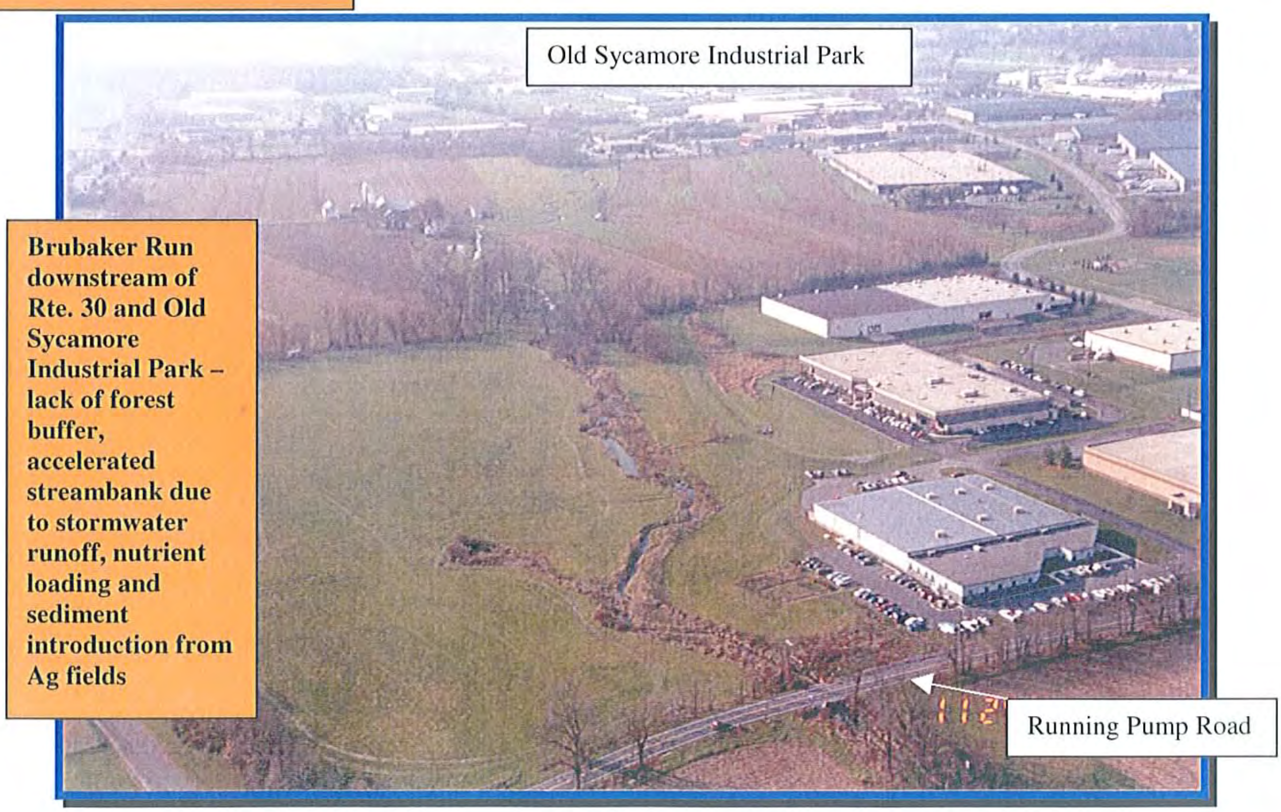

Columbia Avenue (Rte. 462)
Potential forest buffer and bank stabilization improvements
Stone Mill Shopping Plaza
Monitoring Station #10
Maple Grove
Previous riparian buffer, bioengineering, bank stabilization and in-stream fish habitat improvement project funded by a National Fish and Wildlife Foundation grant and was sponsored by Lancaster Township
Stonemill Road

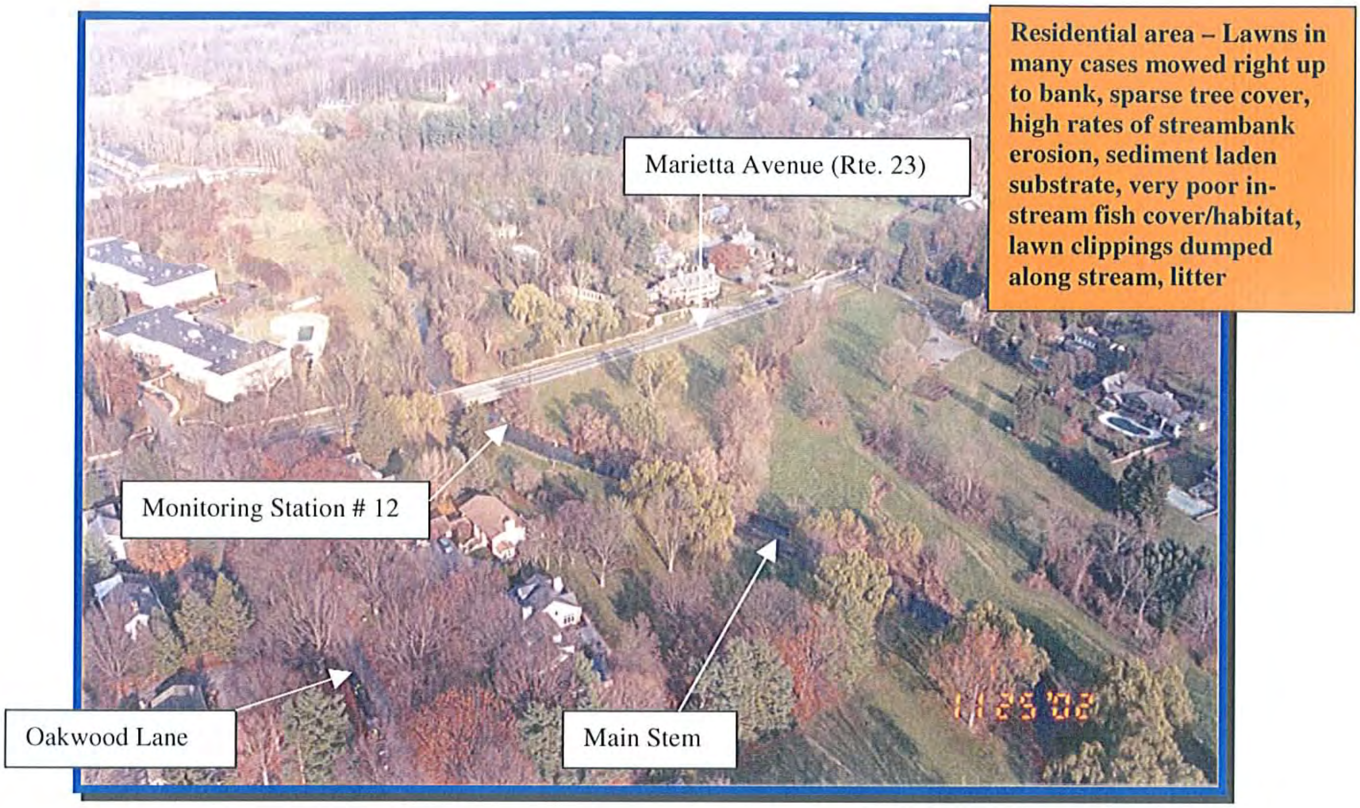

Forest buffer potential along creek on private properties
Ridgeview Avenue
Park owned by East Hempfield Township – Could be improved with forest buffer, streambank stabilization and in-stream habitat structures for fish
Brubaker Run and Main Stem confluence
Main Stem upstream of Columbia Avenue (Rte. 462)



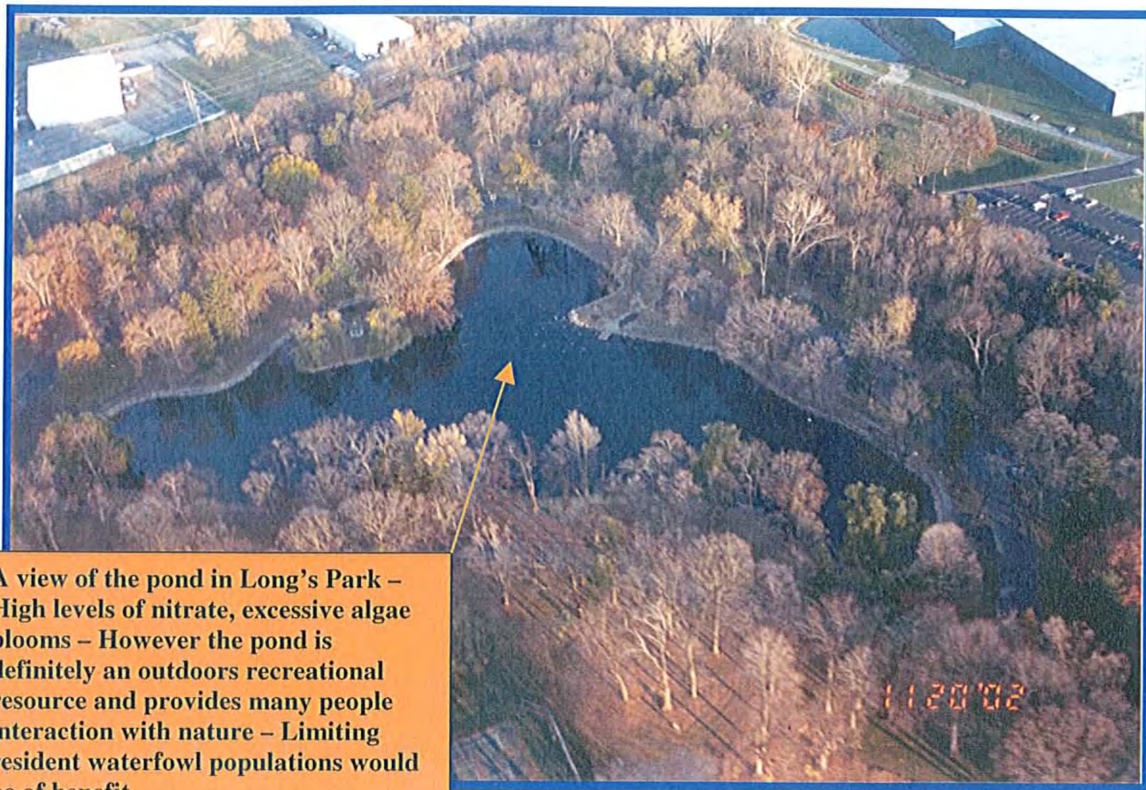
Brubaker Run upstream of previous picture and east of Good Drive


Lack of forest buffer, high rates of streambank erosion due to upstream stormwater runoff, nutrient loading
Rte. 30
Brubaker Run
Erosion and sediment control on construction site was ok during inspection
Rohrerstown Road (Rte. 741)
Channelized streambed, stormwater runoff, litter and thermal pollution problems
Stauffers of Kissel Hill store


Old Sycamore Industrial Park
Brubaker Run downstream of Rte. 30 and Old Sycamore Industrial Park – lack of forest buffer, accelerated streambank due to stormwater runoff, nutrient loading and sediment introduction from Ag fields
Running Pump Road

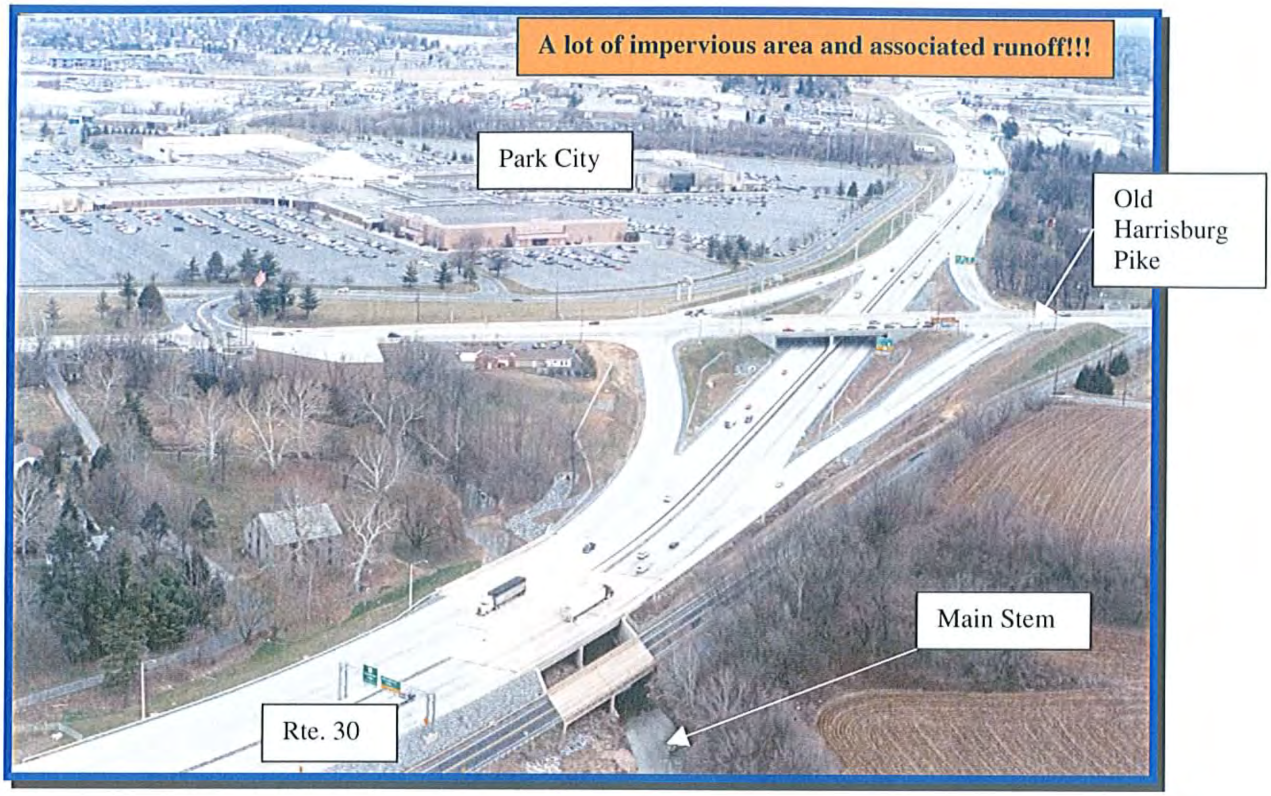

Residential area – Lawns in many cases mowed right up to bank, sparse tree cover, high rates of streambank erosion, sediment laden substrate, very poor in-stream fish cover/habitat, lawn clippings dumped along stream, litter
Marietta Avenue (Rte. 23)
Monitoring Station # 12
Oakwood Lane
Main Stem
11 25 '02

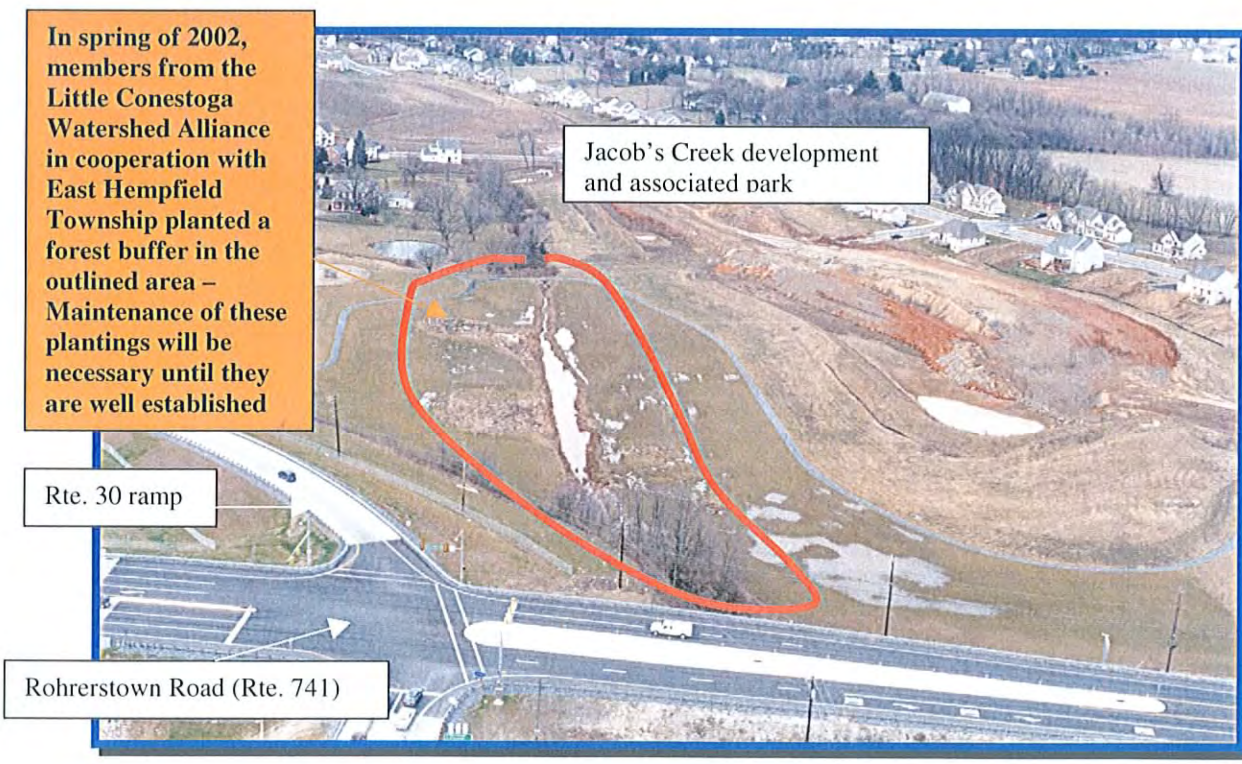

Good forest buffer and fairly good in-stream habitat
Conrail Rail Road
Main Stem

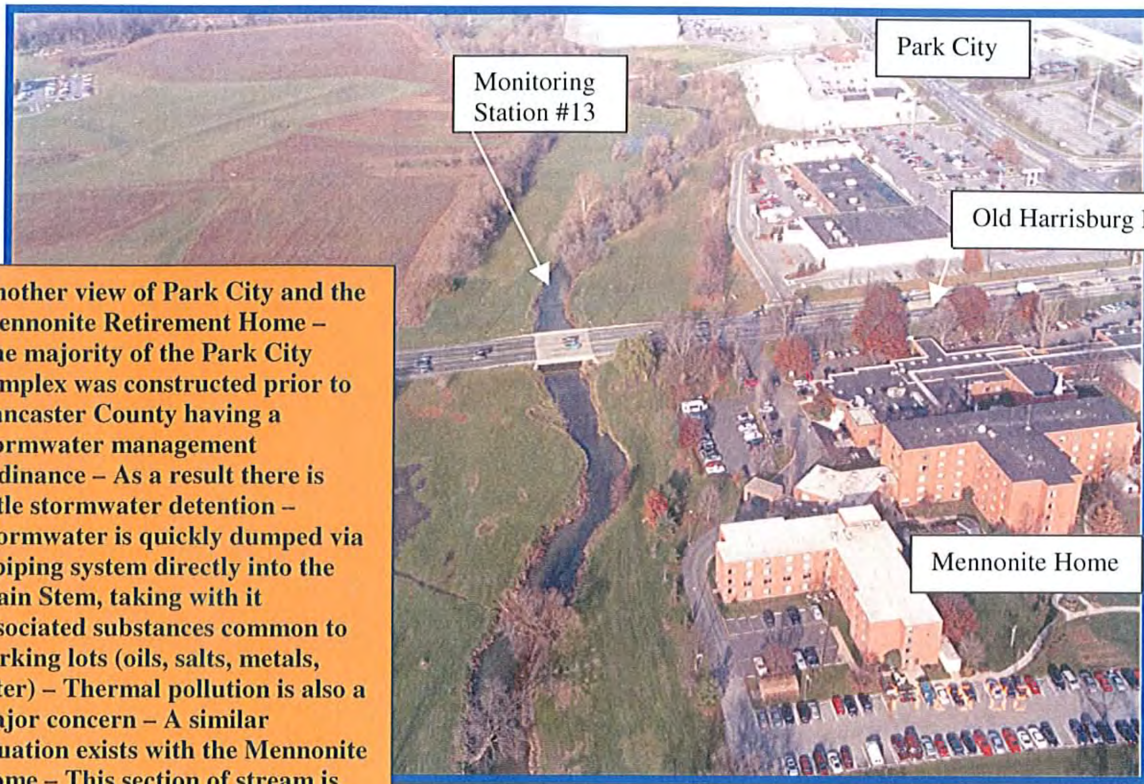


A view of the pond in Long's Park – High levels of nitrate, excessive algae blooms – However the pond is definitely an outdoors recreational resource and provides many people interaction with nature – Limiting resident waterfowl populations would be of benefit

A view of Dillerville Swamp and Red Rose Commons – See plans for spraying and controlling invasive Purple loosestrife in "Completed Restoration Projects" chapter of this report for further details – Dillerville Swamp is now but a fraction of the once incredibly diverse wetland habitat it once was – Franklin and Marshall College had in the past completed extensive flora investigations within the swamp and had identified several rare, threatened and endangered plant species – Recent investigations indicate a loss of these plant species – A unique opportunity exists for restoring the original plant community

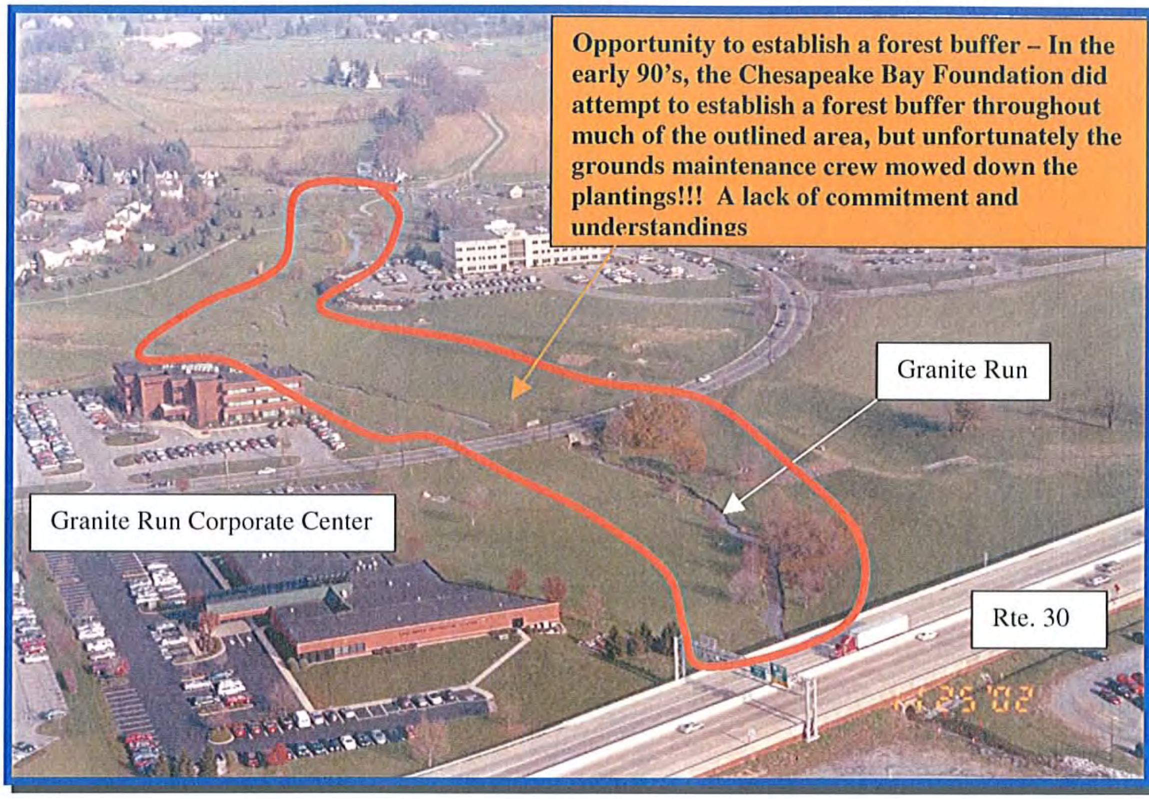

A lot of impervious area and associated runoff!!!
Park City
Old Harrisburg Pike
Main Stem
Rte. 30


In spring of 2002, members from the Little Conestoga Watershed Alliance in cooperation with East Hempfield Township planted a forest buffer in the outlined area – Maintenance of these plantings will be necessary until they are well established
Jacob's Creek development and associated park
Rte. 30 ramp
Rohrerstown Road (Rte. 741)

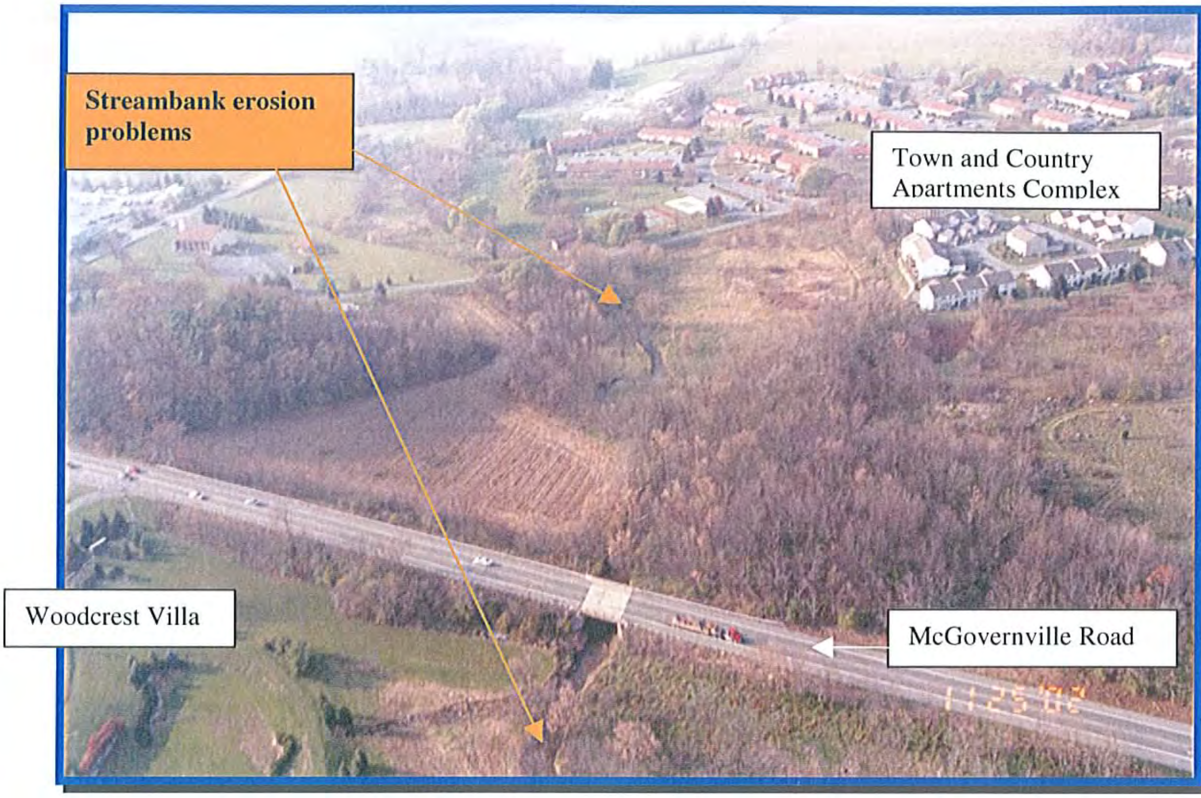


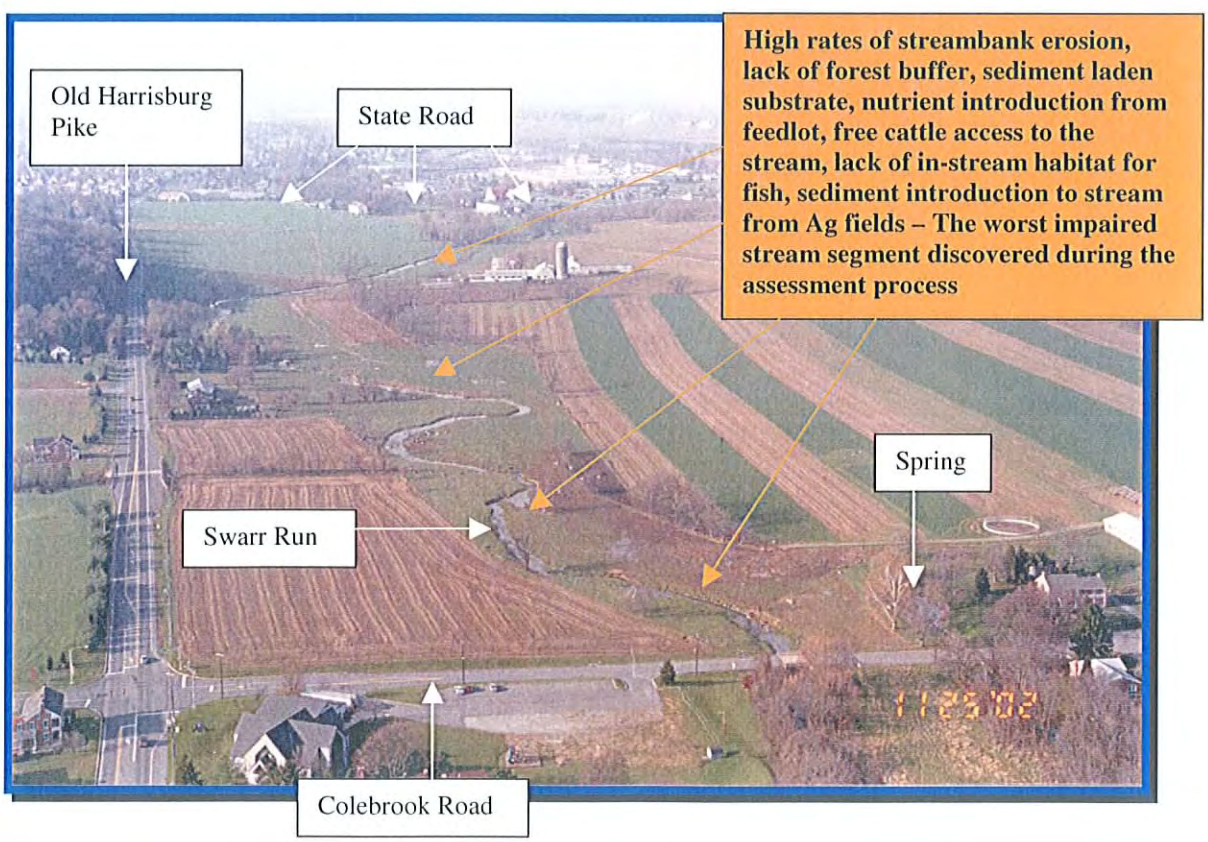
Another view of Park City and the Mennonite Retirement Home – The majority of the Park City complex was constructed prior to Lancaster County having a stormwater management ordinance – As a result there is little stormwater detention – Stormwater is quickly dumped via a piping system directly into the Main Stem, taking with it associated substances common to parking lots (oils, salts, metals, litter) – Thermal pollution is also a major concern – A similar situation exists with the Mennonite Home – This section of stream is severely degraded – High rates of streambank erosion, sediment laden substrate, lack of forest buffer and very poor in-stream habitat for fish

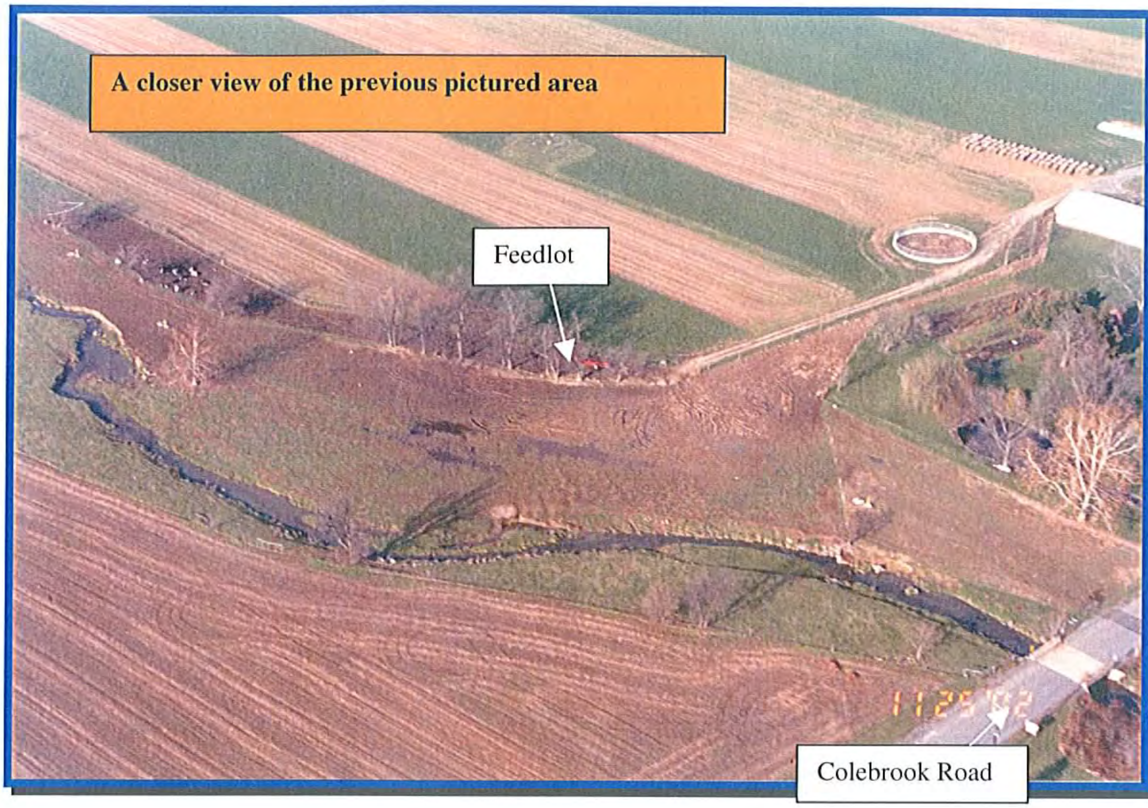
Excellent opportunity for retrofitting stormwater management controls (possibly a wetland treatment system and bioretention areas) – A forest buffer, bank stabilization and in-stream habitat improvements could easily be made if landowners were willing

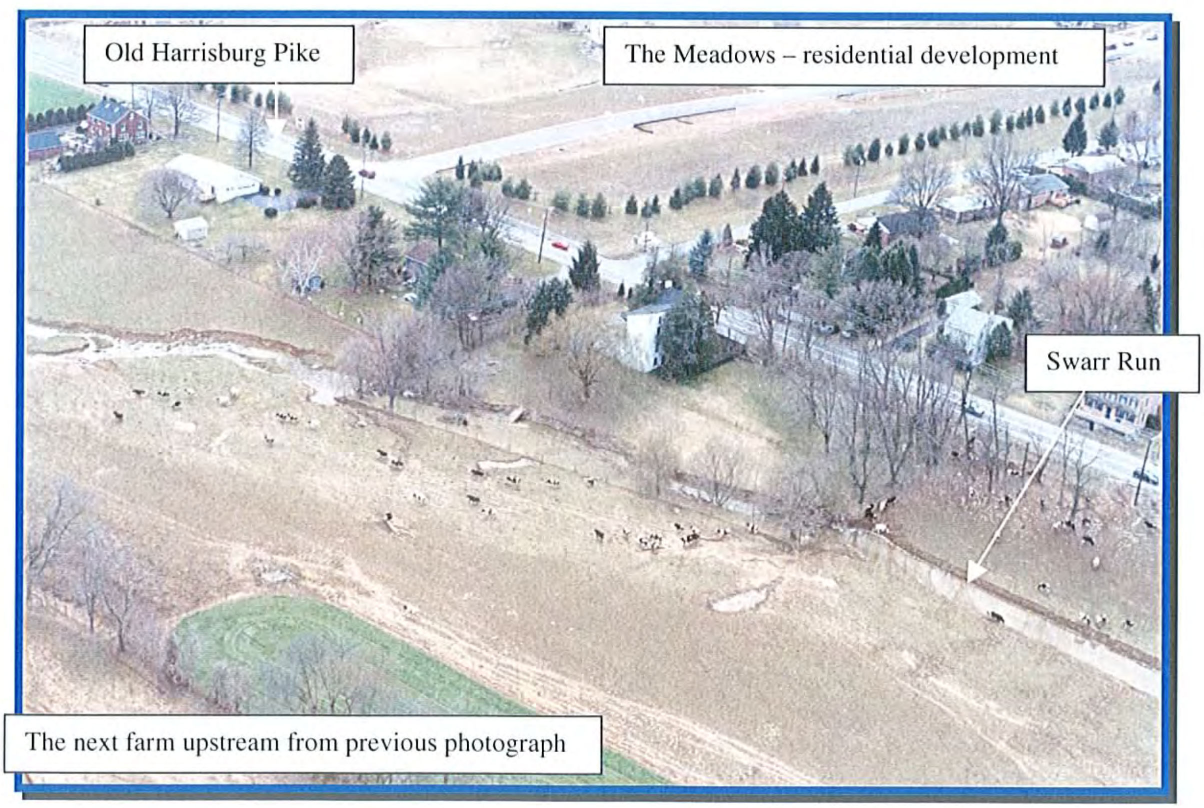

Opportunity to establish a forest buffer – In the early 90's, the Chesapeake Bay Foundation did attempt to establish a forest buffer throughout much of the outlined area, but unfortunately the grounds maintenance crew mowed down the plantings!!! A lack of commitment and understandings
Granite Run
Granite Run Corporate Center
Rte. 30

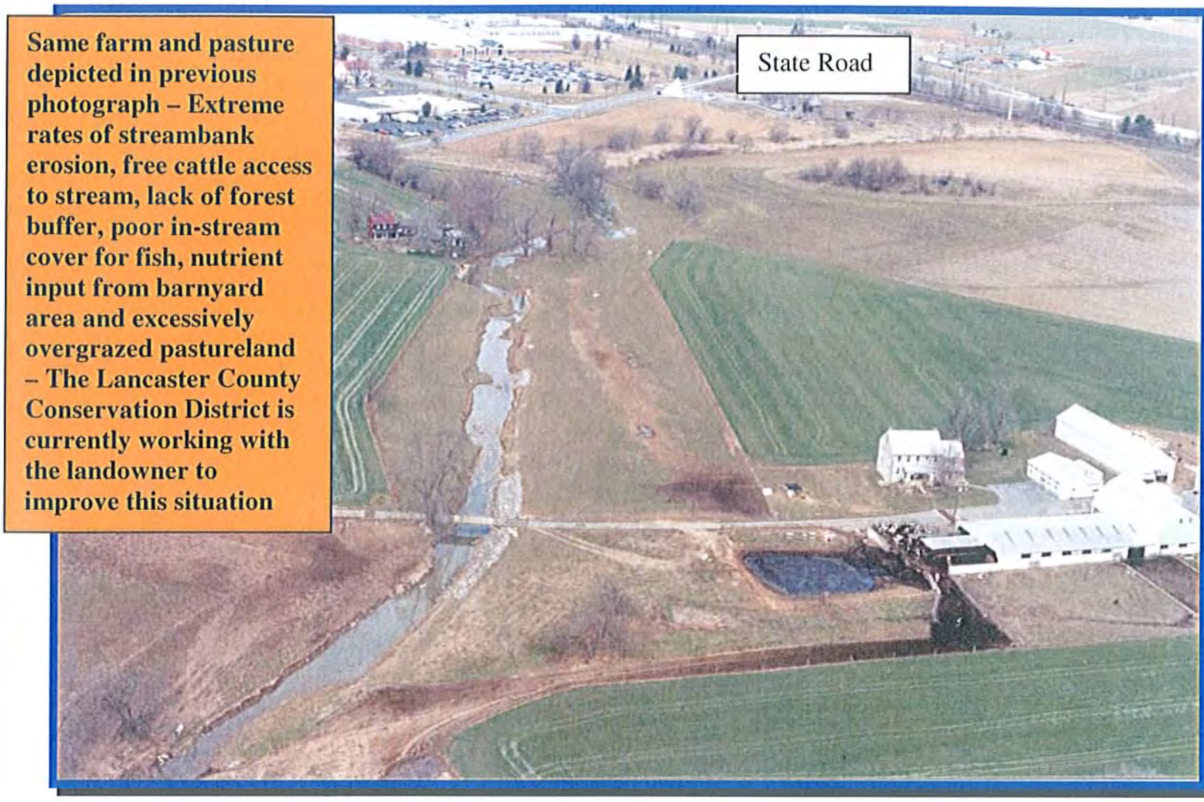

Littering and stormwater related erosion problems
Swarr Run confluence with Main Stem – southeast of McGovernville Road
Swarr Run Road

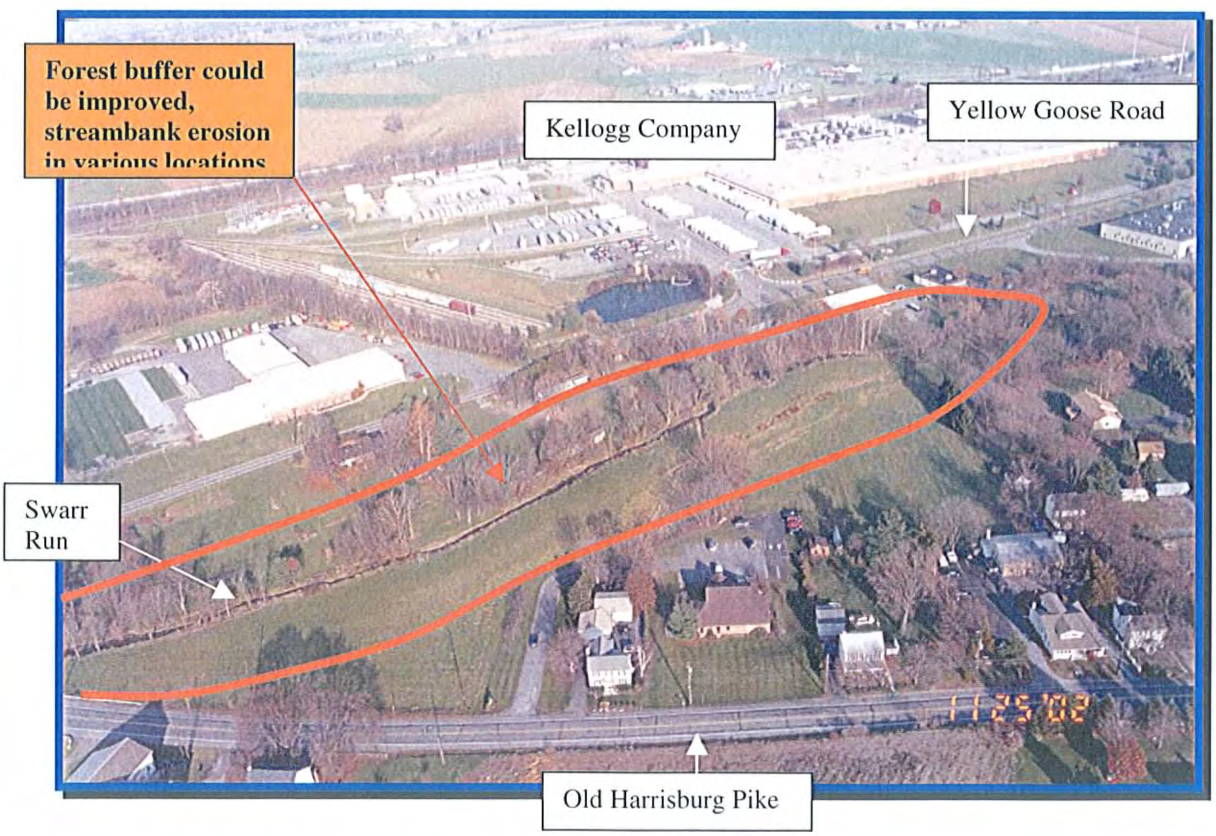

Streambank erosion problems
Town and Country Apartments Complex
Woodcrest Villa
McGovernville Road
11 25 '02

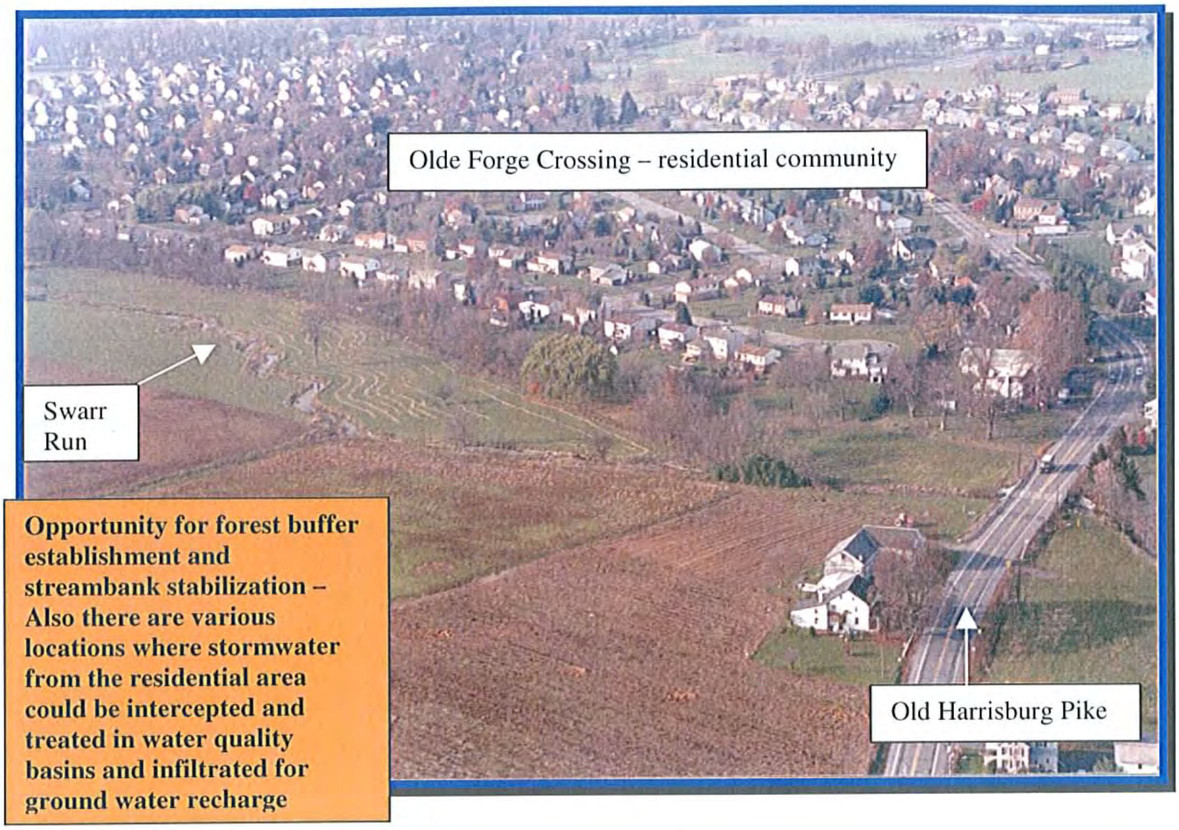

Old Harrisburg Pike
State Road
High rates of streambank erosion, lack of forest buffer, sediment laden substrate, nutrient introduction from feedlot, free cattle access to the stream, lack of in-stream habitat for fish, sediment introduction to stream from Ag fields – The worst impaired stream segment discovered during the assessment process
Spring
Swarr Run
Colebrook Road
11 25 '02

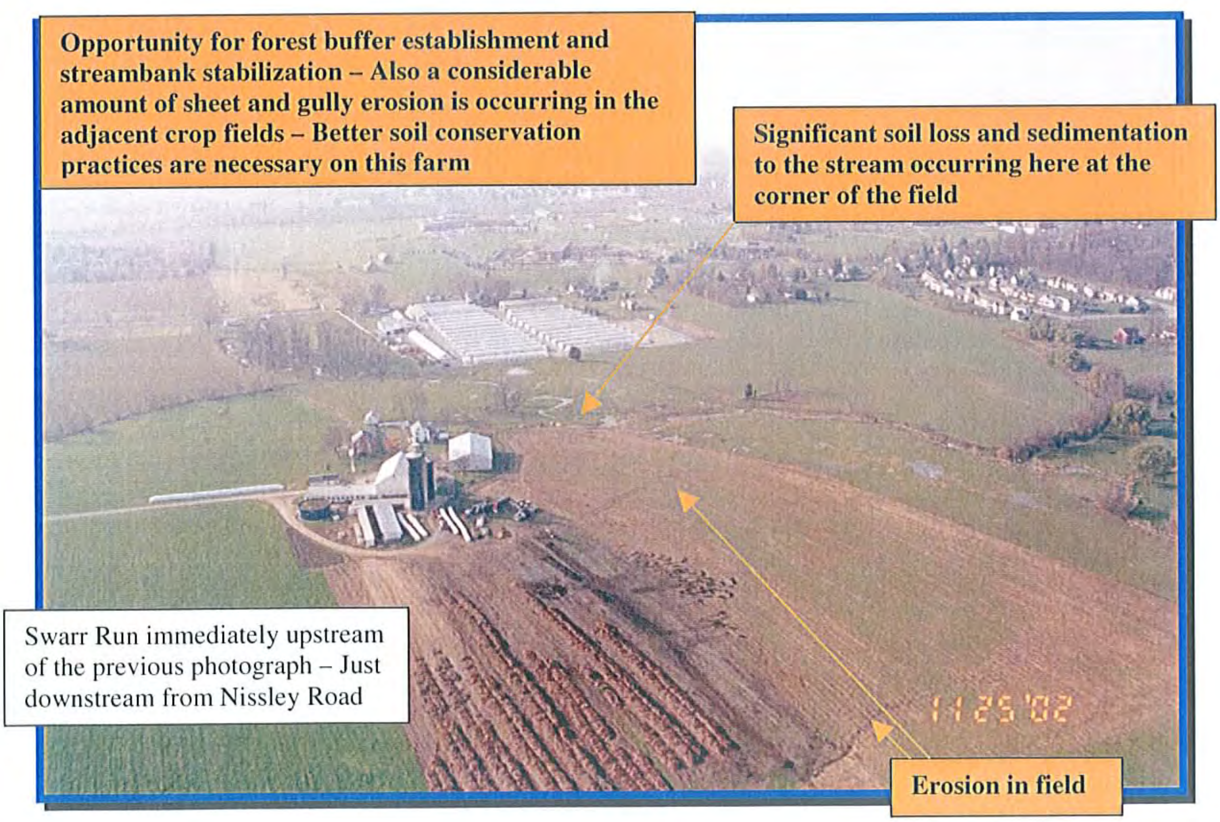

A closer view of the previous pictured area
Feedlot
Colebrook Road

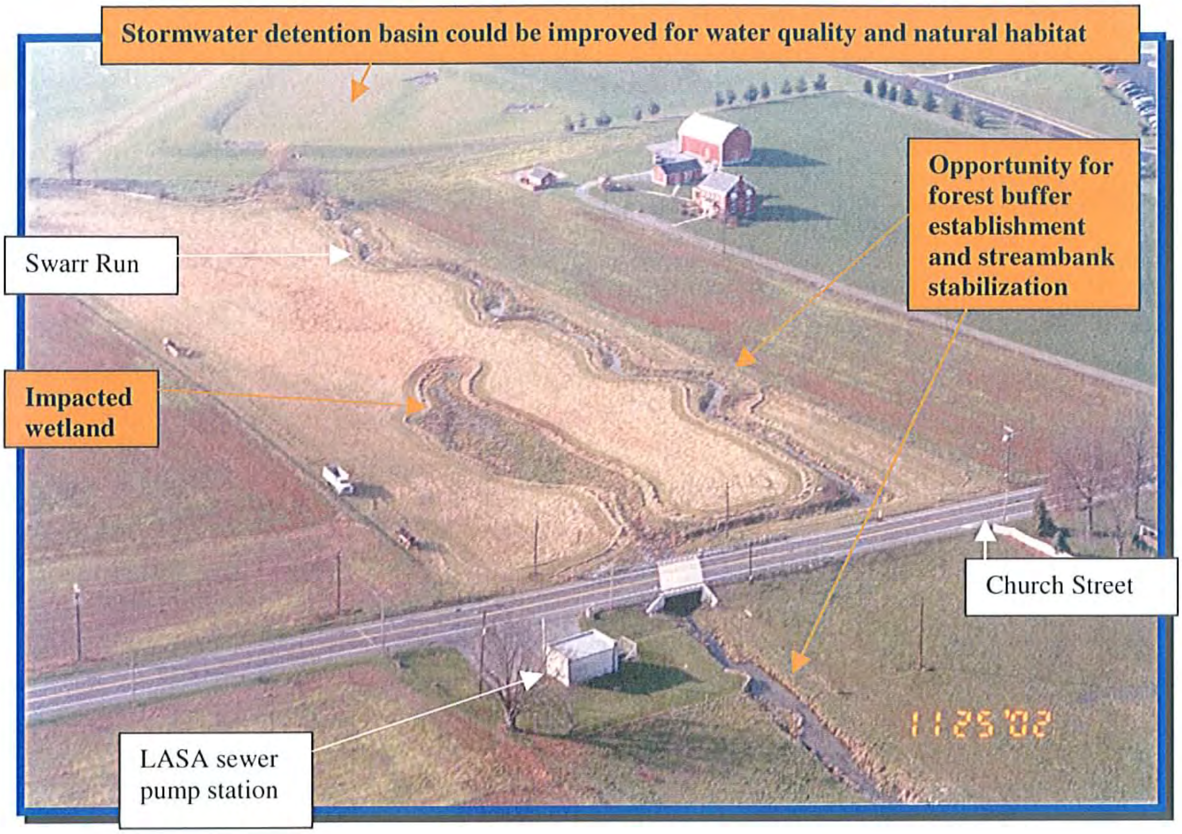

Old Harrisburg Pike
The Meadows – residential development
Swarr Run
The next farm upstream from previous photograph

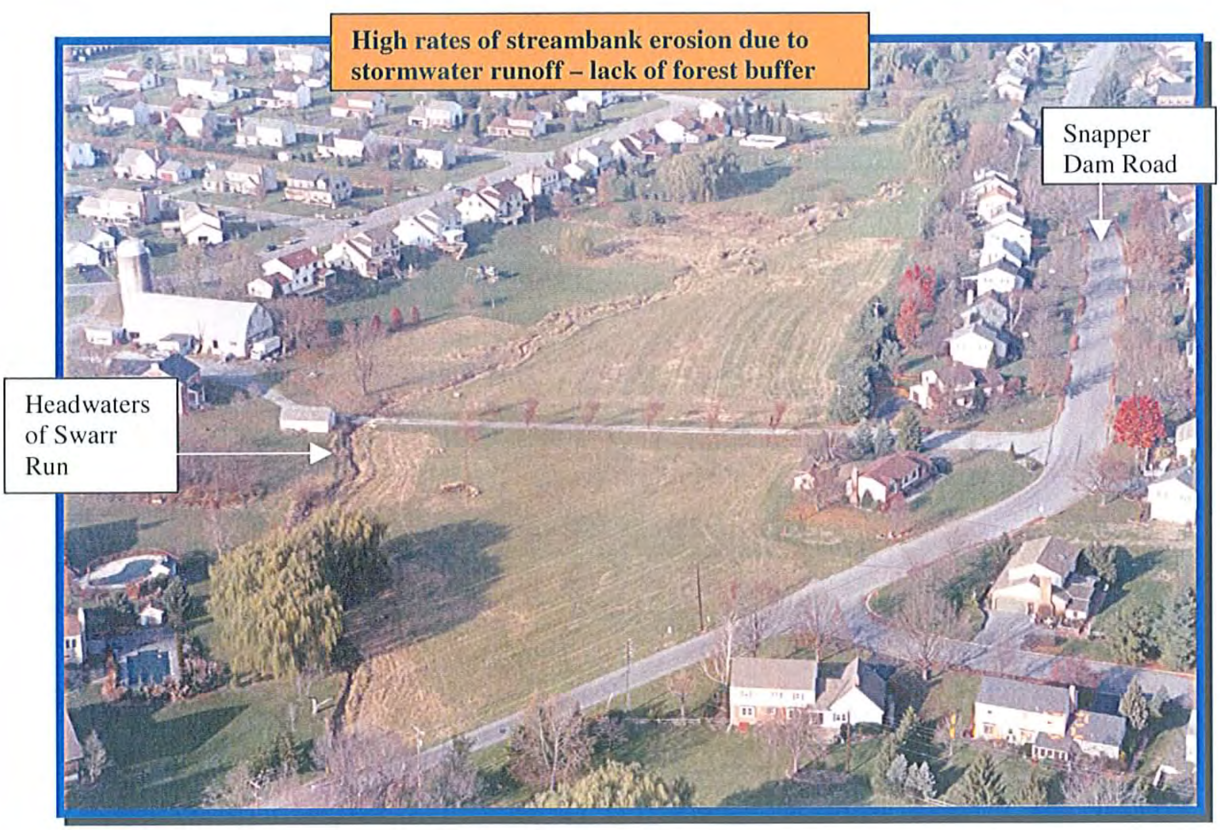

Same farm and pasture depicted in previous photograph – Extreme rates of streambank erosion, free cattle access to stream, lack of forest buffer, poor in-stream cover for fish, nutrient input from barnyard area and excessively overgrazed pastureland – The Lancaster County Conservation District is currently working with the landowner to improve this situation
State Road

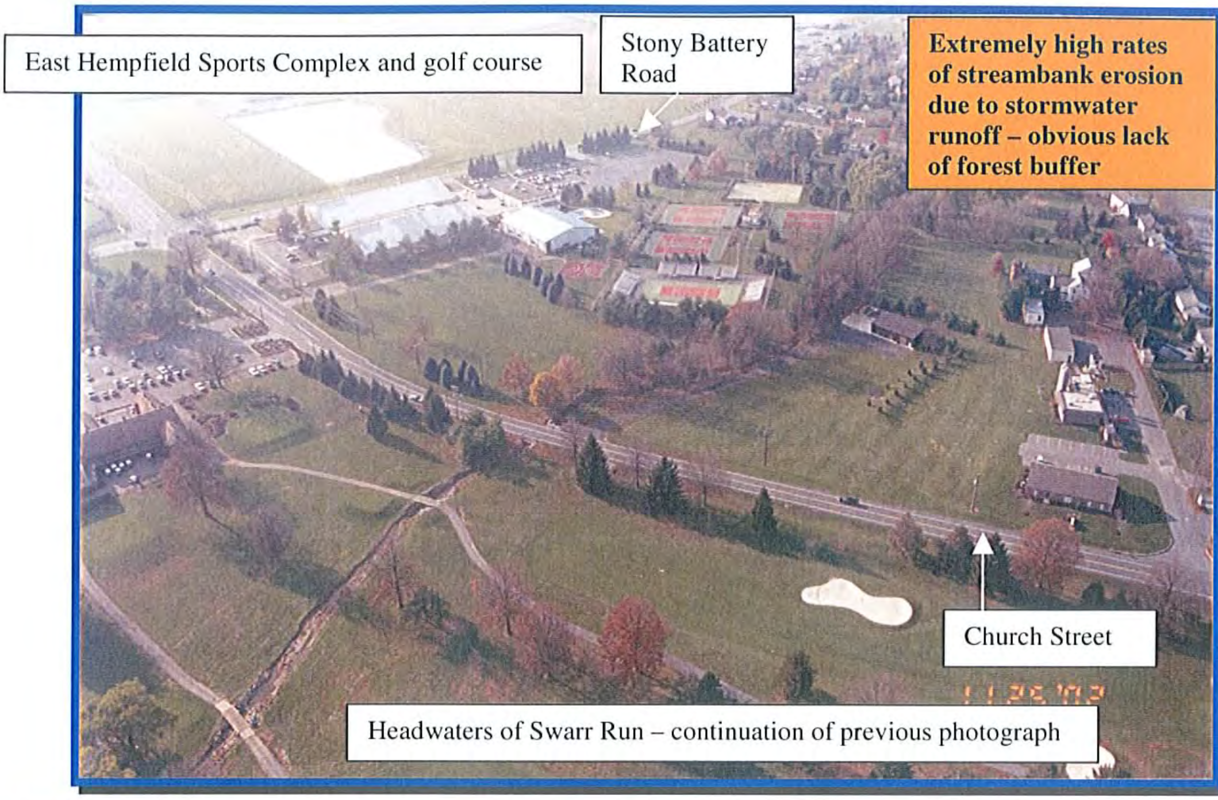

Forest buffer could be improved, streambank erosion in various locations
Kellogg Company
Yellow Goose Road
Swarr Run
11 25 '02
Old Harrisburg Pike

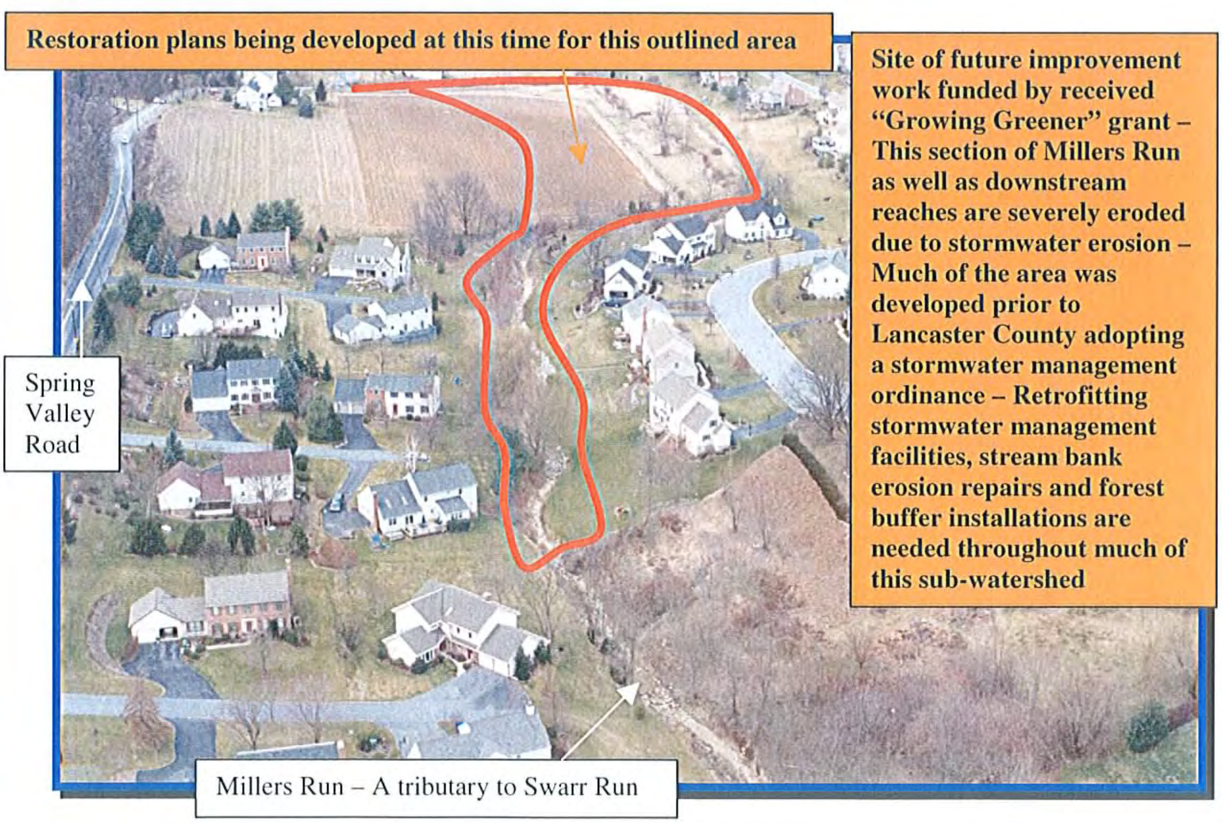

Olde Forge Crossing – residential community
Swarr Run
Opportunity for forest buffer establishment and streambank stabilization – Also there are various locations where stormwater from the residential area could be intercepted and treated in water quality basins and infiltrated for ground water recharge
Old Harrisburg Pike


Opportunity for forest buffer establishment and streambank stabilization – Also a considerable amount of sheet and gully erosion is occurring in the adjacent crop fields – Better soil conservation practices are necessary on this farm
Significant soil loss and sedimentation to the stream occurring here at the corner of the field
Swarr Run immediately upstream of the previous photograph – Just downstream from Nissley Road
11 25 '02
Erosion in field

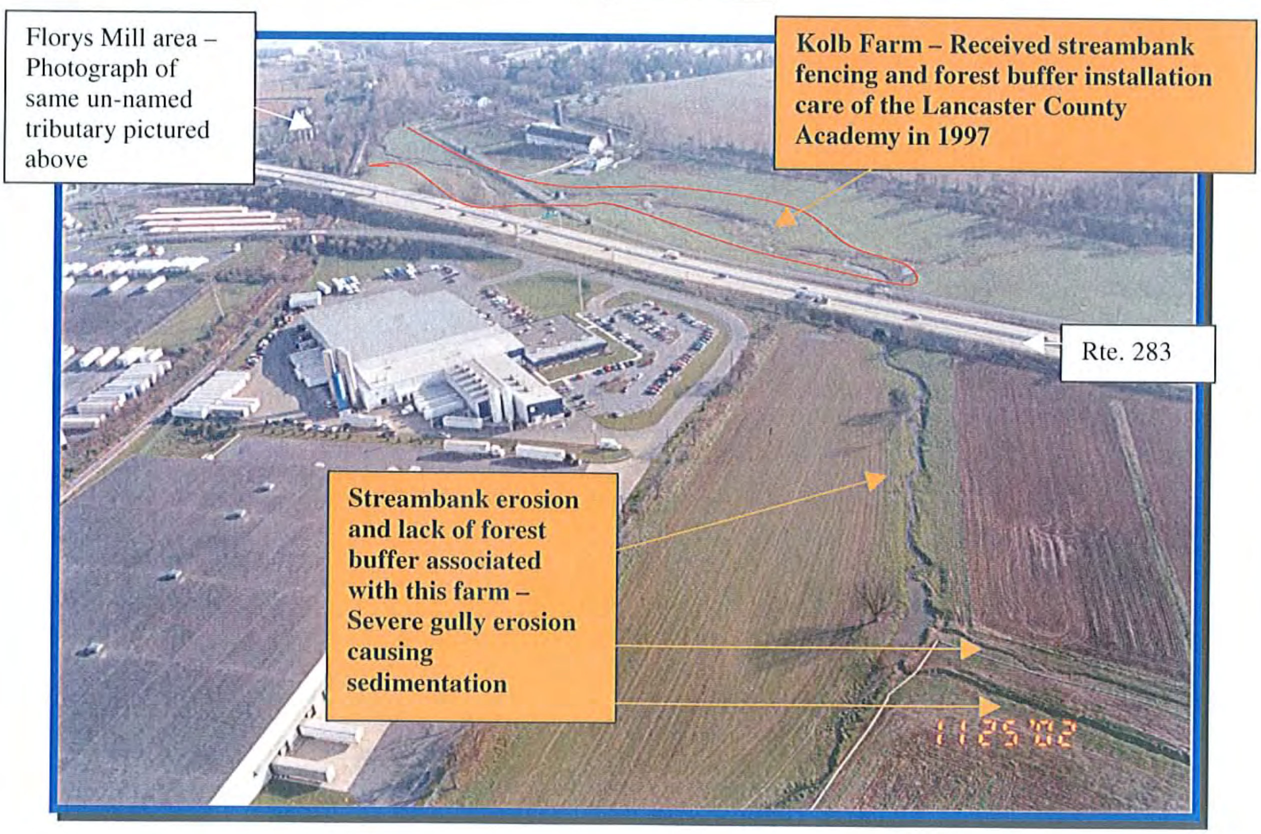

Stormwater detention basin could be improved for water quality and natural habitat
Swarr Run
Opportunity for forest buffer establishment and streambank stabilization
Impacted wetland
Church Street
LASA sewer pump station
11 25 '02

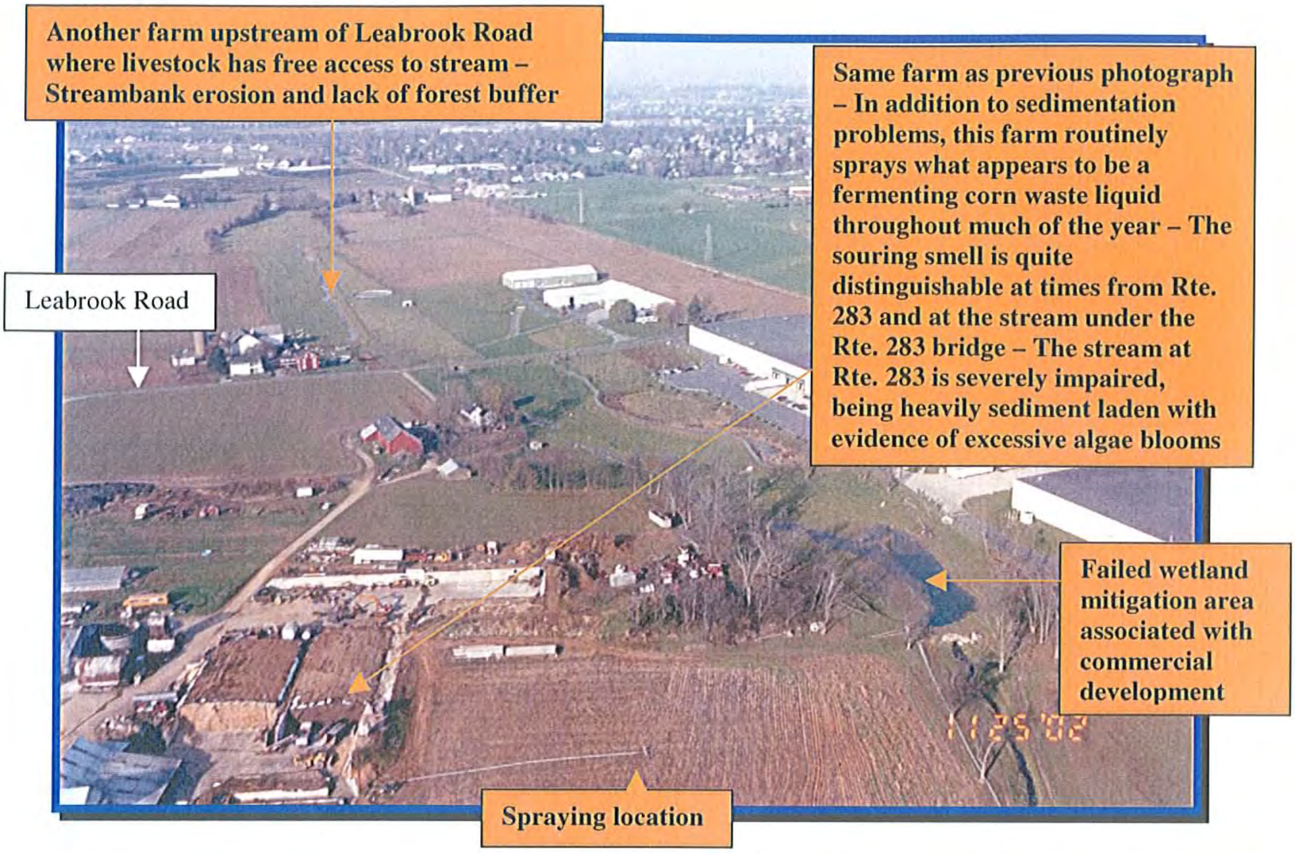

High rates of streambank erosion due to stormwater runoff – lack of forest buffer
Snapper Dam Road
Headwaters of Swarr Run


East Hempfield Sports Complex and golf course
Stony Battery Road
Extremely high rates of streambank erosion due to stormwater runoff – obvious lack of forest buffer
Church Street
Headwaters of Swarr Run – continuation of previous photograph

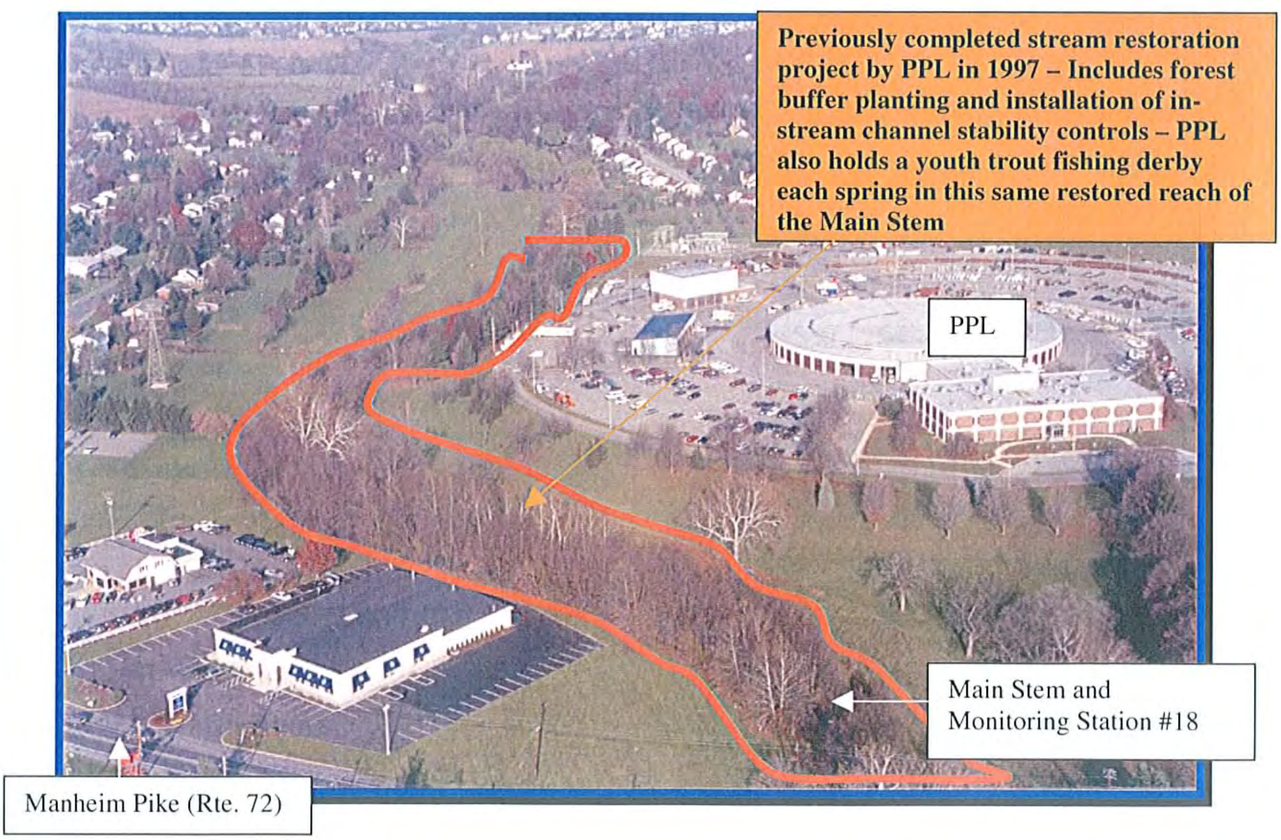

Restoration plans being developed at this time for this outlined area
Site of future improvement work funded by received "Growing Greener" grant – This section of Millers Run as well as downstream reaches are severely eroded due to stormwater erosion – Much of the area was developed prior to Lancaster County adopting a stormwater management ordinance – Retrofitting stormwater management facilities, stream bank erosion repairs and forest buffer installations are needed throughout much of this sub-watershed
Spring Valley Road
Millers Run – A tributary to Swarr Run


Rte. 283
Florys Mill
Un-named tributary to Main Stem
Rohrerstown Road (Rte. 741)
Main Stem

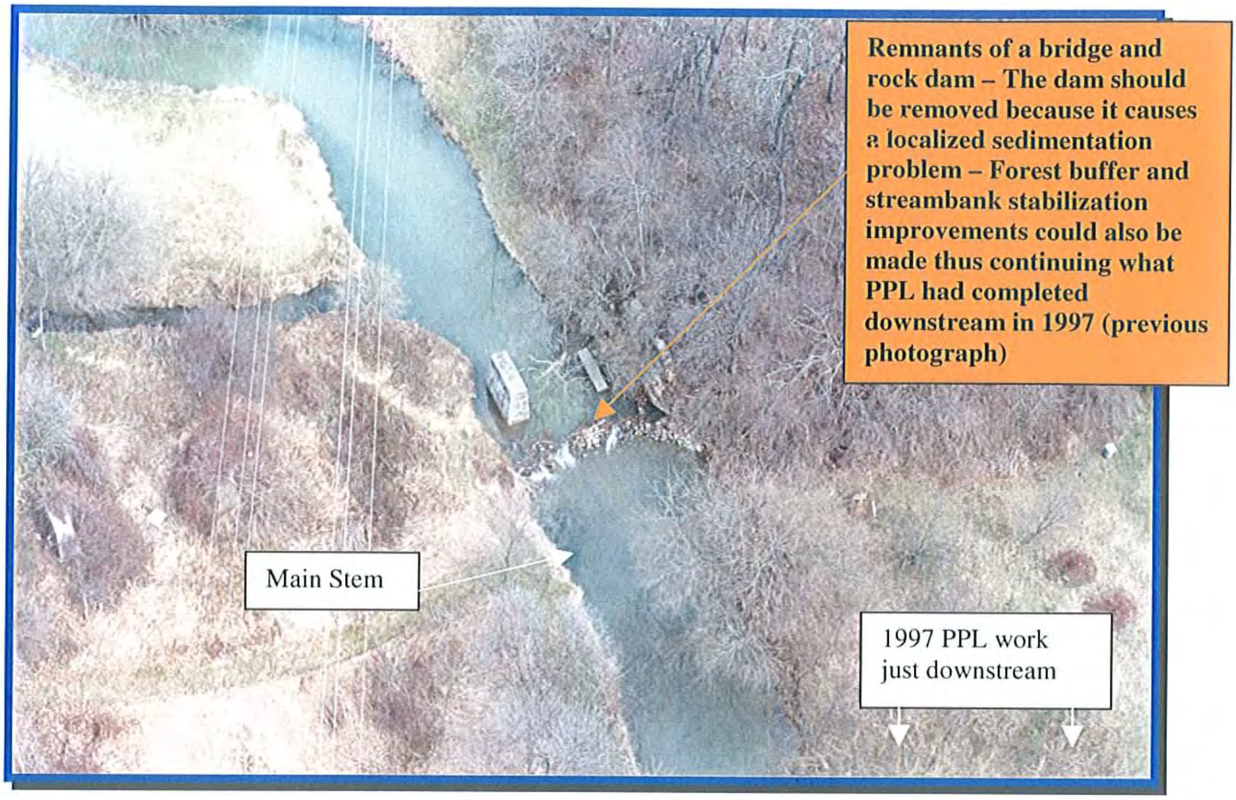

Florys Mill area – Photograph of same un-named tributary pictured above
Kolb Farm – Received streambank fencing and forest buffer installation care of the Lancaster County Academy in 1997
Rte. 283
Streambank erosion and lack of forest buffer associated with this farm – Severe gully erosion causing sedimentation



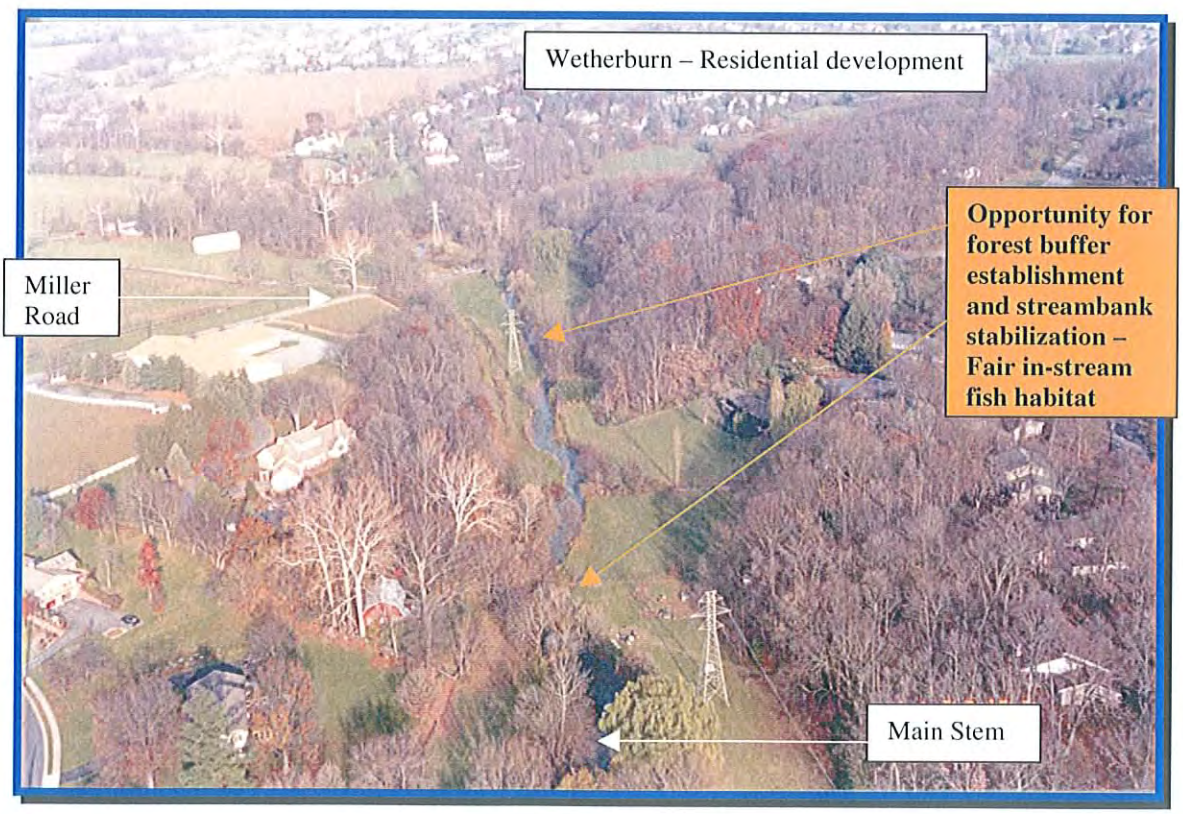
Another farm upstream of Leabrook Road where livestock has free access to stream – Streambank erosion and lack of forest buffer
Same farm as previous photograph – In addition to sedimentation problems, this farm routinely sprays what appears to be a fermenting corn waste liquid throughout much of the year – The souring smell is quite distinguishable at times from Rte. 283 and at the stream under the Rte. 283 bridge – The stream at Rte. 283 is severely impaired, being heavily sediment laden with evidence of excessive algae blooms
Leabrook Road
Failed wetland mitigation area associated with commercial development
11 25 '02
Spraying location



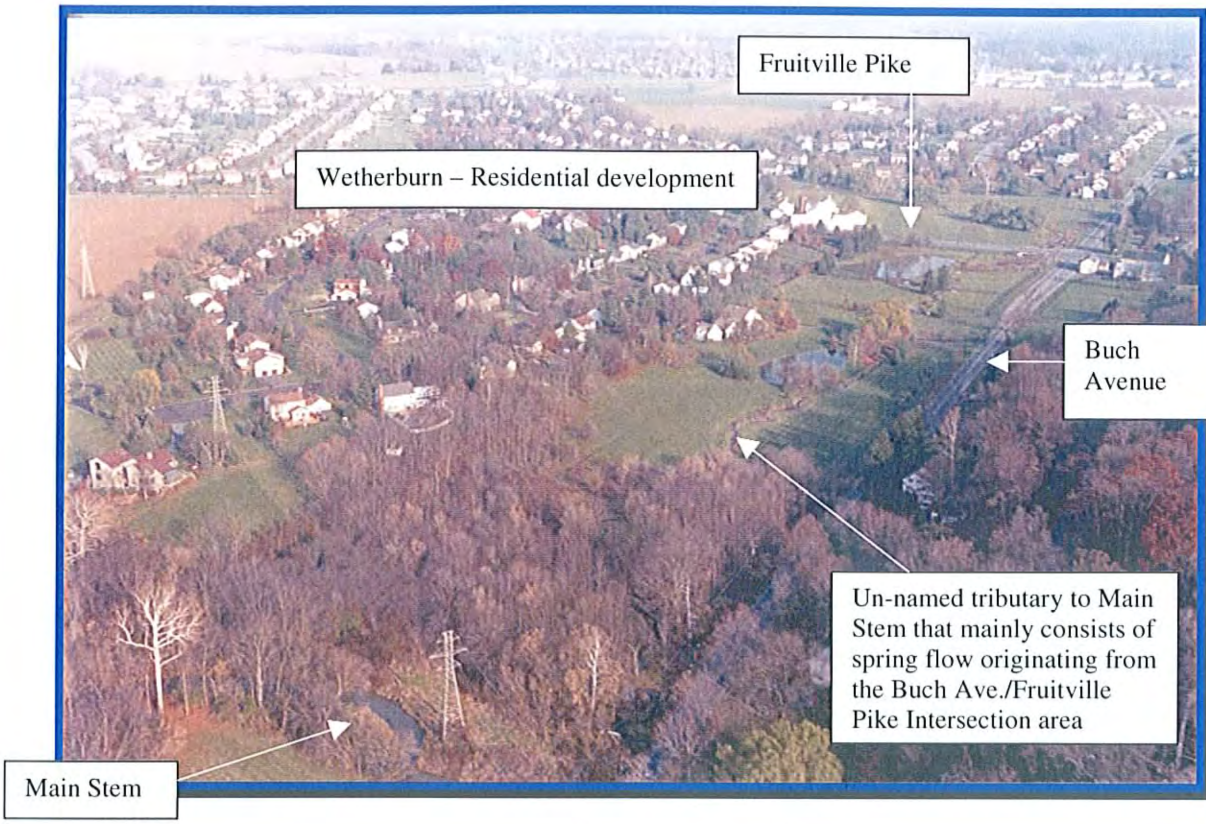
Previously completed stream restoration project by PPL in 1997 – Includes forest buffer planting and installation of in-stream channel stability controls – PPL also holds a youth trout fishing derby each spring in this same restored reach of the Main Stem
PPL
Main Stem and Monitoring Station #18
Manheim Pike (Rte. 72)

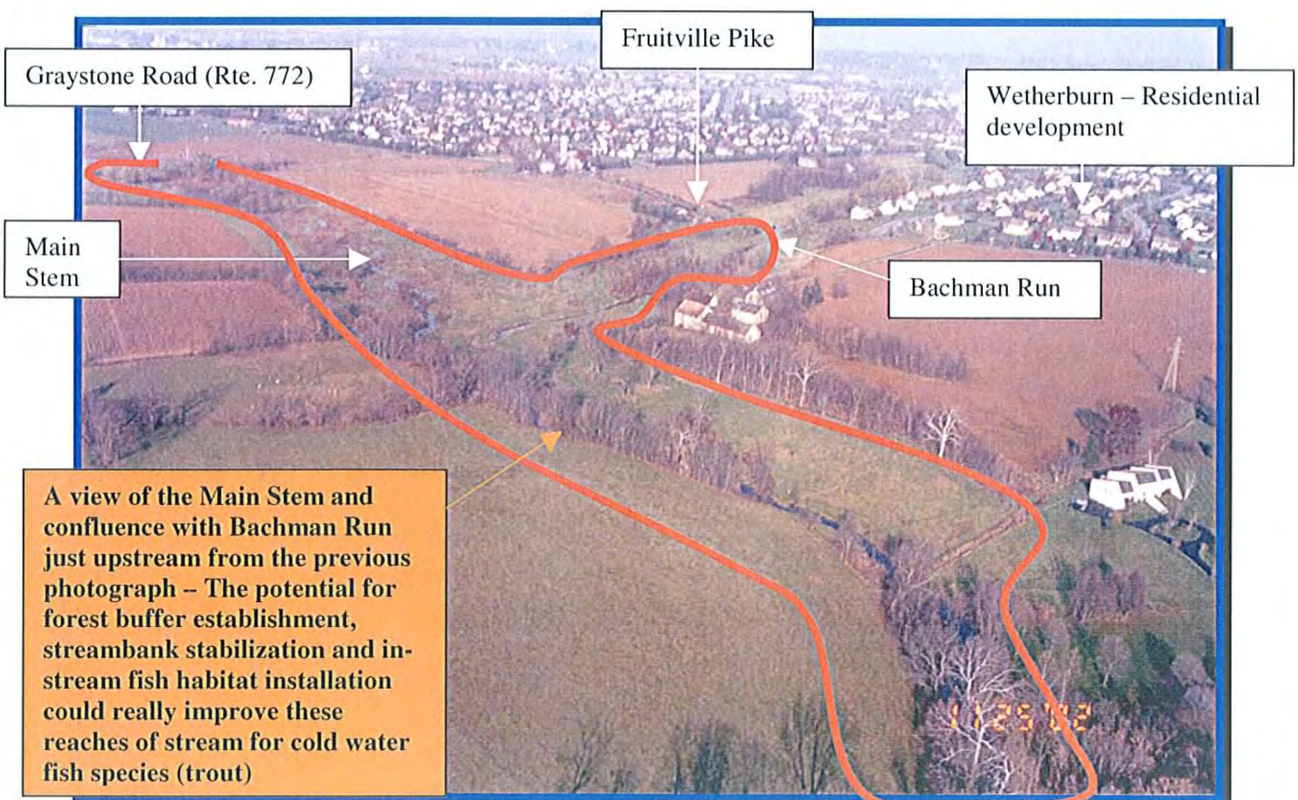


Remnants of a bridge and rock dam – The dam should be removed because it causes a localized sedimentation problem – Forest buffer and streambank stabilization improvements could also be made thus continuing what PPL had completed downstream in 1997 (previous photograph)
Main Stem
1997 PPL work just downstream

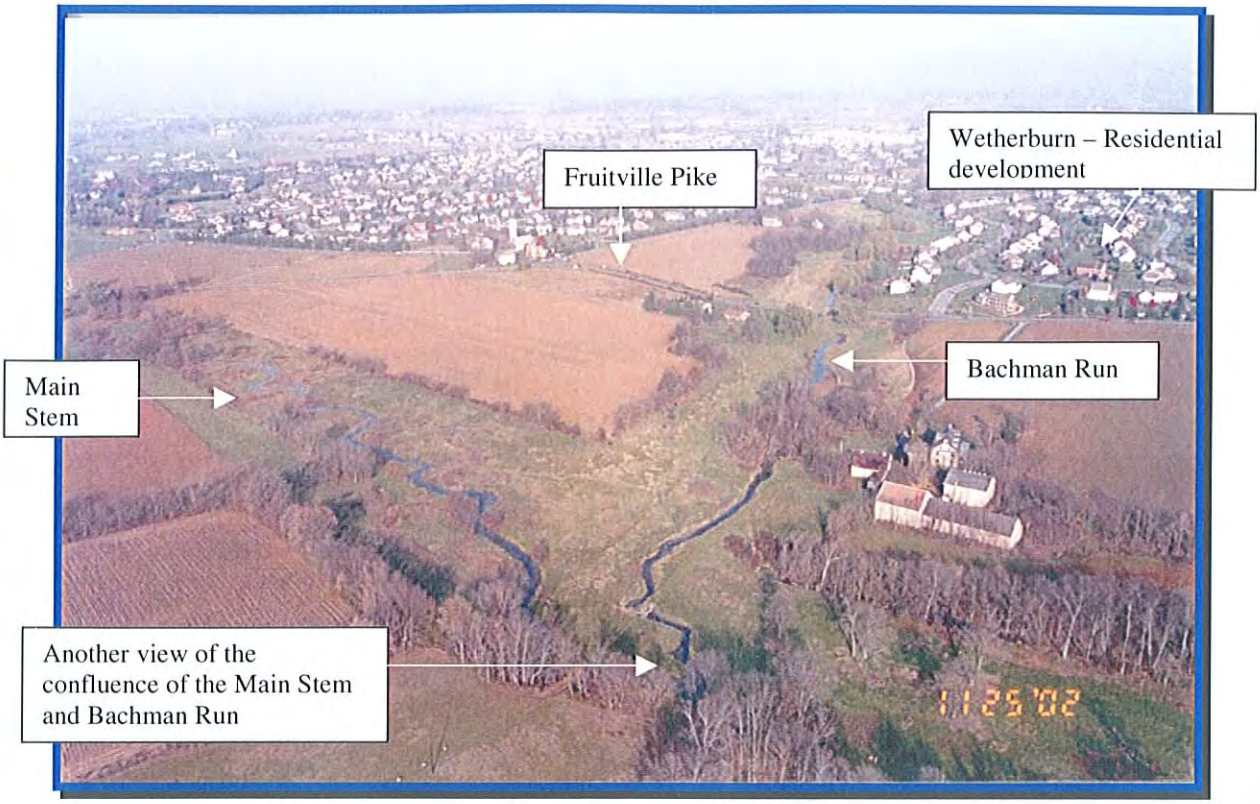


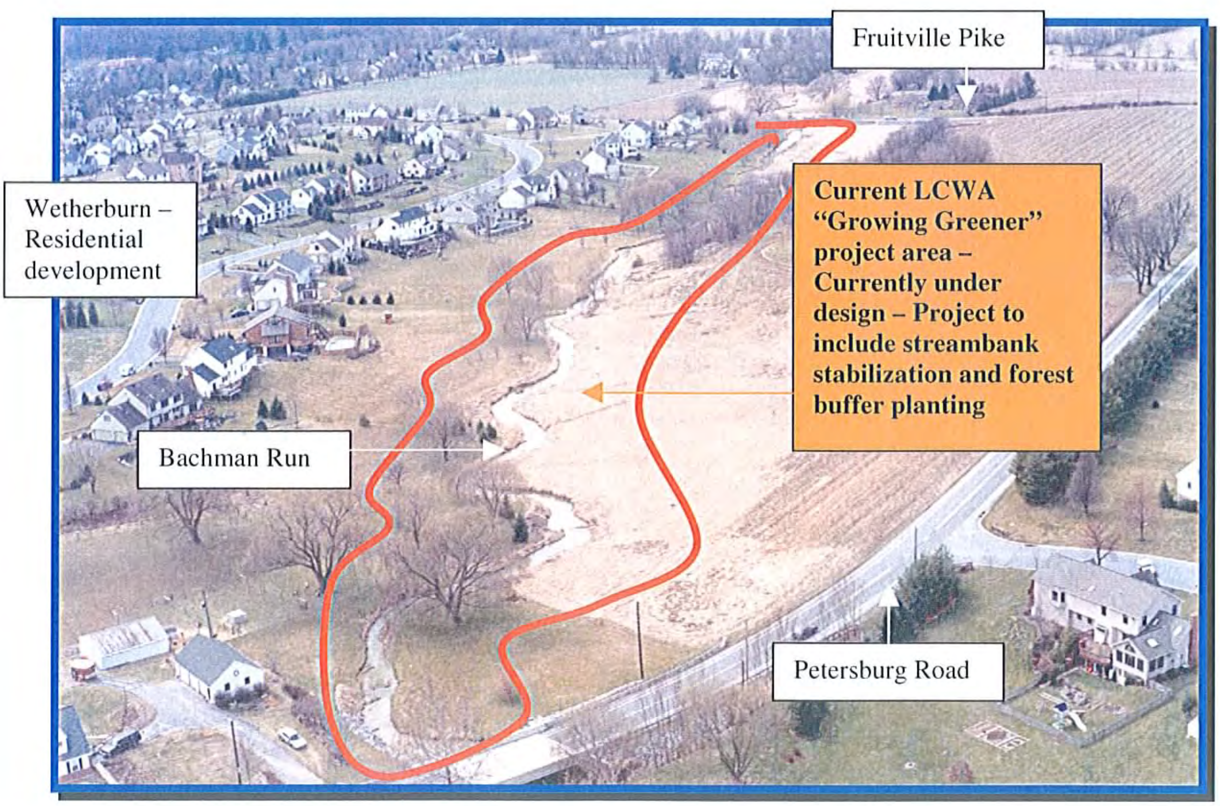
Wetherburn – Residential development
Miller Road
Opportunity for forest buffer establishment and streambank stabilization – Fair in-stream fish habitat
Main Stem

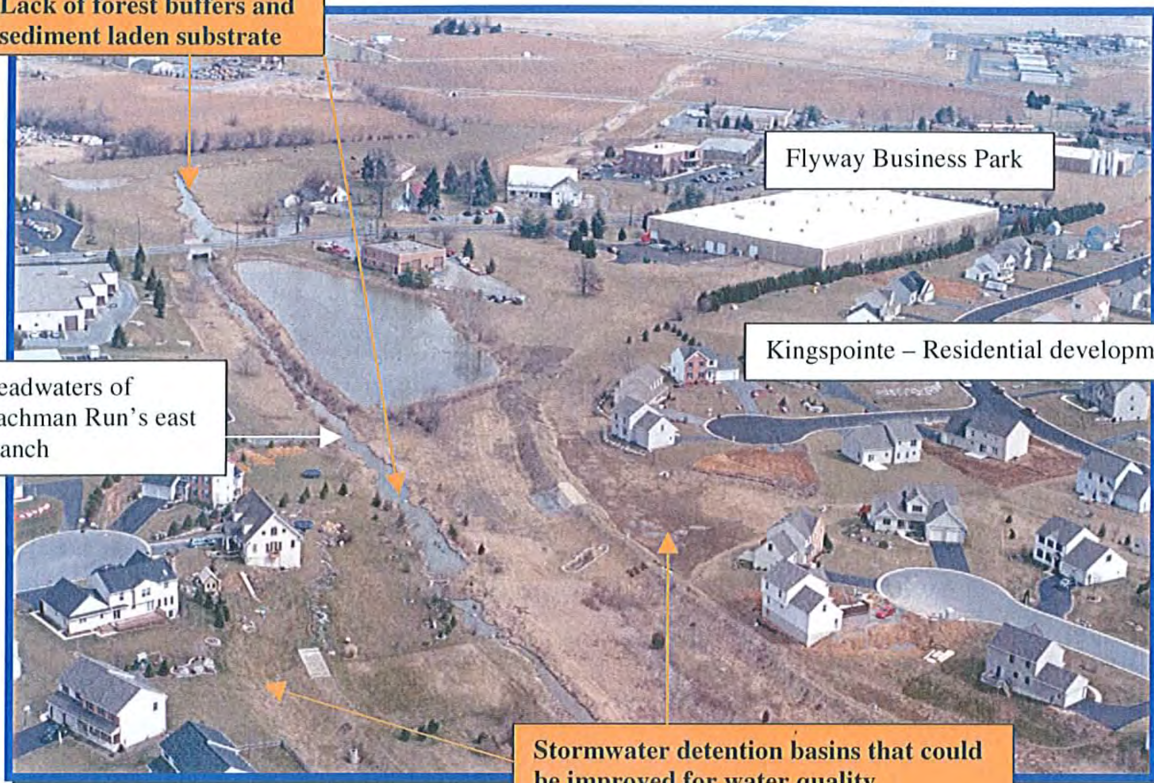


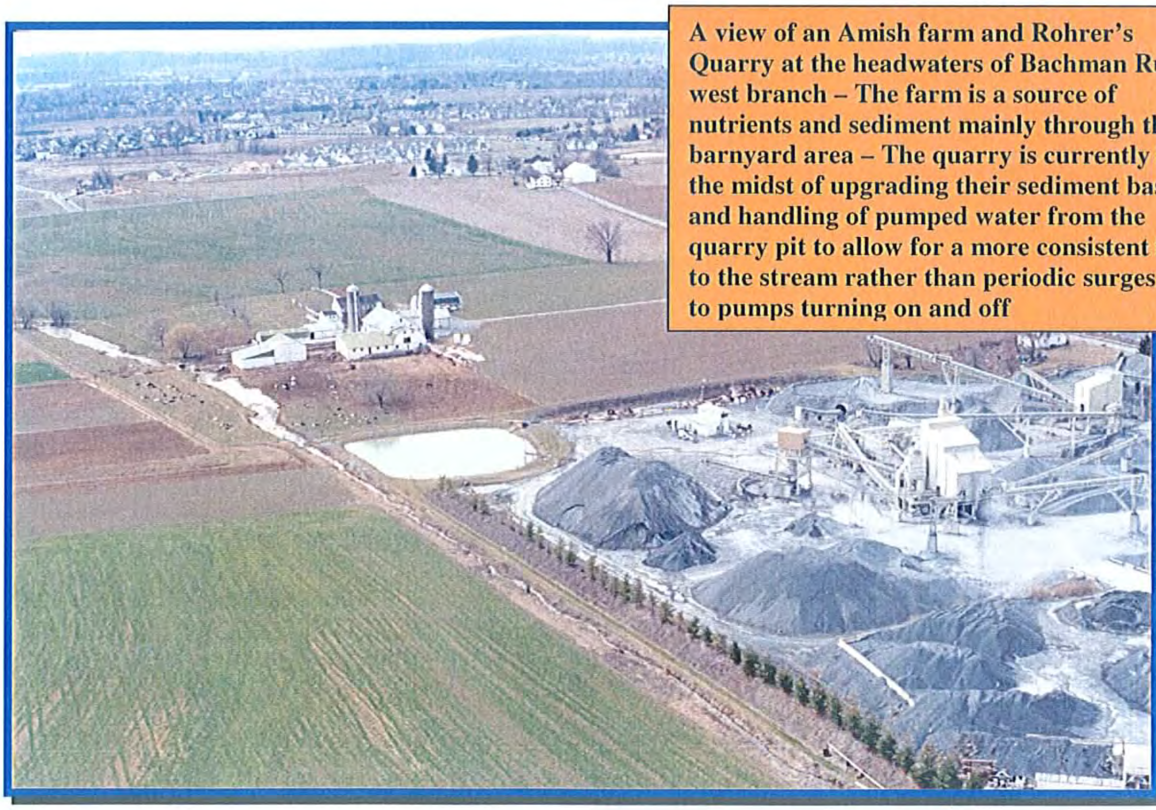


A view of the Main Stem and confluence with Bachman Run just upstream from the previous photograph – The potential for forest buffer establishment, streambank stabilization and in-stream fish habitat installation could really improve these reaches of stream for cold water fish species (trout)

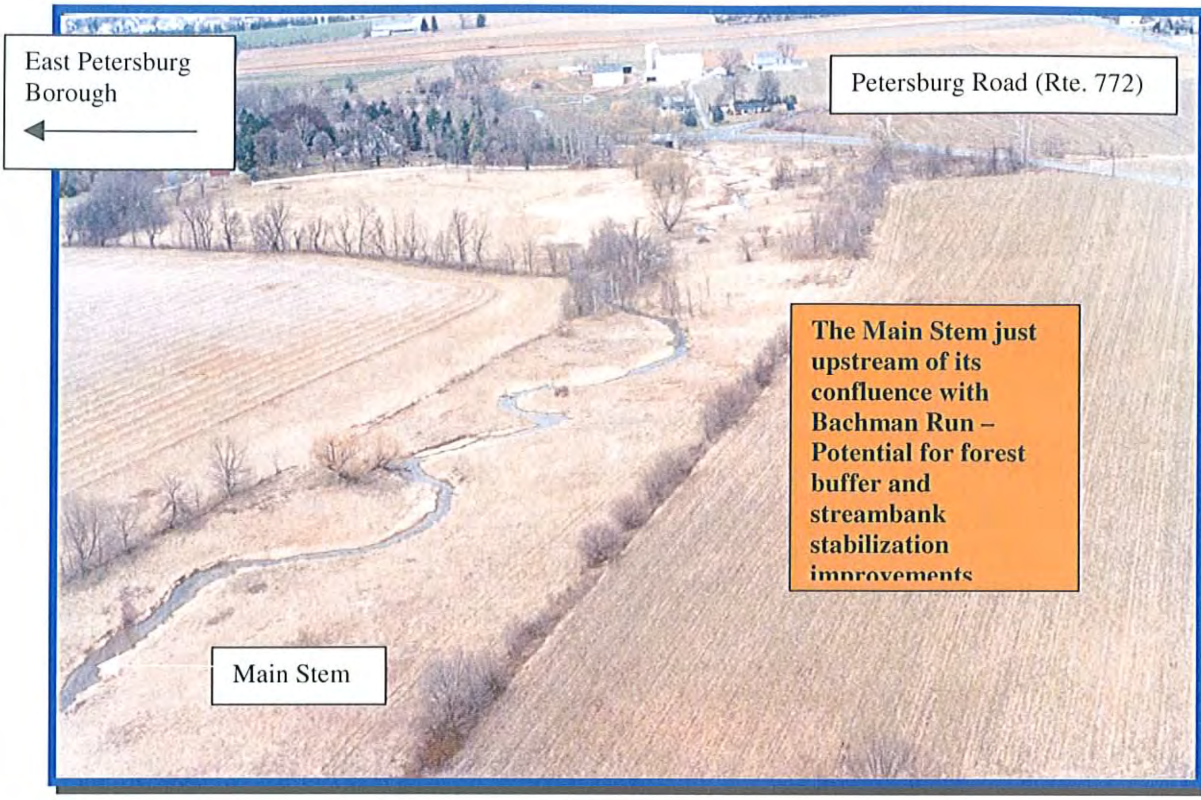

Fruitville Pike
Wetherburn – Residential development
Main Stem
Bachman Run
Another view of the confluence of the Main Stem and Bachman Run
1 1 25 '02

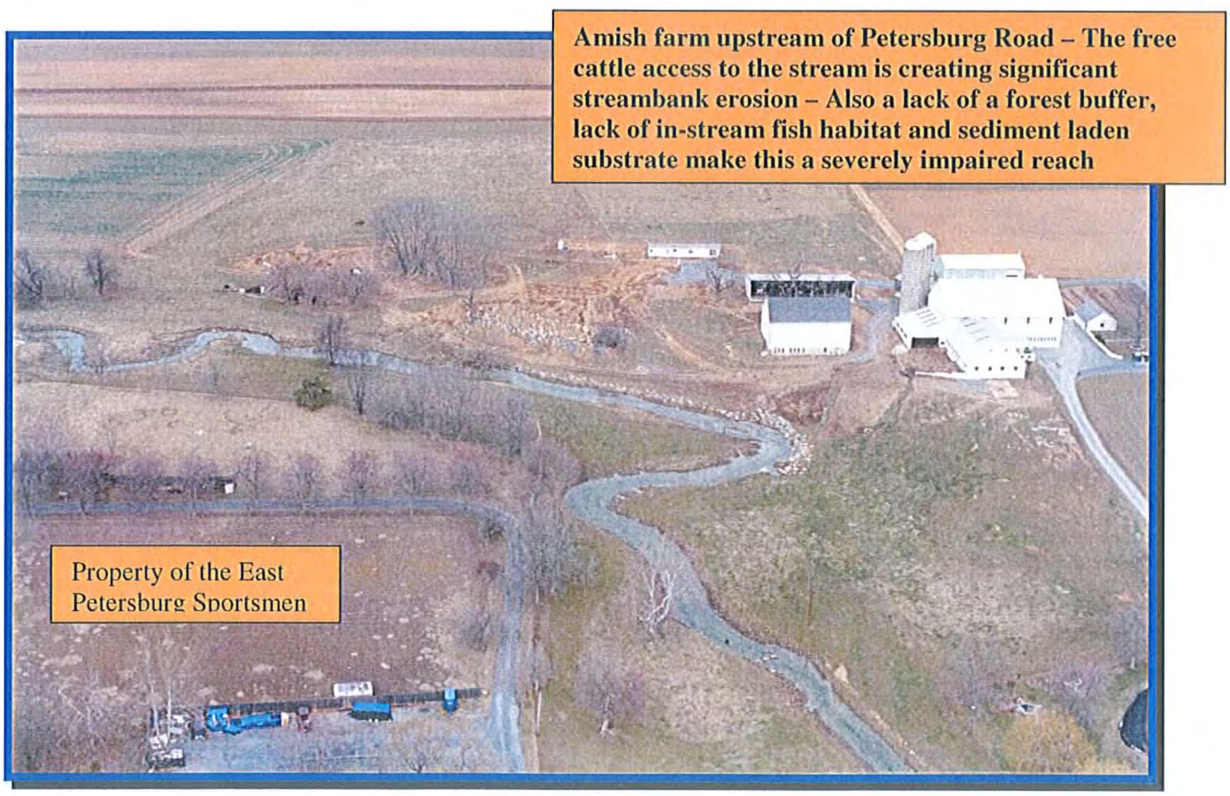

Fruitville Pike
Wetherburn – Residential development
Current LCWA "Growing Greener" project area – Currently under design – Project to include streambank stabilization and forest buffer planting
Bachman Run
Petersburg Road

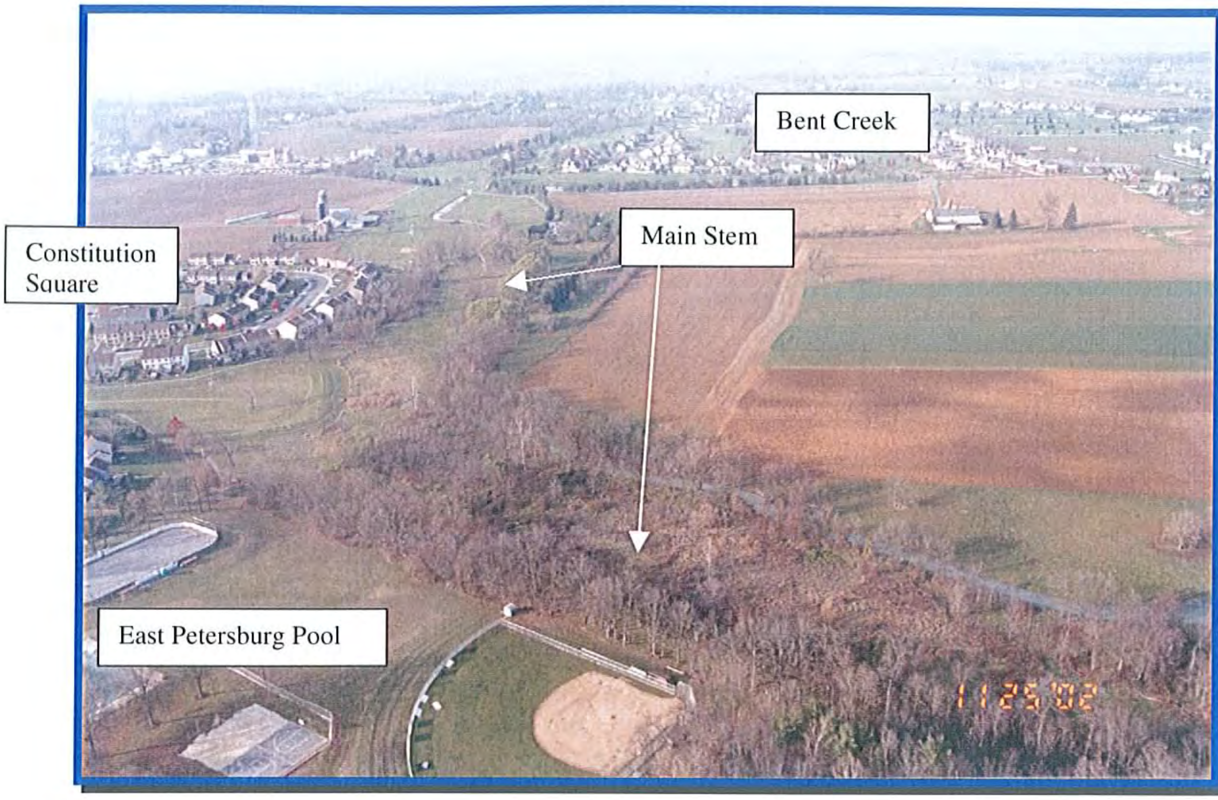


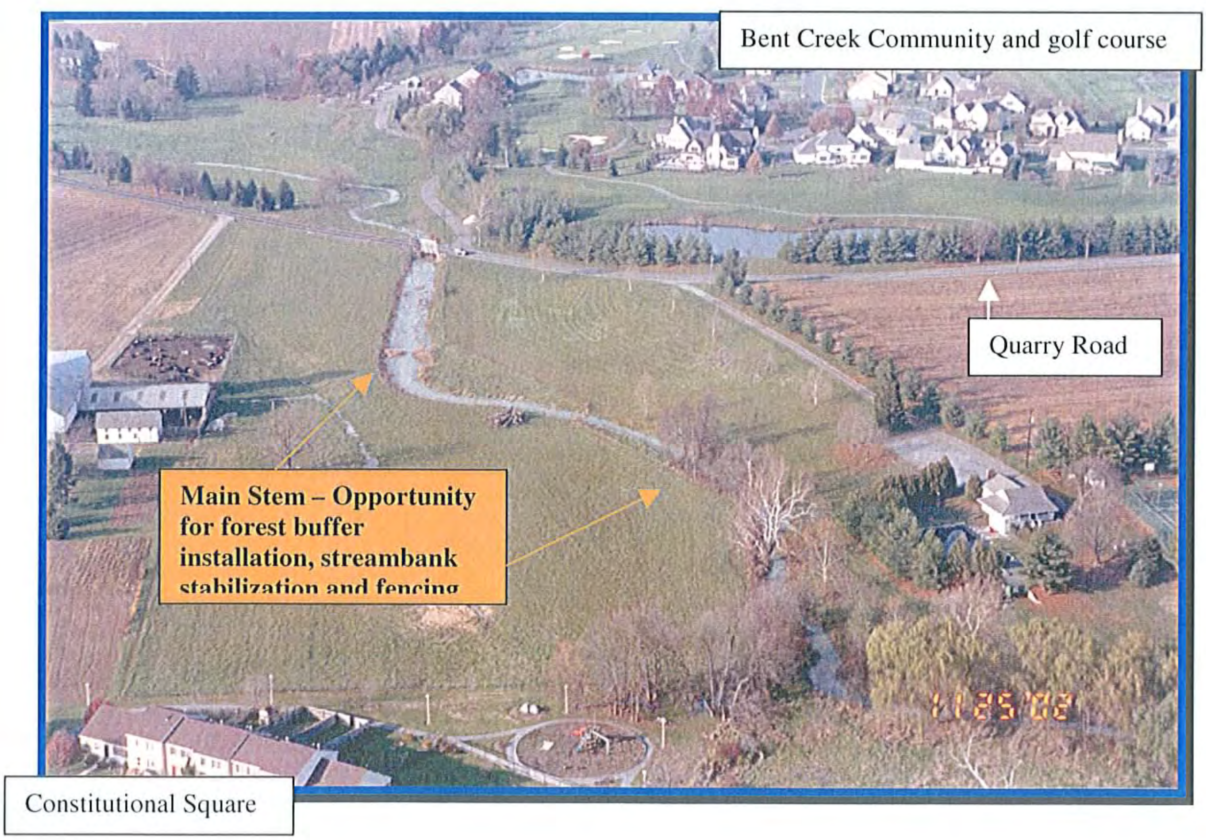


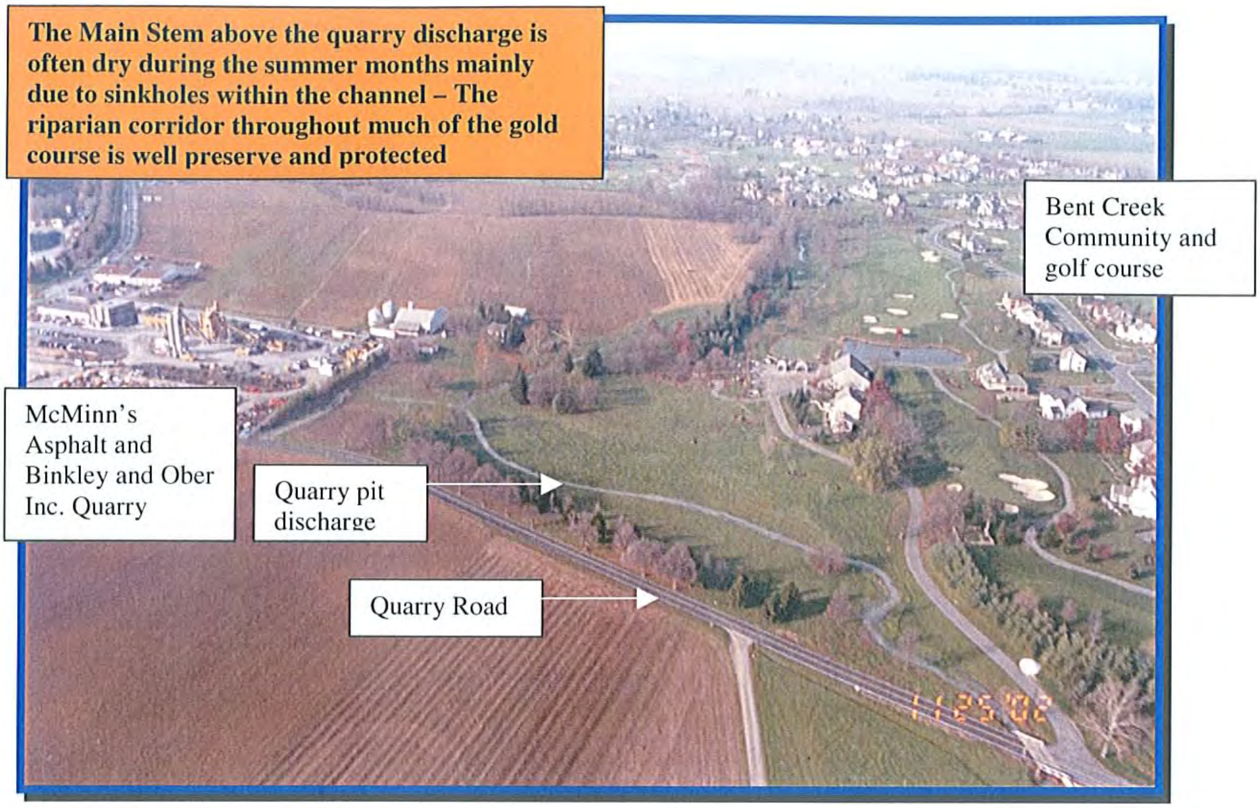
A view of an Amish farm and Rohrer's Quarry at the headwaters of Bachman Run's west branch – The farm is a source of nutrients and sediment mainly through the barnyard area – The quarry is currently in the midst of upgrading their sediment basin and handling of pumped water from the quarry pit to allow for a more consistent flow to the stream rather than periodic surges due to pumps turning on and off

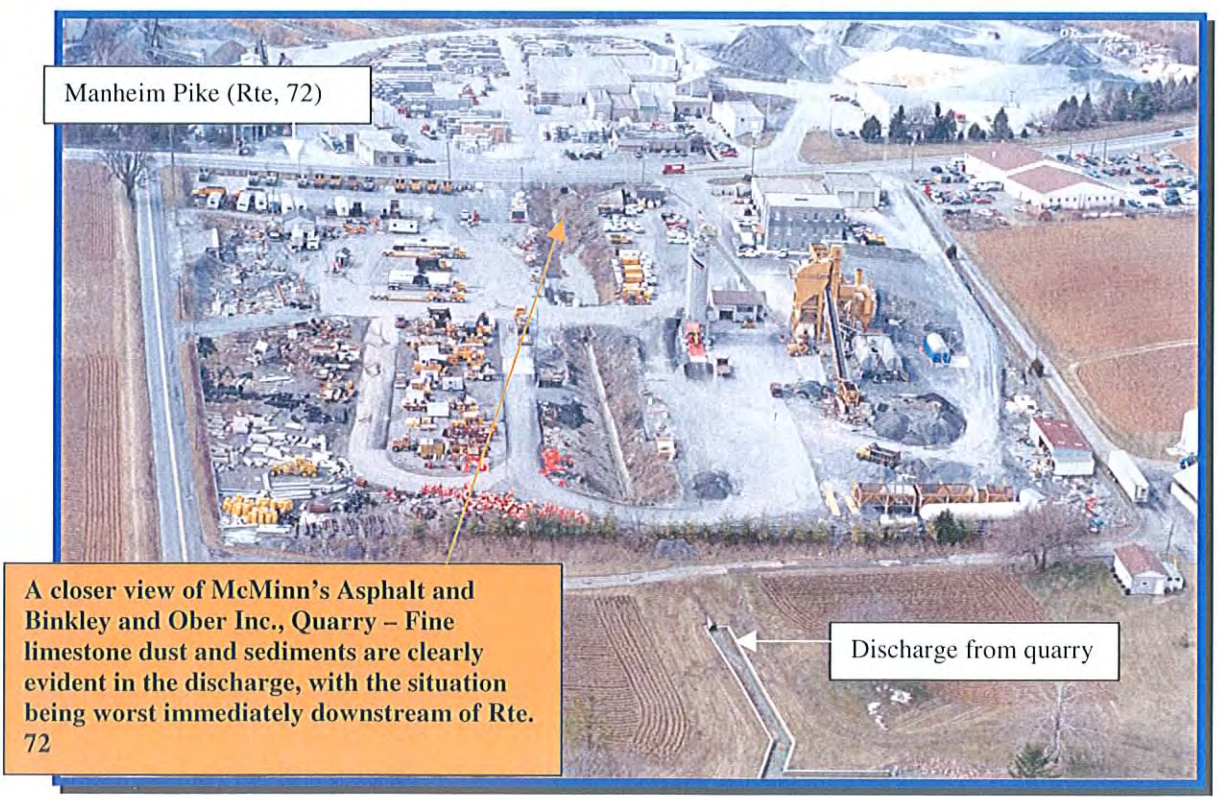

East Petersburg
Borough
Petersburg Road (Rte. 772)
The Main Stem just upstream of its confluence with Bachman Run – Potential for forest buffer and streambank stabilization improvements
Main Stem


Amish farm upstream of Petersburg Road – The free cattle access to the stream is creating significant streambank erosion – Also a lack of a forest buffer, lack of in-stream fish habitat and sediment laden substrate make this a severely impaired reach
Property of the East
Petersburg Sportsmen

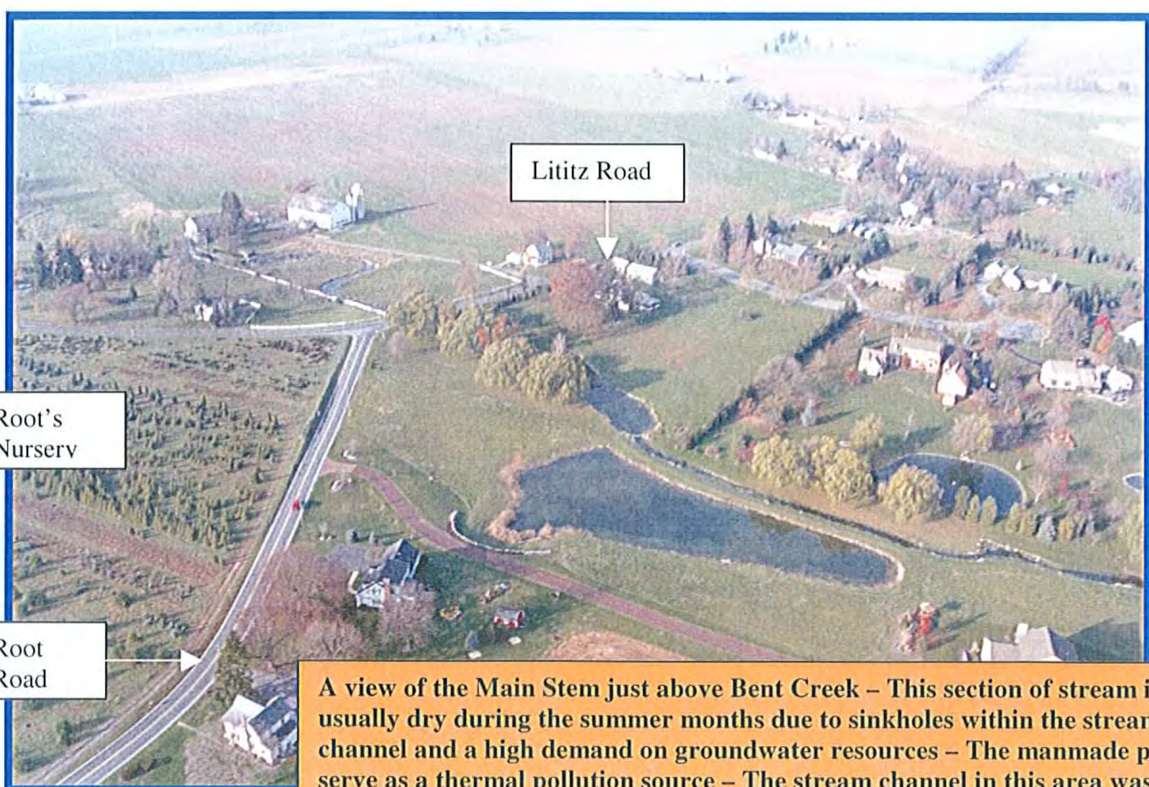

Bent Creek
Constitution Square
Main Stem
East Petersburg Pool
11 25 '02


Bent Creek Community and golf course
Quarry Road
Main Stem – Opportunity for forest buffer installation, streambank
11 25 '02
Constitutional Square

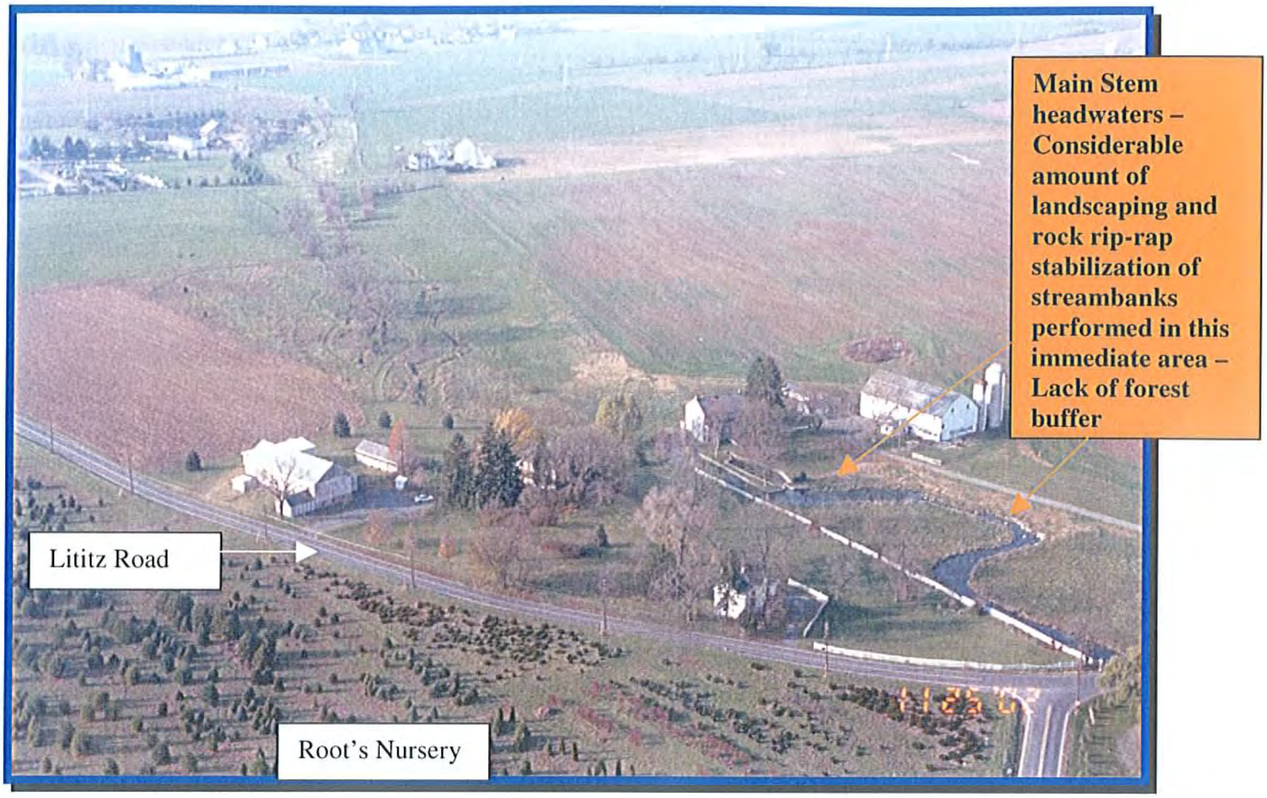

The Main Stem above the quarry discharge is often dry during the summer months mainly due to sinkholes within the channel – The riparian corridor throughout much of the gold course is well preserve and protected
Bent Creek Community and golf course
McMinn's Asphalt and Binkley and Ober Inc. Quarry
Quarry pit discharge
Quarry Road
11 25 '02

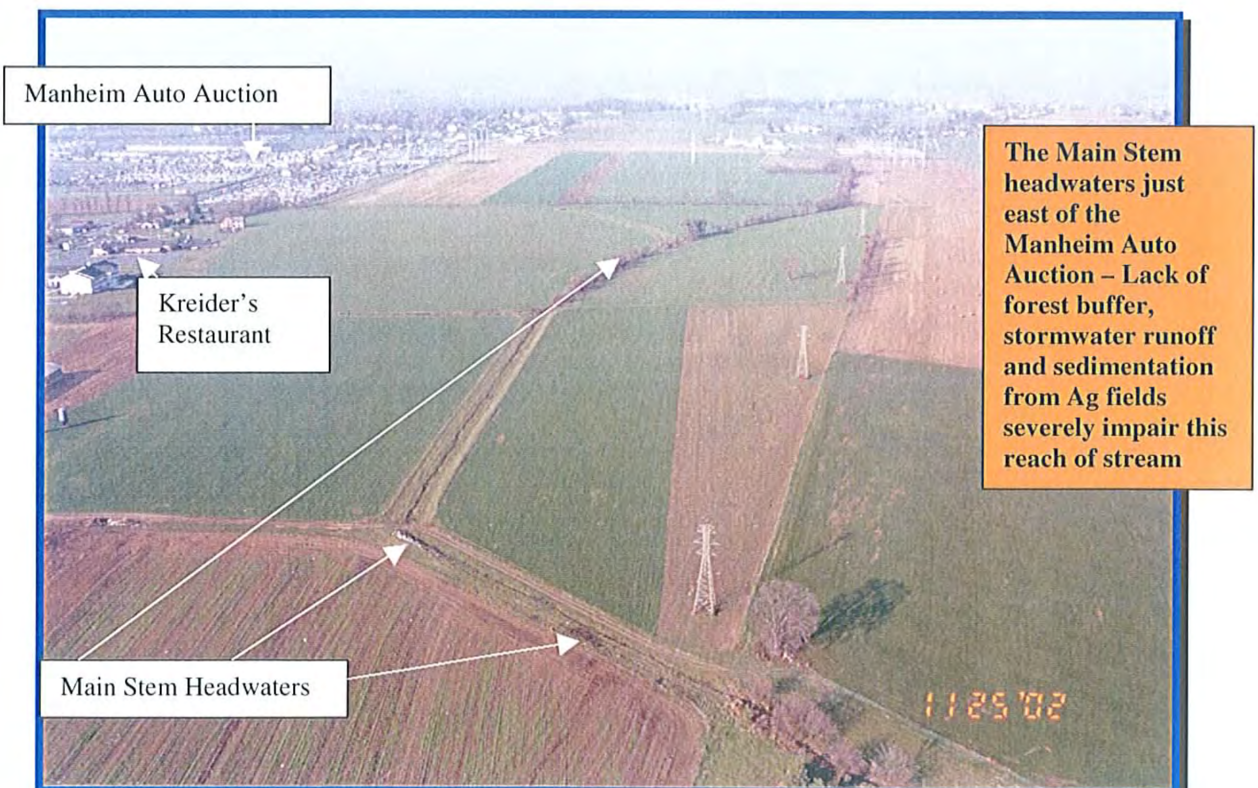

Manheim Pike (Rte, 72)
A closer view of McMinn's Asphalt and Binkley and Ober Inc., Quarry – Fine limestone dust and sediments are clearly evident in the discharge, with the situation being worst immediately downstream of Rte. 72
Discharge from quarry

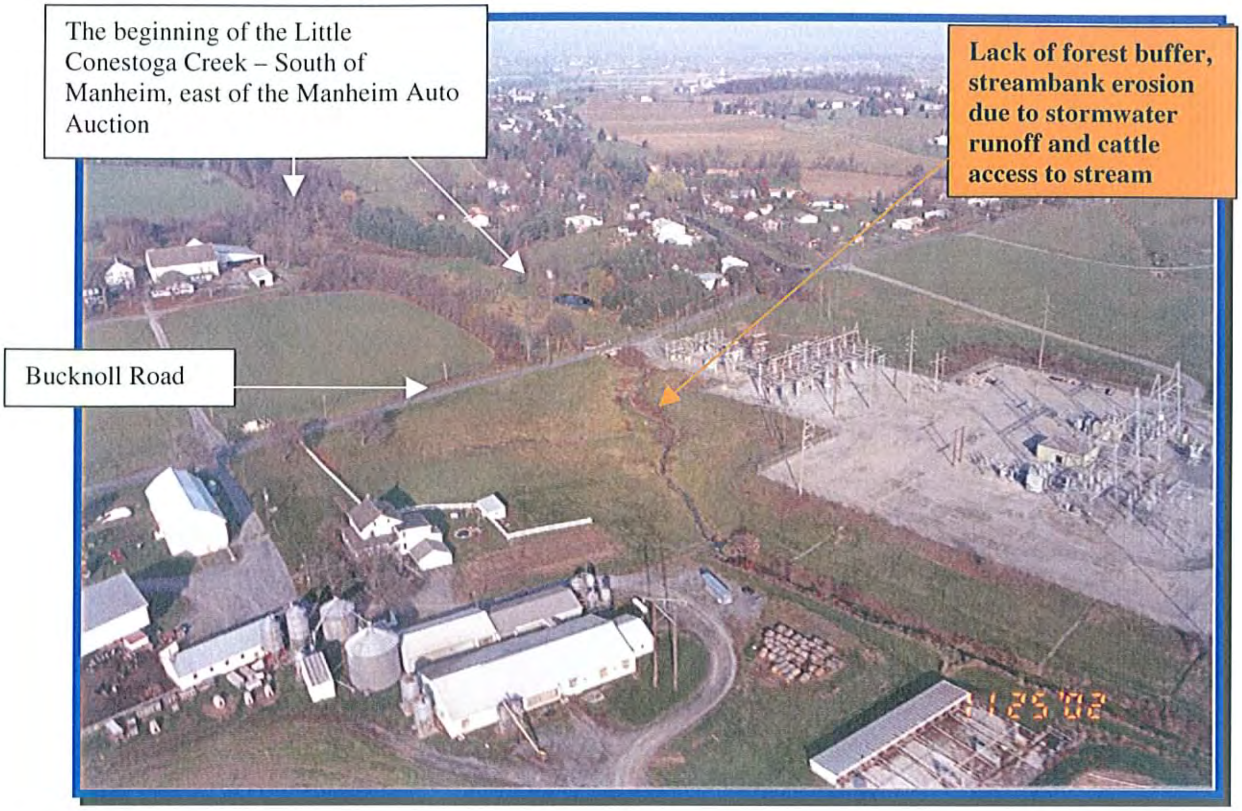
A closer view of the Bent Creek golf course – Wetland areas protected though a forest buffer planting would certainly be of benefit



A view of the Main Stem just above Bent Creek – This section of stream is usually dry during the summer months due to sinkholes within the stream channel and a high demand on groundwater resources – The manmade ponds serve as a thermal pollution source – The stream channel in this area was heavily landscaped and is maintained in a most unnatural state


Main Stem headwaters – Considerable amount of landscaping and rock rip-rap stabilization of streambanks performed in this immediate area – Lack of forest buffer
Lititz Road
Root's Nursery


Manheim Auto Auction
The Main Stem headwaters just east of the Manheim Auto Auction – Lack of forest buffer, stormwater runoff and sedimentation from Ag fields severely impair this reach of stream
Kreider's Restaurant
Main Stem Headwaters
11 25 '02


The beginning of the Little Conestoga Creek – South of Manheim, east of the Manheim Auto Auction
Lack of forest buffer, streambank erosion due to stormwater runoff and cattle access to stream
Bucknoll Road
1 25 '02

MACROINVERTEBRATE INVESTIGATION

By closely examining a stream's macroinvertebrate community, one can learn a great deal about the stream's water quality and overall health. Macroinvertebrates (aquatic insects, worms, clams, snails, leeches and the like) are desirable indictors of water quality because they are fairly sedentary and of course are more or less confined to living in the stream year round (except perhaps for various life stages of various species); thus they are present and have to deal with any introduced perturbations.

Fish are also good indicators of water quality, but typically not to the extent of macroinvertebrates. Fish, depending on the circumstance, can simply leave an impacted area or flee from a pollution event.

Physical and chemical measurements tend to only provide "snap shot" data. That is to say these measurements are instantaneous and only describe conditions at the very point in time in which they were taken.

Still, a thorough water quality investigation or monitoring program should be comprised of and consider all the above - macroinvertebrates, fish, physical and chemical. This chapter deals solely with the macroinvertebrate investigation; the others are discussed elsewhere in this writing.

RETTEW biologists conducted macroinvertebrate sampling at **28 different monitoring stations** strategically located around the Little Conestoga Creek Watershed (as can be seen on the enclosed map). For the record, fish and physical habitat data were also collected at these same 28 monitoring locations/stations.

Macroinvertebrate investigations were performed using the United States Environmental Protection Agency's "rapid bioassessment protocols" - mainly the Biological Reconnaissance or Problem Identification Survey approach (though RETTEW biologist used a modified form for recording collected organisms). This particular protocol is very similar to the one used by Pennsylvania Department of Environmental Protection biologists involved in Pennsylvania's "Surface Waters Assessment" program (SWAP).

Collected organisms were identified to the taxonomic "family" level using a dissecting scope and reference keys such as Aquatic Insects of North America by R.W. Merrit and K.W. Cummins and Freshwater Macroinvertebrates of Northeastern North America by Barbara Peckarsky.

Five biological indices/metrics were utilized and computed at each of the 28 monitoring stations. They are as follows:

Taxa Richness

This metric is simply the number of taxa in a particular community. In this study, taxa were identified to the taxonomic "family" level so the taxa richness value determined for the sampled macroinvertebrate community at each monitoring station refers to the number of different discovered macroinvertebrate families.

Hilsenhoff Biological Index (HBI)

This index involves assigning pollution tolerance values (ranging from zero (0) to ten (10) with a 0 value assigned to taxa with the least amount of pollution tolerance and a 10 value assigned to the most pollution tolerant organisms) to the various collected taxa. All collected organisms within the sample are identified, counted and matched with the appropriate tolerance values. A final value for the whole entire macroinvertebrate sample is then computed allowing comparison and referencing of HBI scores with other sampled sites and streams.

EPT Index

The EPT Index is the summation of all identified mayflies (*Ephemeroptera*), stoneflies (*Plecoptera*) and caddisflies (*Trichoptera*) families. These insect orders are used in this particular index because of their general intolerance for pollution.

Percent EPT

Percent EPT is the percentage of mayflies (*Ephemeroptera*), stoneflies (*Plecoptera*) and caddisflies (*Trichoptera*) individuals within the sample. Again these insect orders are used in this particular metric because of their general intolerance for pollution.

Healthy or impaired decision based on previously computed Hilsenhoff score and Biological Reconnaissance findings

The macroinvertebrate community was suspected of being impaired if the HBI score was higher than 4.00 (except in purely limestone stream conditions as was the case at monitoring station #22 above Rohrer's Quarry) and/or if value target thresholds were not attained through the Biological Reconnaissance process.

LITTLE CONESTOGA CREEK - MACROINVERTEBRATE COMMUNITY SCORES

MONITORING STATION #	# OF FAMILIES	HBI SCORE	EPT INDEX SCORE	% EPT	IMPAIRED YES/NO	RANKING 1 - 28
1	21	3.55	5	76	NO	2
2	16	3.80	4	48	NO	4
3	17	3.68	5	74	NO	3
4	16	3.82	4	54	NO	5
5	10	3.04	4	81	NO	1
6	9	4.32	5	81	YES	7
7	11	5.06	1	6	YES	12
8	15	4.79	3	29	YES	9
9	19	5.65	3	38	YES	20
10	13	5.43	2	34	YES	15
11	18	5.12	5	18.5	YES	13
12	16	6.35	2	8	YES	24
13	16	5.46	3	15	YES	17
14	15	5.96	2	5	YES	23
15	16	5.82	2	10	YES	21
16	11	4.72	3	24	YES	8
17	6	6.77	0	0	YES	26
18	10	4.84	2	45	YES	10
19	15	4.85	3	34	YES	11
20	9	7.00	0	0	YES	27
21	7	6.70	0	0	YES	25
22	5	4.23	0	0	NO	6
23	9	5.22	1	8	YES	14
A1	8	5.58	2	19	YES	19
A2	5	5.88	1	2	YES	22
A3	7	5.45	3	20	YES	16
A4	4	5.48	1	12	YES	18
A5	6	7.71	1	3	YES	28

Through the macroinvertebrate collection process, some interesting observations were made that are worth noting at this time.

Monitoring station #3, located in the upper reaches of Indian Run, stood out as unique because it was the only station where stoneflies (*Plecoptera*) were collected. The station also had a high percent EPT score. Overall, the station ranked 3rd.

Monitoring station #7, located on the West Branch immediately below Columbia Avenue (Rte. 462), is considered impaired based on RETTEW findings and only ranked 12th best out of the 28 stations. However a September 1998 United States Geological Survey study claimed this area had the least impaired aquatic insect community as compared to their other 14 monitoring locations. After reviewing the data sheets and revisiting the site, RETTEW biologists would question the accuracy and conclusions of the USGS macroinvertebrate collection. The USGS study apparently depended heavily upon the use of volunteers for collection purposes. Having worked with such volunteers, RETTEW would argue that however well intending the typical volunteers, they simply lack the necessary training to recognize and distinguish subtleties in aquatic habitat from which to collect a sample that is truly representative of that particular reach of stream. Its appears at best, USGS only came up with 12 different taxa at their top station whereas RETTEW produced 21 different taxa at their monitoring station #1, while three of the others considered unimpaired produced 16 taxa or better. The time of year could account for some of the discrepancies – the USGS collection having been completed in September 1998, the RETTEW collection throughout the spring of 2002. Interesting, USGS found 12 taxa at their top station (#11). RETTEW found 11 taxa at monitoring station #7 which appears to be very close to the USGS station #11. Another fact worth noting is that USGS did not have any monitoring stations in close proximity to the two best scoring RETTEW monitoring stations #1 and #5. Additionally USGS had a total of 15 monitoring stations whereas RETTEW had 28.

Monitoring station #22, located upstream of Rohrer's Quarry in the headwaters of Bachman Run, had low macroinvertebrate diversity and a total absence of EPT taxa but was considered unimpaired due to the fact this upper reach of Bachman Run is truly a limestone stream. One simply cannot compare limestone macroinvertebrate diversity with that of a freestone type stream. Station #22 is very typical of a limestone stream – cold, spring fed water and a considerable amount of watercress (*Cardamine*). It also makes sense that a stream flowing past a limestone quarry would likely be a limestone stream!

Generally speaking, all monitoring stations located upstream of Millersville (with the exception of station #22) scored poorly and showed signs of impairment. These stations tended to have high percentages of beetles (*Coleoptera*) and true flies/midges (*Diptera*). Station #10 was unique in that it was the only station toad bugs (*Gelastocoridae*) were present. Toad bugs are commonly found on sandy beeches and dunes as are present at this Maple Grove monitoring station.

FISHERY INVESTIGATION

A watershed assessment would probably be considered incomplete by most people if it lacked any sort of fish investigation. People relate to fish. People keep fish as pets. People eat fish. People raise fish as a business. People fish for fish - some even fish for fish with fish as bait. Tell someone you are studying a stream and they'll likely ask you (or tell you in some cases) about the fish. Likewise telling someone you're in the midst of a stream improvement project to improve the trout fishery will normally bring about good, positive feedback; while telling them you're in the midst of a stream improvement project to better the in-stream habitat for stoneflies will normally bring about puzzled looks. As said before, people relate to fish.

Much stream improvement work accomplished in Pennsylvania at the grassroots level is done so in the interest of improving the fishery and angling opportunity. Perhaps there is no greater example of this than all the various local TU (Trout Unlimited) chapters scattered across the Keystone State that are involved in stream restoration projects. Many watershed organizations have anglers as members, board members and officers on their rosters. Fishermen learned long ago that good water and good habitat mean good fishing.

Considering the above, the fish community within the Little Conestoga Creek Watershed was thoroughly investigated as part of the overall watershed assessment. Fish assemblages were investigated at 24 strategically located monitoring stations (the same stations used for the macroinvertebrate investigation – stations #1 through #23 and station A1 – fish data was not collected for stations A2 through A5).

Fish were collected using a backpack type electrofishing unit (specifically, a LR-24 Electrofisher by Smith-Root, Inc.) and a variety of nets and seines. The electrofishing unit is used to send an electrical current through the water in the immediate area of the operator and a netter. The operator controls the intensity of the created electrical field so as not to over do it and cause unnecessary physical harm to the fish. The operator controls the voltage, frequency and duration of the electrical impulses so as to only temporarily stun the fish so that they can be netted.

Depending on the situation, fish were either immediately identified and put back into the water or were placed in a water filled tote barge for later streamside or lab identification. Most fish species were identified on-site with the aid of identification manuals such as How to Know the Freshwater Fishes by Samuel Eddy and James C. Underhill, Identification Guide to Pennsylvania Fishes by Clark Shiffer and Fishes of Pennsylvania and the Northeastern United States by Edwin L. Cooper. However there were times when it was necessary to kill and preserve select specimens from the harder to identify genera – dace and shiner species being among the more difficult. In these cases, identification took place in the lab with the aid of proper lighting, a dissecting scope, and identification manuals. Previous collection lists by the Pennsylvania Fish and Boat Commission were also consulted. Specimens were also collected for photography purposes.

In regards to game fish, only one specimen from each species of collected sunfish, sucker and catfish were purposely killed. All trout species were immediately returned to the water. Some thirty specimens from non-game dace and shiner species and one Quillback carpsucker were purposely killed during the investigation. Mortality due to direct electrofishing was near non-existent due to the purposely-selected low voltage, low frequency electrofishing setting. Most fish regained muscle control and escaped the area immediately after floating or twitching their way out of the electrical field.

Field investigations by RETTEW biologists produced 31 species of fish within the Little Conestoga Creek Watershed, with the majority being considered coolwater and warmwater species. The Pennsylvania Fish and Boat Commission has recorded an additional 8 species.

Stocked Brown and Rainbow trout (*Salmo trutta and Oncorhynchus mykiss*), which are considered coldwater species, were captured in the West Branch and the Main Stem upstream of Route 72 (Manheim Pike) to more or less East Petersburg Borough. No trout were observed in Bachman Run. The stocked trout purely exist in a put and take situation. The Pennsylvania Fish and Boat Commission stock trout being in March through May with the regular trout season opening in April; thus the Commission "put" the trout and the anglers in turn "take" them. Given current habitat conditions in these stocked waters, RETTEW biologists feel there is little opportunity for any trout to survive and carryover to the next year. In most cases the water simply gets too warm during the summer months. However there are at least two known locations where private landowners do have small trout ponds that feed into the Main Stem. In these cases, the landowners simply improved spring seeps and made small ponds out of them.

Even though the meager trout fishery now existing in the Little Conestoga Creek Watershed is totally dependent upon stocking and limited to a seasonal condition, there is hope and promise for something a little more substantial. The lower portion of the West Branch and the Main Stem between Millers Road and Quarry Road near East Petersburg Borough seem to be two possible stream reaches where more of a year round trout fishery could be developed.

The lower portion of the West Branch is well vegetated, shaded and contains good in-stream cover. While electrofishing at monitoring station #5, RETTEW biologists encountered a single Brown trout that surfaced underneath a tangle of tree roots. Though the biologists could clearly see the fish, there was no physical way of getting to it with a net for a closer look. It was the only trout observed at that location and it was rather small, approximately 9-inches. The trout was brilliantly colored and just didn't strike the biologists as being a hatchery-raised fish. The conclusion (though it's a guess) was that the fish was either a holdover from the previous year's upstream stocking, or was a stream-bred fish.

The Main Stem (excluding Bachman Run) between Millers Road upstream to Quarry Road (close to the Bent Creek Golf Course) is a very promising stretch of future trout water provided stream restoration takes place throughout much of this headwater area. A number of springs are located along this length of stream, providing a source of cold water.

However the vast majority of the Little Conestoga Creek and its tributaries should be considered and managed as coolwater and warmwater fisheries. By and large, the bulk of monitoring stations were dominated by White sucker (*Catostomus commersoni*), Rock bass (*Ambloplites rupestris*), Bluntnose minnow (*Pimephales notatus*) and Tessellated darter (*Etheostoma olmstedi*). Blacknose dace (*Rhinichthys atratulus*), Longnose dace (*Rhinichthys cataractae*) and Redbreast sunfish (*Lepomis auritus*) were common. Smallmouth bass (*Micropterus dolomieu*) were fairly common where the in-stream habitat was adequately consisting of rocky substrates, woody debris and tree root overhangs.

Smallmouth were found in the Main Stem from its confluence with the Conestoga River upstream to Columbia Avenue at Maple Grove. Upstream from that point, the quality of habitat simply declined. In-stream habitat around Flory's Mill just below Route 283 seemed like it should have harbored at least a bass or two, but none were found. In-stream habitat conditions near Park City were absolutely horrendous, with the substrate being heavily silt laden and very little in-stream overhead structure (rocks, logs) for fish to find refuge under.

However RETTEW biologists see no reason why Smallmouth bass shouldn't exist as far upstream as Route 72 (Manheim Pike) if the in-stream habitat is improved. Likewise, effort should be made to improve in-stream habitat conditions for Smallmouth bass even where they presently exist because their numbers in those locations really are not all that good and are greatly limited by the scarceness of available cover.

Consider this - the biggest Smallmouth bass (15-inches) was found hiding under a 4X8-foot piece of plywood in Manor Park upstream of the footbridge. It's a rather odd thing to ponder that the biggest, best game fish in the entire creek was hiding under a big piece of litter!

Two discovered species that haven't yet been mentioned deserve attention. The two species in mind are the Greenside and Banded darters (*Etheostoma blennioides* and *Etheostoma zonale*), both of which are considered pollution intolerant species. These colorful, little, bottom dwelling fish were found only in the very lower portion of the Main Stem – interestingly within the deemed "unimpaired zone" as per the Pennsylvania Department of Environmental Protection's 303 (d) List of Impaired Waters (monitoring stations #1 through #5). Historically, Banded darters are not indigenous to the Susquehanna River Watershed. It is thought the Banded darter somehow gained access to the Susquehanna via Pine Creek in Potter County sometime in the late 1960's and have since rapidly colonized mainstem riffles and many tributaries downstream into Maryland. So Native American Indians would not have found these colorful little fish swimming in the Little Conestoga. The fish however are native to North America.

The Little Conestoga Creek is also home to some truly exotic fish - Common Carp (*Cyprinus carpio*) from Europe, Goldfish (*Carassius auratus*) from Asia and Brown trout (*Salmo trutta*) from Europe (though a naturally reproducing population does not exist – it is rather through stocking that Brown trout exist within the Little Conestoga Creek). Carp and Goldfish are for the most part considered a nuisance, undesirable species given the fact they routinely displace native fish species. Carp are especially known destroyers of native aquatic habitats via their tendency to dig in the soft sediments while feeding. Aquatic plants are often uprooted and/or die because of the constantly cloudy water and the inability to photosynthesize. Native fish nests and eggs are often destroyed by feeding Carp as are the eggs and larva of aquatic insects.

Even Brown trout can receive an unwelcome response when introduced into Brook trout (*Salvelinus fontinalis*) streams.

LITTLE CONESTOGA CREEK – FISH COMMUNITY ASSEMBLAGES

MONITORING STATION #	# OF NATIVE FISH SPECIES (INCLUDES SMALLMOUTH BASS)	# OF DARTER SPECIES	# OF SUNFISH SPECIES	# OF SUCKER SPECIES	# OF POLLUTION INTOLERANT SPECIES	% OF POLLUTION INTOLERANT SPECIES	WILD TROUT PRESENT YES/NO	STOCKED TROUT PRESENT YES/NO
1	9	1	3	2	1	8.8	NO	NO
2	9	2	2	2	2	**13.5**	NO	NO
3	7	1	0	1	1	11	NO	NO
4	8	**3**	0	2	2	15	NO	NO
5	11	1	3	1	**3**	10.6	?	YES
6	10	1	2	2	1	4.2	NO	NO
7	9	1	1	2	1	12.1	NO	NO
8	**13**	1	**5**	2	0	0	NO	NO
9	10	1	3	2	1	2.5	NO	NO
10	11	1	4	2	1	3.1	NO	NO
11	11	1	2	1	0	0	NO	NO
12	10	1	3	2	0	0	NO	NO
13	8	1	3	1	1	1.2	NO	YES
14	9	1	2	1	0	0	NO	YES
15	10	1	3	1	0	0	NO	YES
16	8	1	3	2	0	0	NO	YES
17	8	0	1	1	0	0	NO	NO
18	10	1	2	2	0	0	NO	YES
19	10	1	3	2	1	4.2	NO	NO
20	10	1	3	1	0	0	NO	NO
21	0	0	0	0	0	0	NO	NO
22	3	1	0	0	0	0	NO	NO
23	11	1	2	1	1	0.9	NO	YES
A1	5	0	2	1	0	0	NO	NO

LITTLE CONESTOGA CREEK - COLLECTED FISH SPECIES

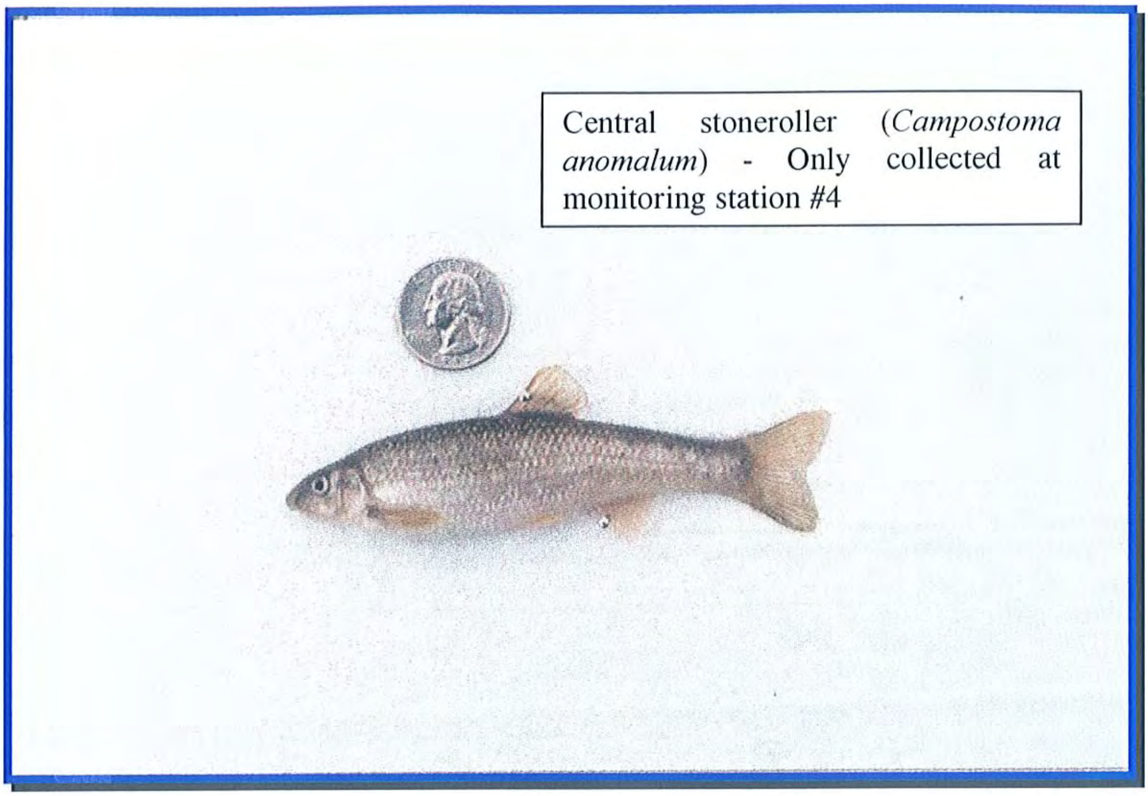
SPECIES	PFBC 4-30-97	PFBC 5-5-97	PFBC 5-12-97	PFBC 5-19-97	PFBC 6-2-97	RETTEW APRIL – JUNE 2002
ANGUILLIDA (Freshwater eels)						
Anguilla rostrata (American eel)						
CLUPEIDAE (Herrings)						
Alosa mediocris (Hickory shad)						
Alosa pseudoharengus (Alewife)						
Alosa sapidissima (American shad)						
Dorosoma cepedianum (Gizzard shad)					X	
CYPRINIDAE (Carps and Minnows)						
Campostoma anomalum (Central stoneroller)	X	X			X	X
Carassius auratus (Goldfish)	X	X	X			X
Clinostomus funduloides (Rosyside dace)						
Cyprinella analostana (Satinfin shiner)	X			X	X	X
Cyprinella spiloptera (Spotfin shiner)	X	X	X	X		X
Cyprinus carpio (Common carp)	X	X	X	X	X	X
Exoglossum maxillingua (Cutlips minnow)	X	X	X	X		X
Luxilus cornutus (Common shiner)	X	X	X	X	X	X
Margariscus margarita (Pearl dace)						
Nocomis micropogen (River chub)						
Notemigonus crysoleucas (Golden shiner)						X
Notropis amoenus (Comely shiner)	X					
Notropis hudsonius (Spottail shiner)	X	X	X	X	X	X
Notropis procne (Swallowtail shiner)		X				
Notropis rubellus (Rosyface shiner)						
Notropis volucellus (Mimic shiner)	X					

Pimephales notatus (Bluntnose minnow)	X	X	X	X	X	X
Pimephales promelas (Fathead minnow)						X
Rhinichthys atratulus (Blacknose dace)	X	X	X	X	X	X
Rhinichthys cataractae (Longnose dace)	X	X	X	X	X	X
Semotilus atromaculatus (Creek chub)	X	X	X	X	X	X
Semotilus corporalis (Fallfish)						X
CATOSTOMIDAE (Suckers)						
Carpiodes cyprinus (Quillback)	X		X			X
Catostomus commersoni (White sucker)	X	X	X	X	X	X
Hypentelium nigricans (Northern hog sucker)	X	X	X	X	X	X
Moxostoma macrolepidotum (Shorthead redhorse)	X	X	X	X		
ICTALURIDAE (Bullhead catfishes)						
Ameiurus natalis (Yellow bullhead)	X			X		X
Ameiurus nebulosus (Brown bullhead)	X		X			
Ictalurus punctatus (Channel catfish)	X		X			
Noturus insignis (Margined madtom)						
ESOCIDAE (Pikes)						
Esox lucius (Northern pike)						
Esox masquinongy (Muskellunge)						
Esox niger (Chain pickerel)						
SALMONIDAE (Trouts)						
Oncorhynchus mykiss (Rainbow trout)					X	X
Salmo trutta (Brown trout)						X
Salvelinus fontinalis (Brook trout)						
CYPRINODONTIDAE (Killifishes)						
Fundulus diaphanus (Banded killifish)						X
COTTIDAE (Sculpins)						

Cottus bairdi (Mottled sculpin)						
Cottus cognatus (Slimy sculpin)						
CENTRACHIDAE (Sunfishes)						
Ambloplites rupestris (Rock bass)	X	X	X	X	X	X
Lepomis auritus (Redbreast sunfish)			X			X
Lepomis cyanellus (Green sunfish)		X		X		X
Lepomis gibbosus (Pumpkinseed)	X		X	X	X	X
Lepomis macrochirus (Bluegill)		X	X	X	X	X
Micropterus dolomieu (Smallmouth bass)	X	X	X		X	X
Micropterus salmoides (Largemouth bass)	X	X	X		X	
Pomoxis annularis (White crappie)						
Pomoxis nigromaculatus (Black crappie)						
PERCIDAE (Perches)						
Etheostoma blennioides (Greenside darter)	X	X	X			X
Etheostoma olmstedi (Tessellated darter)		X		X	X	X
Etheostoma zonale (Banded darter)	X	X	X	X	X	X
Perca flavescens (Yellow perch)						
Stizostedion vitreum (Walleye)						
OTHER						

****PFBC – Pennsylvania Fish and Boat Commission – Information provided by fishery biologist Bryan Chikotas – Fish collected 90 meters upstream of Route 999 of Main Stem****

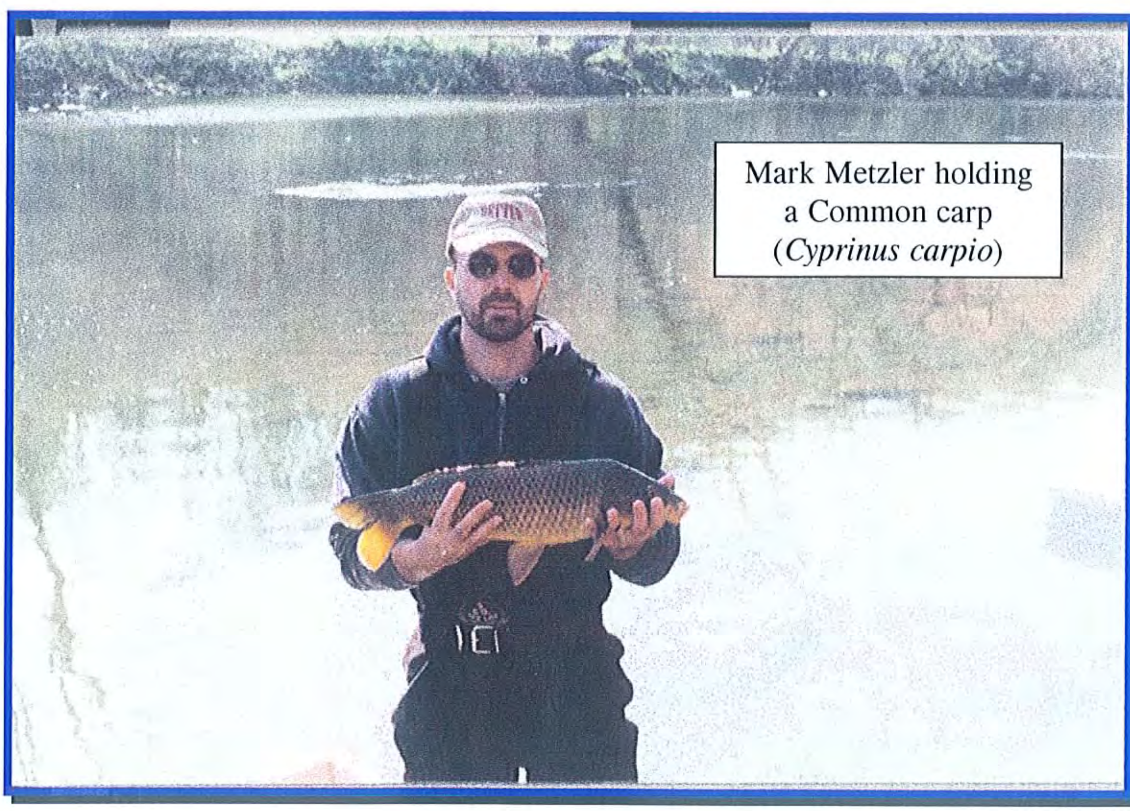
Little Conestoga Creek – Collected Fish Species Photographs



Central stoneroller (*Campostoma anomalum*) - Only collected at monitoring station #4

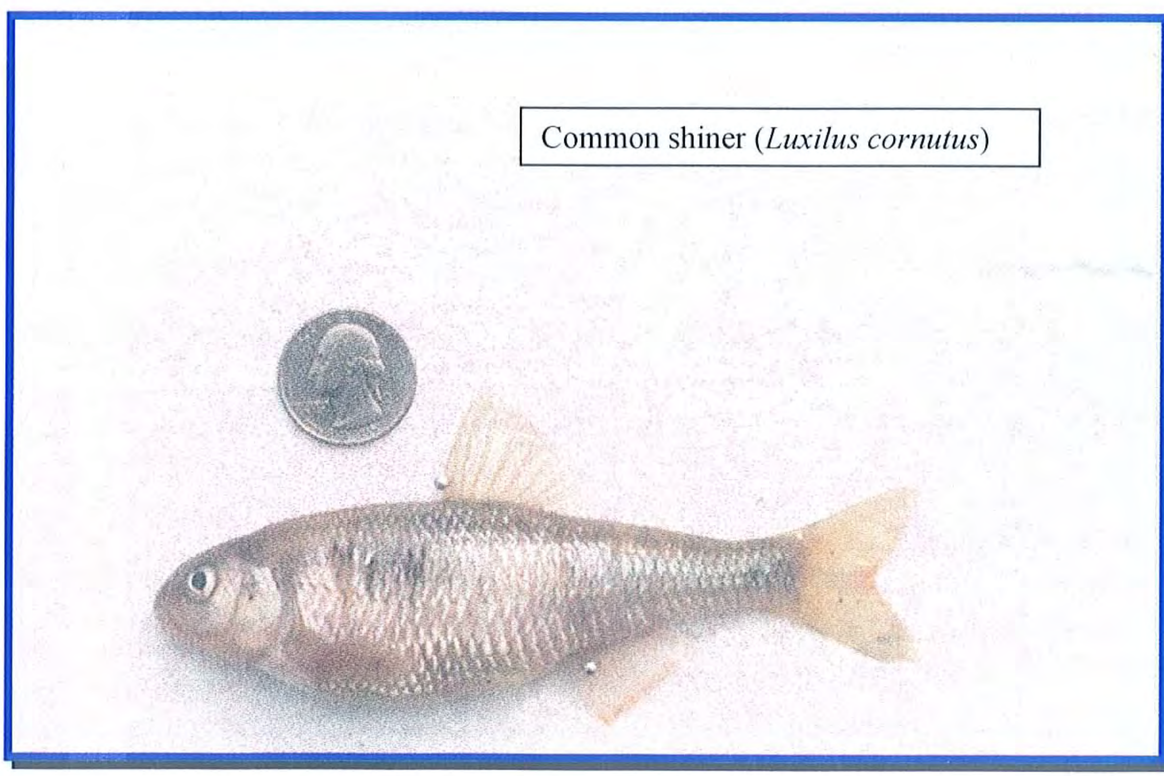
Satinfin shiner (*Cyprinella analostana*)

Spotfin shiner (*Cyprinella spiloptera*)



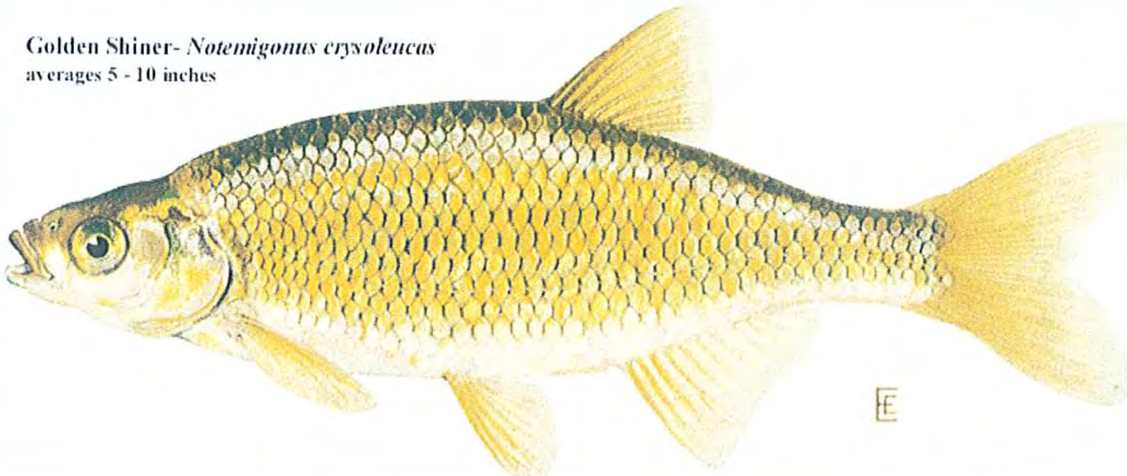
Mark Metzler holding a Common carp (*Cyprinus carpio*)

Cutlips minnow (*Exoglossum maxillingua*)



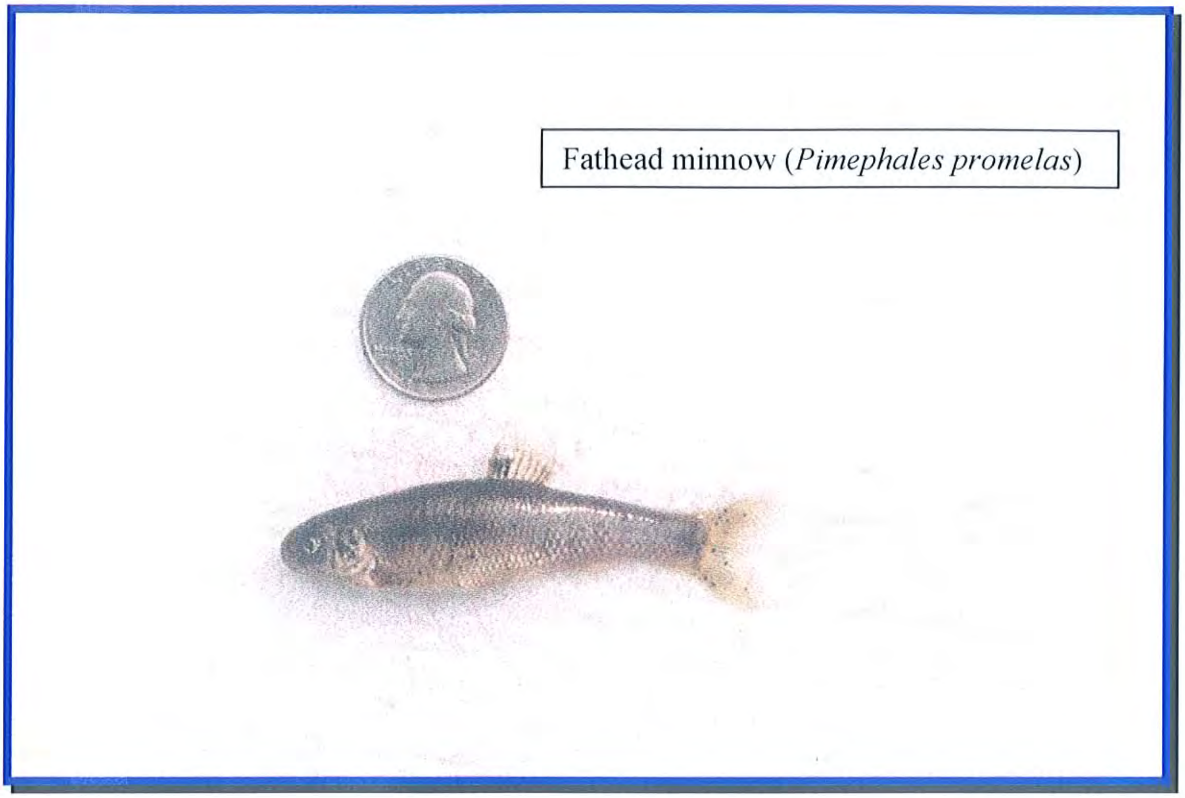
Common shiner (*Luxilus cornutus*)

Golden Shiner- *Notemigonus crysoleucas*
averages 5 - 10 inches

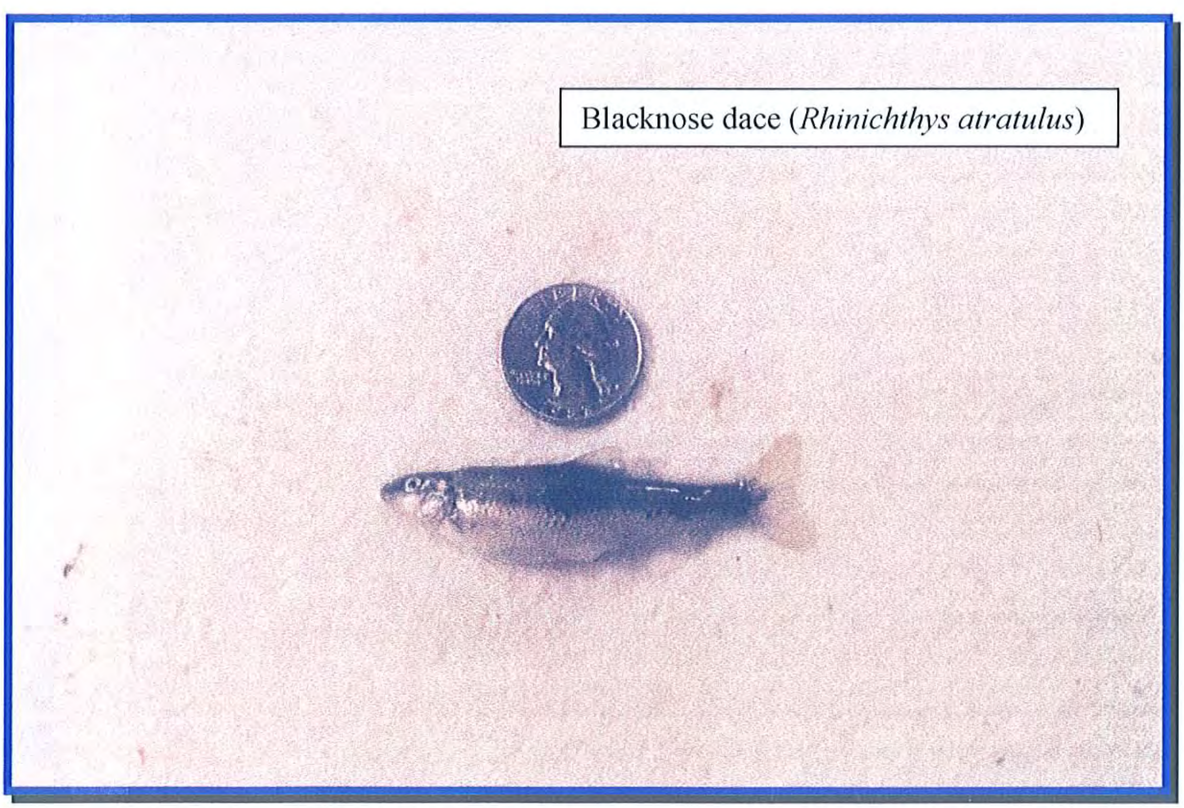


Spottail Shiner - *Notropis hudsonius*
averages 3-4 inches

Bluntnose minnow (*Pimephales notatus*)



Fathead minnow (*Pimephales promelas*)

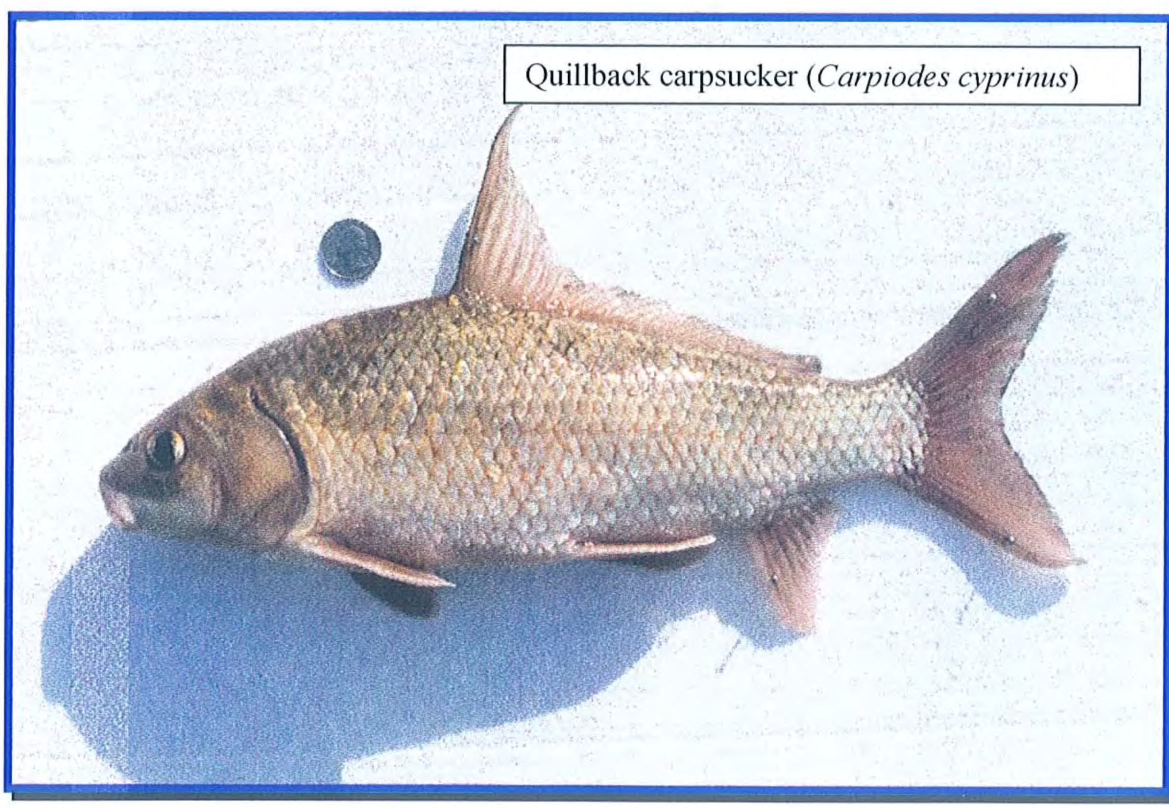


Blacknose dace (*Rhinichthys atratulus*)

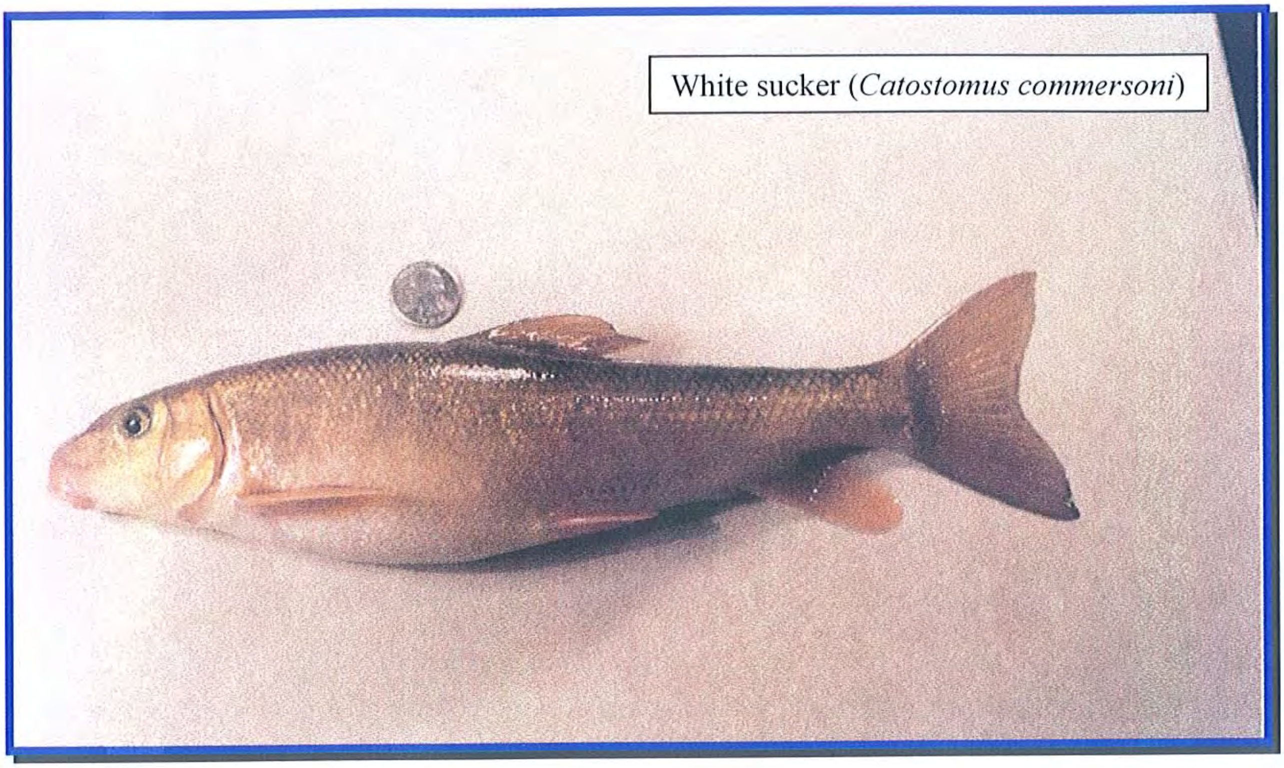
Longnose dace (*Rhinichthys cataractae*)

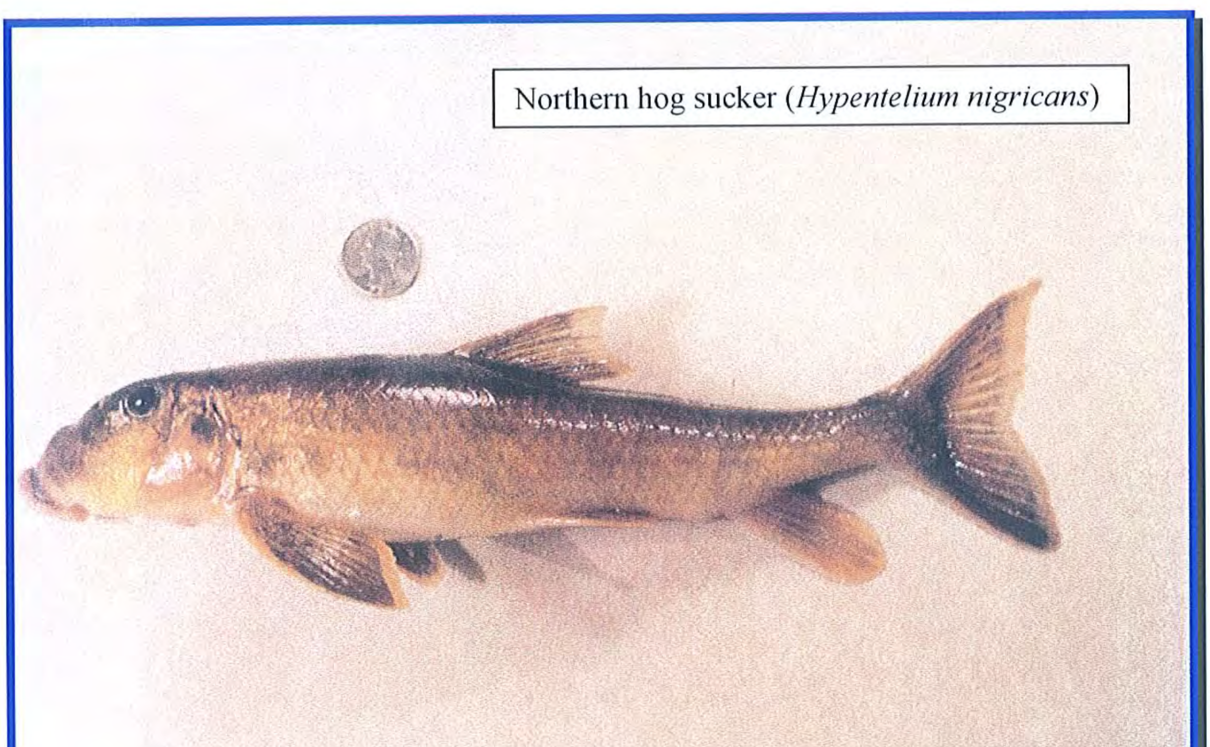
Creek chub (*Semotilus atromaculatus*)

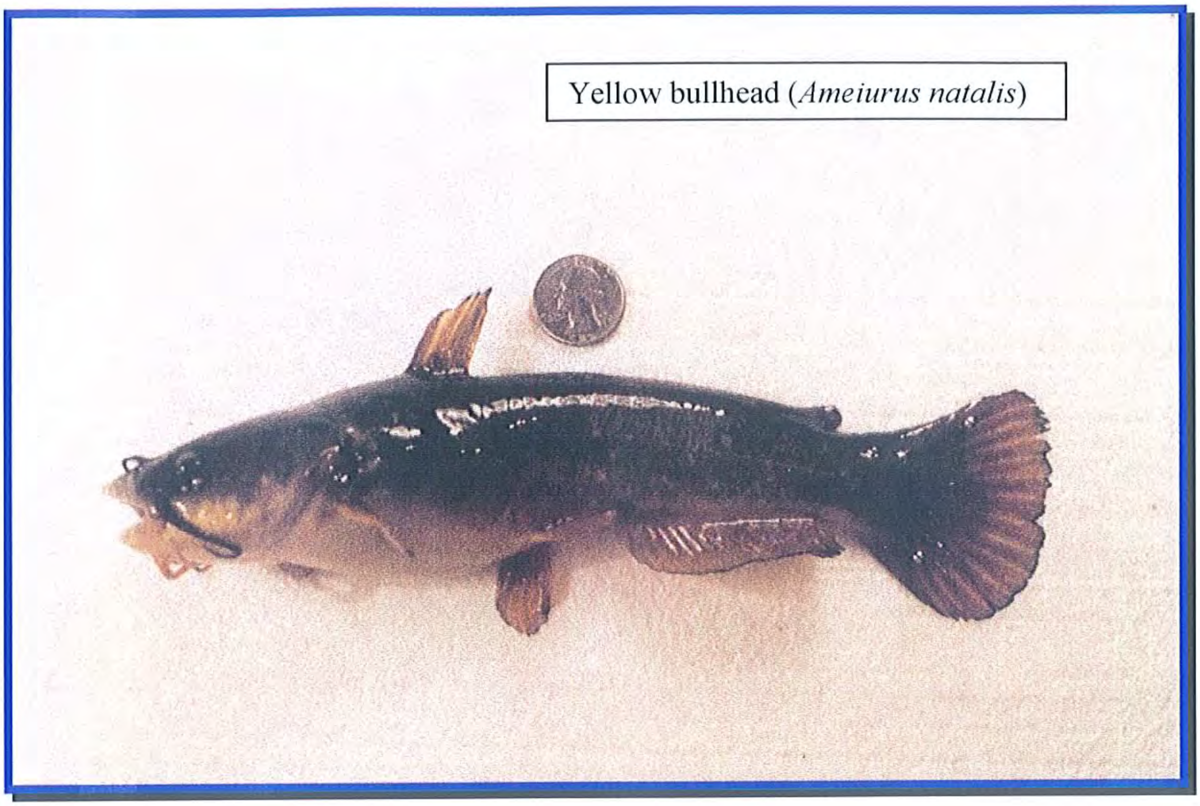
Fallfish (Semotilus corporalis)



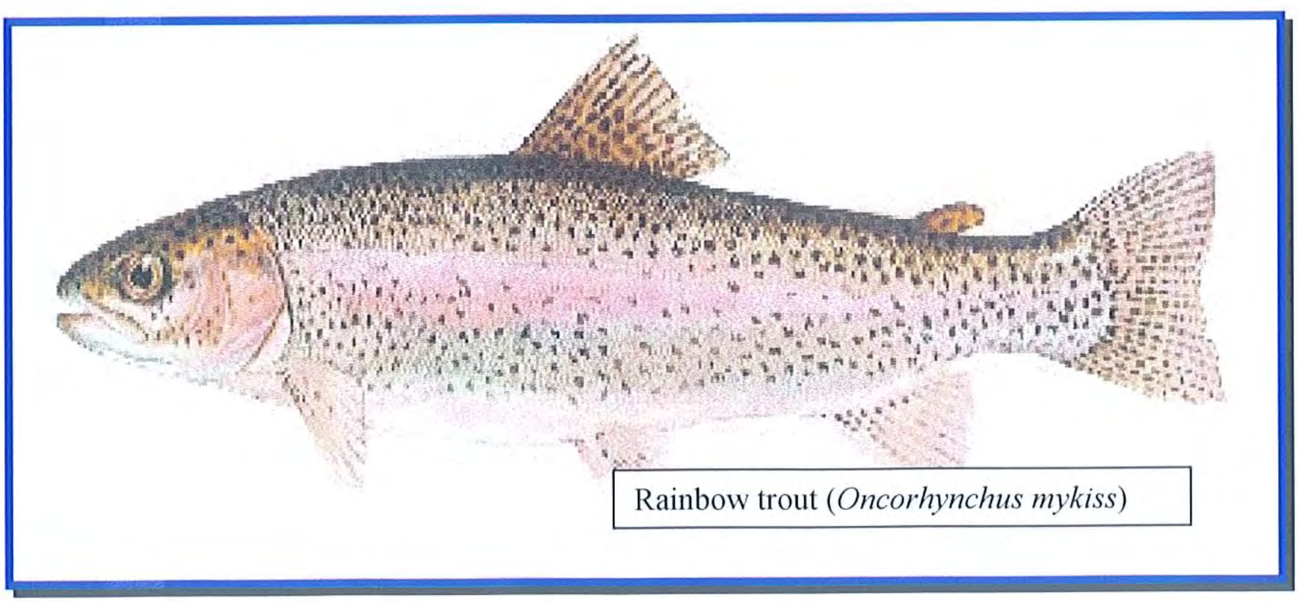
Quillback carpsucker (*Carpiodes cyprinus*)


White sucker (*Catostomus commersoni*)

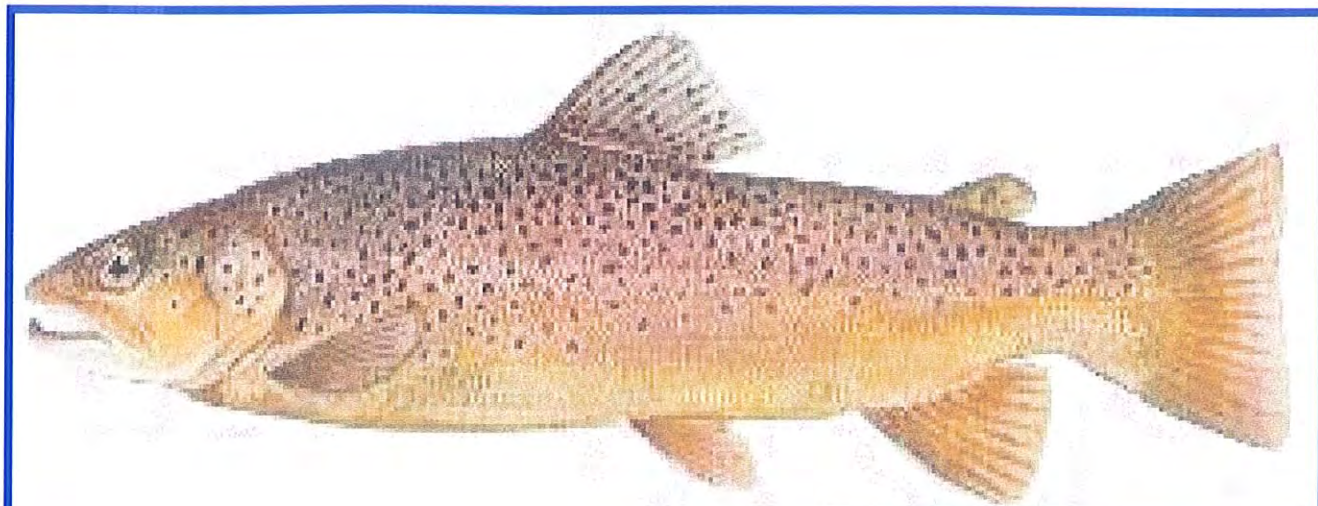

Northern hog sucker (*Hypentelium nigricans*)



Yellow bullhead (*Ameiurus natalis*)

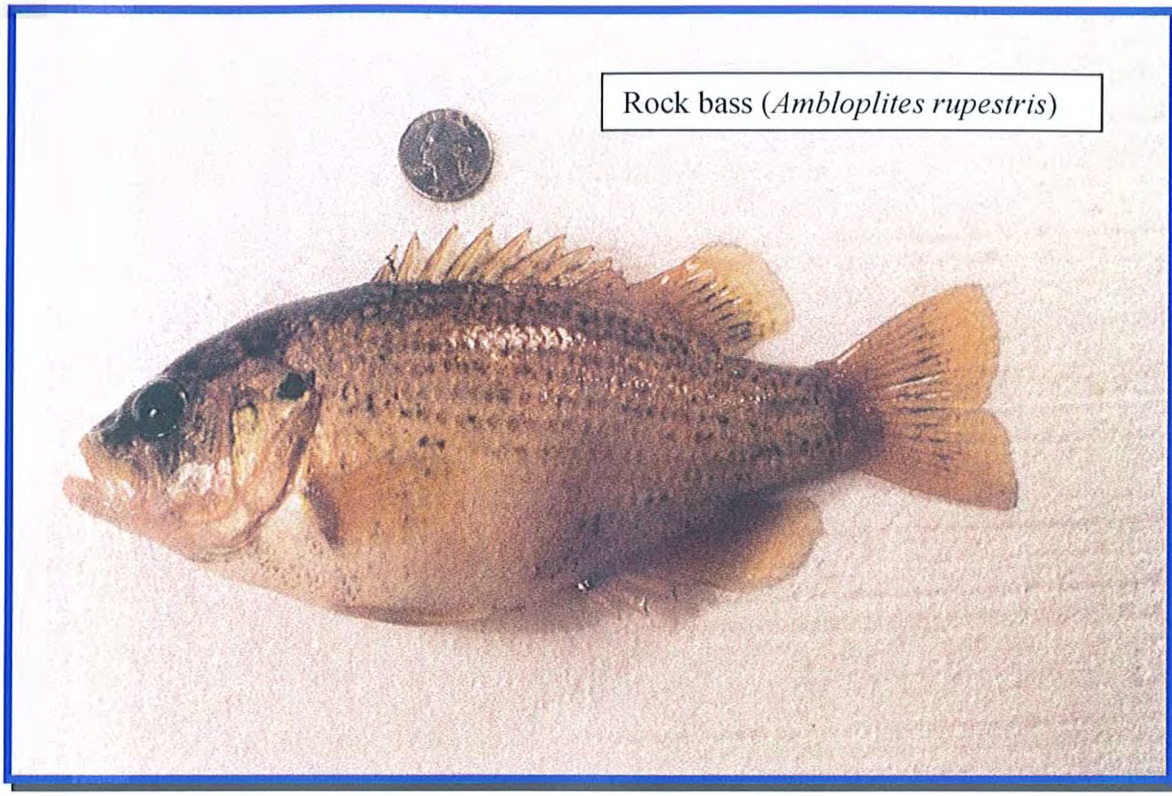


Rainbow trout (*Oncorhynchus mykiss*)

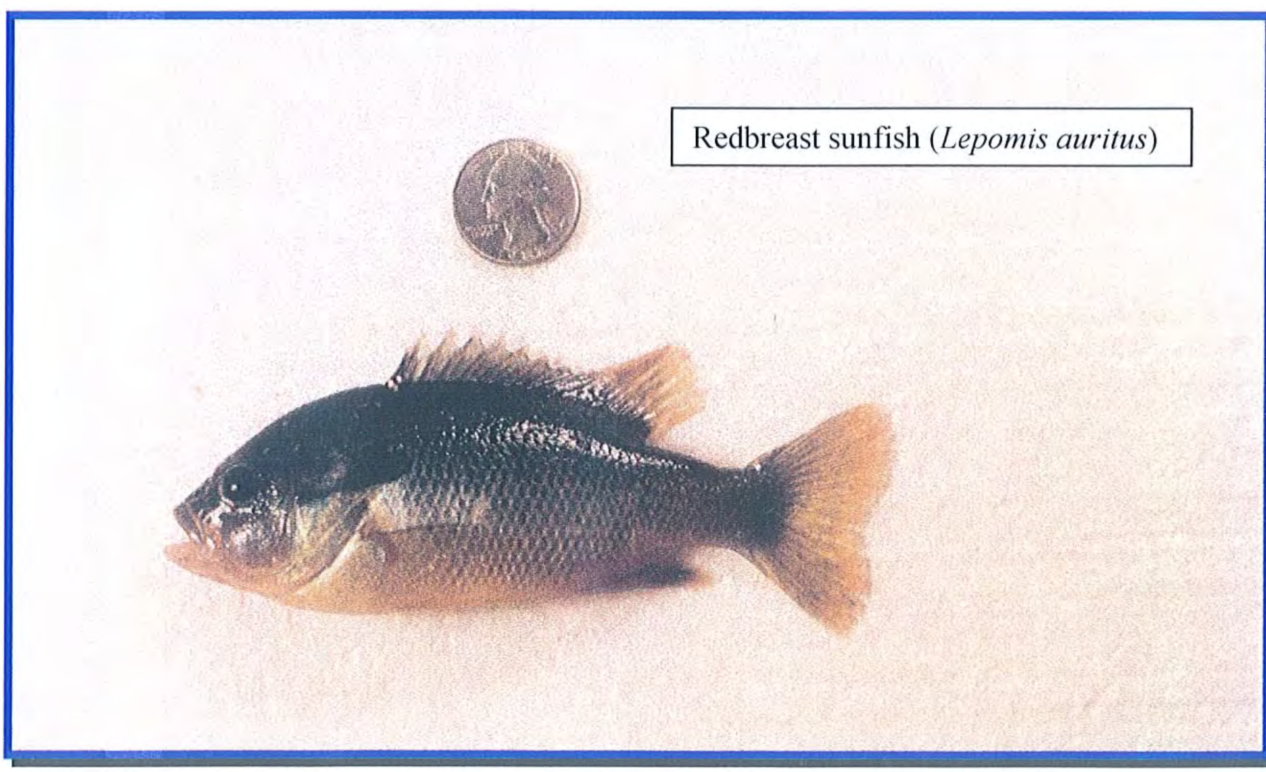


Brown trout (*Salmo trutta*)

Banded killifish (*Fundulus diaphanus*)

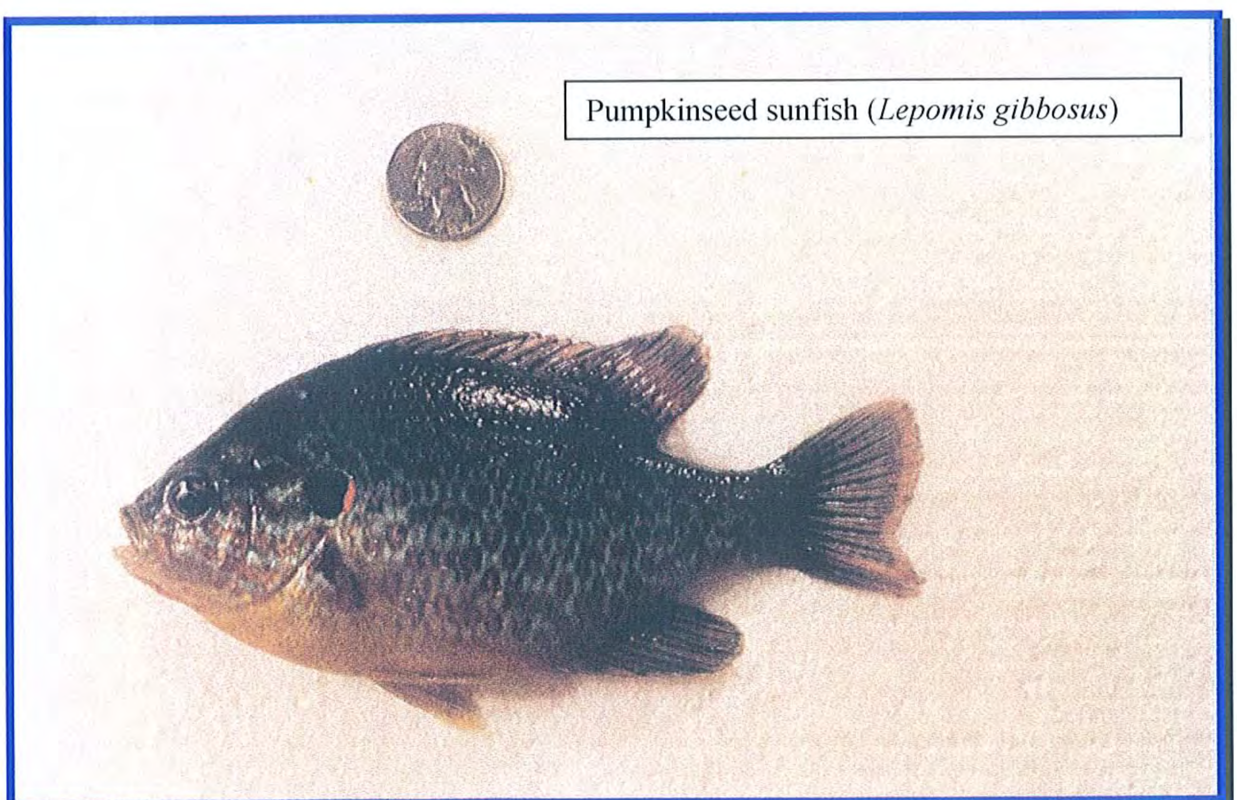


Rock bass (*Ambloplites rupestris*)

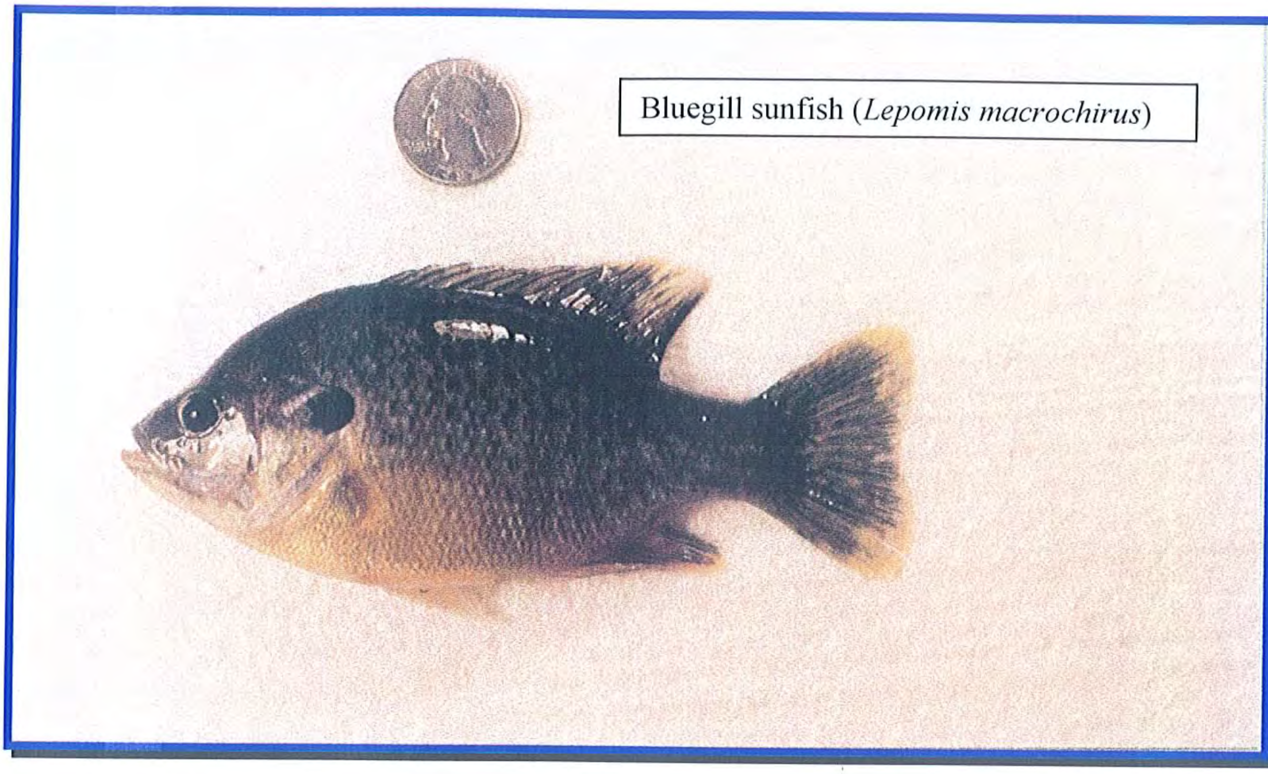


Redbreast sunfish (*Lepomis auritus*)

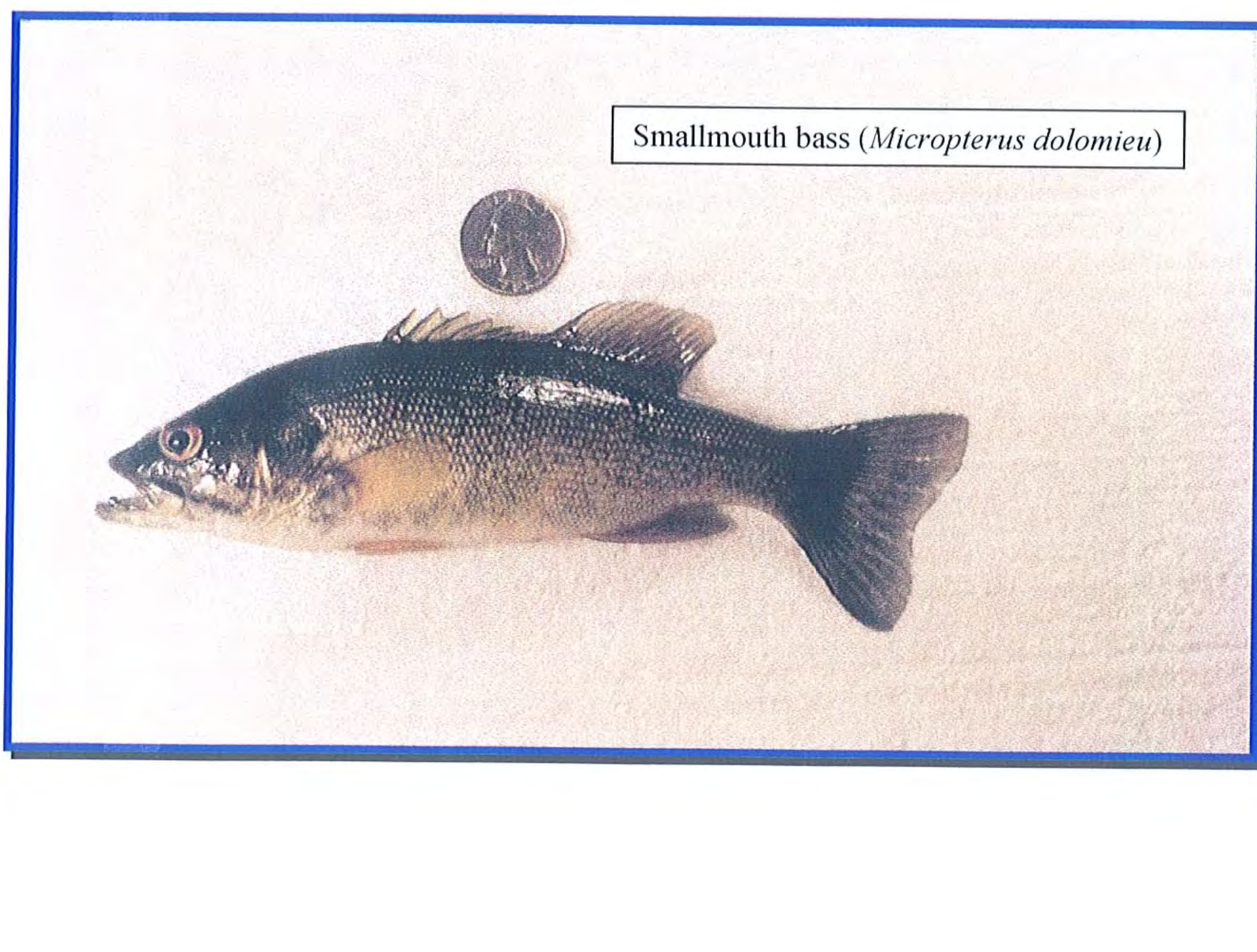
Green sunfish (*Lepomis cyanellus*)



Pumpkinseed sunfish (*Lepomis gibbosus*)



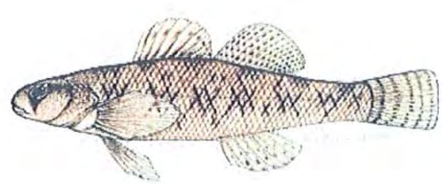
Bluegill sunfish (*Lepomis macrochirus*)

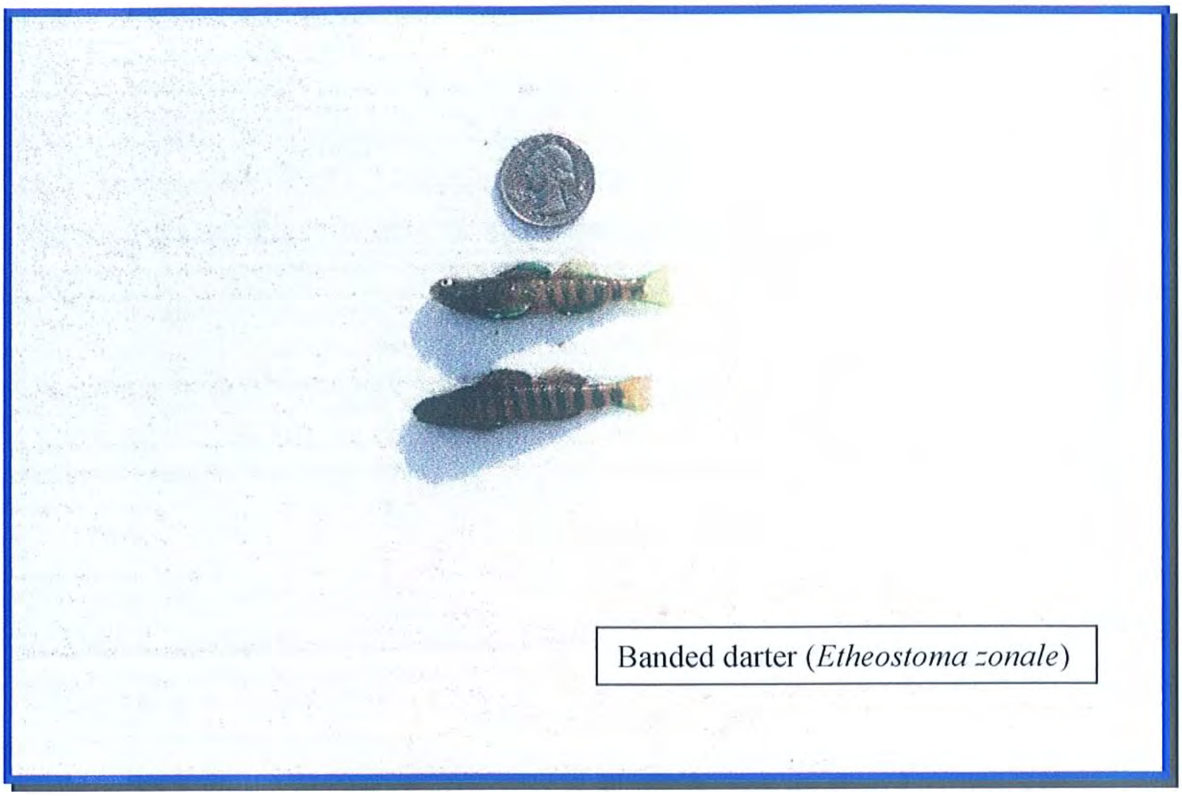


Smallmouth bass (*Micropterus dolomieu*)

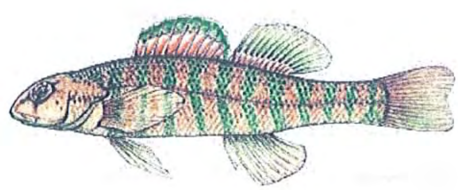
Greenside darter (*Etheostoma blennioides*)

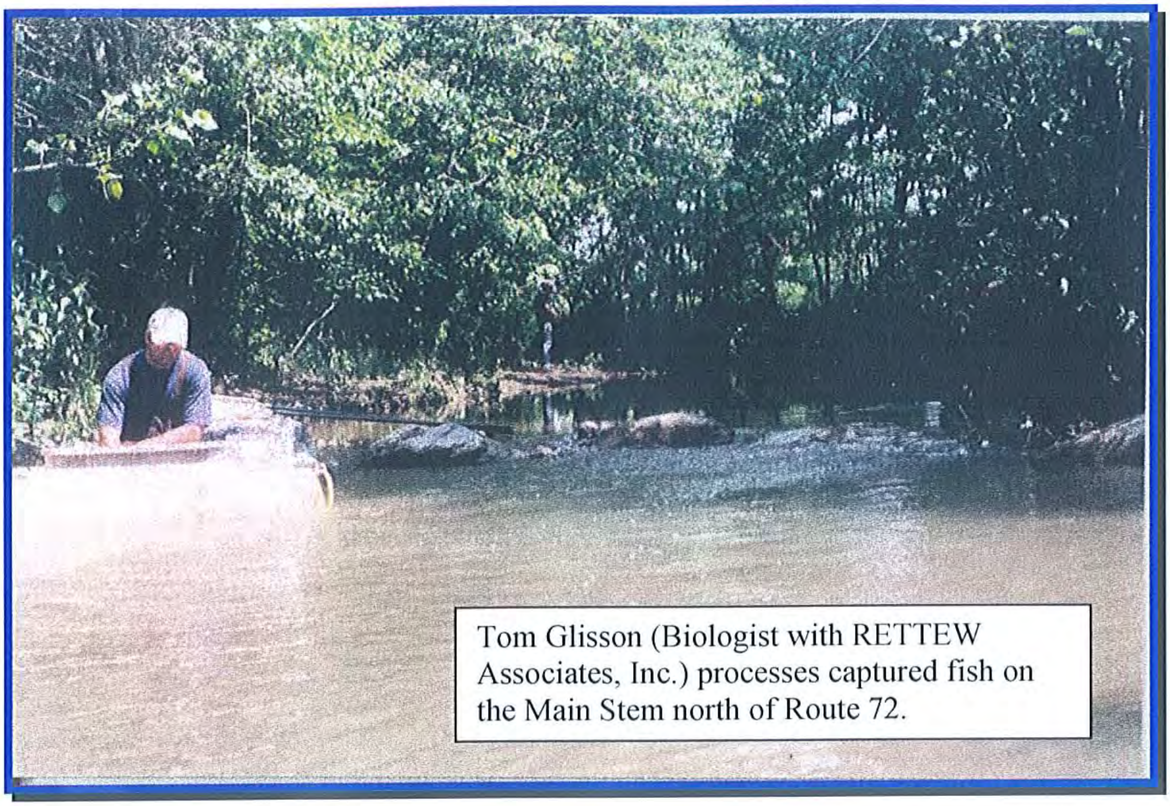
Tessellated darter (*Etheostoma olmstedi*)





Banded darter (*Etheostoma zonale*)





Tom Glisson (Biologist with RETTEW Associates, Inc.) processes captured fish on the Main Stem north of Route 72.

WATER CHEMISTRY

As stated earlier in this writing, chemical measurements only provide "snap shot" data. That is to say these measurements are instantaneous and only describe conditions at the very point in time in which they are taken. For this reason, it is best if water chemistry can be monitored year round on a regular basis as much as possible. Obviously monitoring more locations at a greater frequency will yield better data sets from which to draw conclusions.

In the case of this Little Conestoga Creek Watershed Assessment, it would have been nice to monitor a variety of water chemistry parameters on a monthly basis for two or more years at stations #1 through #23 and station A1 (or had access to that degree of background, baseline data), but such was not within the scope and budget of this project.

Fortunately chemistry data was available from a September 1998 United States Geological Survey study (previously referenced), a local volunteer group known as the Senior Environmental Corps, the "Stream Team" at Lancaster Academy (a local alternative high school) and an environmental problems class at Franklin and Marshall College in Lancaster, Pennsylvania. When coupled with the findings of the RETTEW biologists, conclusions as to the chemical nature of Little Conestoga Creek water could be drawn. As stated earlier in this writing, it is vital water chemistry data be considered in concert with macroinvertebrate, fish and habitat data when drawing overall conclusions about a stream's water quality.

There are seemingly endless chemical tests that can be performed on water, but fishery biologists and stream restoration practitioners typically concern themselves with only a few choice chemical and physical parameters when conducting routine monitoring. Of course there is sometimes due cause for investigating very specific chemical parameters when a specific source of impairment is suspected, but on a routine basis the following parameters are among those typically investigated – and for the following reasons:

Water temperature	Dissolved oxygen	Ammonia
pH	Nitrate	Sediment/turbidity
Alkalinity	Phosphate	

Water temperature can exert great control over aquatic communities. If the overall water body temperature of a system is altered, an aquatic community shift can be expected. Many coldwater fish, such as trout and salmon, will disappear as a result of egg and fry mortality, direct adult mortality or reduced reproductive activity, and be replaced by warmwater fish, such as sunfish.

In water above 30° C (86° F), a suppression of all benthic organisms can be expected (James, 1979). Also, different plankton groups will flourish under different temperatures. For example, diatoms dominate at 20-25° C (68-77° F), green algae dominate at 30-35° C (86-95° F), and cyanobacteria dominate above 35° C (95° F) (USEPA, 1987; Dunne, 1978).

In addition, there is potential for physiological distress if a fish swims into a localized warm area of water. Because of water's high heat capacity, water temperature does not change rapidly under natural conditions. Thus fish have not evolved the ability to adapt to rapid temperature fluctuations. As a consequence, undetectable physiological damage occurs when fish are introduced into warmer water. The damage caused is not great enough in itself to cause death; instead motor functions are impaired that make the fish more susceptible to death via "natural causes". For example, slowed reflexes may cause a fish to be less successful during natural predator-prey interactions. As a result, the fish may starve or be preyed upon (Kennish, 1992).

Fish that have safely acclimated to the warmer water of a thermal discharge plume are still in danger. If the thermal emission ceases at any time, the resulting rapid water temperature drop may cause fish to die of cold shock. When the emission resumes, the fish may then suffer heat shock.

Thus water temperature influences the amount of dissolved oxygen in water, the rate of photosynthesis by algae and other aquatic plants, metabolic rates of aquatic organisms and the sensitivity of aquatic organisms to toxic wastes, parasites and disease.

Nonpoint thermal pollution by way of heated stormwater running off of heated urban surfaces (metal roofs, macadam parking lots, etc.) and the removal of shade providing riparian buffers is common within the Little Conestoga Creek Watershed.

COLDWATER AND WARMWATER FISHERY TEMPERATURE TABLE

****Taken from Chapter 93, Water Quality Standards, Title 25, Pennsylvania Code*

TIME PERIOD	COLDWATER FISHERY		WARMWATER FISHERY	
	°C	°F	°C	°F
January 1-31	3.3	38	4.4	40
February 1-29	3.3	38	4.4	40
March 1-31	5.5	42	7.7	46
April 1-15	8.8	48	11.1	52
April 16-30	11.1	52	14.4	58
May 1-15	12.2	54	17.7	64
May 16-31	14.4	58	22.2	72
June 1-15	15.5	60	26.6	80
June 16-30	17.7	64	28.8	84
July 1-31	18.8	66	30.5	87
August 1-31	18.8	66	30.5	87
September 1-15	17.7	64	28.8	84
September 16-30	15.5	60	25.5	78
October 1-15	12.2	54	22.2	72
October 16-31	10	50	18.8	66
November 1-15	7.7	46	14.4	58
November 16-30	5.5	42	10	50
December 1-31	4.4	40	5.5	42

SPECIES	UPPER LIMIT °C	UPPER LIMIT °F	OPTIMUM °C	OPTIMUM °F
Brook trout (*Salvelinus fontinalis*)				
Adult	24	75.2	11-16	51.8-60.8
Spawning	n/a		4.5-10	40.1-50
Brown trout (*Salmo trutta*)				
Adult	27	80.6	12-19	53.6-66.2
Juvenile	27	80.6	7-19	44.6-66.2
Spawning	27	80.6	2-13	35.6-55.4
Rainbow trout (*Oncorhynchus mykiss*)				
Adult	25	77	12-18	53.6-64.4
Spawning	n/a		10-15.5	50-59.9
Smallmouth bass (*Micropterus dolomieu*)				
Adult	32	89.6	21-27	69.8-80.6
Spawning	n/a		12.8-21	55.0-69.8
Largemouth bass (*Micropterus salmoides*)				
Adult	36	96.8	24-30	75.2-86
Spawning	30	86	21	69.8

The power of hydrogen or **pH** is a very common monitored parameter used to determine acidity. The pH scale is a log-base 10 scale that measures the acidity of a solution on a scale of 0 to 14. Neutral solutions, such as pure water, measure a neutral 7 on the scale. Alkaline solutions will have high pHs between 8 and 14 and acidic solutions will measure between 1 and 6. It is important to remember that since the pH scale is a log-base 10 scale, the pH changes 1 unit for every power of ten change in hydrogen ion concentration. For example, a water sample measuring a pH of 3 would have 100 times the amount of hydrogen ions than a water sample measuring 5.

Th pH of water is controlled by the equilibrium achieved by dissolved compounds (rocks and mineral – the area's geology) in the stream system. In natural waters, pH is mainly a function of the carbonate system composed of carbon dioxide, carbonic acid, bicarbonate and carbonate (USEPA, 1986). The presence of limestone geology for example neutralizes introduced acids which could have originated from acid rain or acid mine drainage from mining operations.

The pH greatly influences how other present, dissolved chemical compounds effect the stream's aquatic life. A reduction in pH (more acidic) may allow the release of toxic metals that would otherwise be sorbed to sediment and essentially removed from the water system (at least not available for intake by aquatic life). Once mobilized, these metals are available for uptake by organisms. For many metals, the rate of uptake is directly proportional to the levels of metal availability in the environment. Thus a decrease in pH increases metal availability, lending itself to greater metal uptake by organisms. Metal uptake can cause extreme physiological damage to aquatic life (Connell, 1984).

An increase in pH may cause heightened ammonia concentrations (USEPA, 1986). At low pH, ammonia combines with water to produce an ammonium ion and a hydroxide ion. The ammonium ion is non-toxic and not of concern to organisms. Above a pH of 9, ammonia (unionized) is formed (NH_3) and is very toxic to organisms. Thus organisms experience ammonia toxicity more readily at higher pH levels (Morgan, 1981).

Experiments have shown that a pH decrease of 1.4 units of pH can disturb the aquatic community. After acidification of a test area, the water column concentrations of aluminum, calcium, magnesium and potassium increased: the downstream drift of immature aquatic insect larva increased; the emergence of mature stoneflies (*Plecoptera*) and mayflies (*Ephemeroptera*) decreased; periphyton (attached algae) biomass increased; and trout migrated to areas of higher pH (Smith, 1990).

LIMITING pH values

MINIMUM	MAXIMUM	EFFECTS (Based on various studies)
3.8	10.0	Fish eggs hatch, but deformed young were often produced
4.0	10.1	Limits for the most resistant fish species
4.1	9.5	Range tolerated by trout
4.3	---	Carp die in five days
4.5	9.0	Trout eggs and fry develop normally
4.6	9.5	Limits for perch
5.0	---	Limits for stickleback
5.0	9.0	Tolerable range for most fish
---	8.7	Upper limit for good fishing waters
5.4	11.4	Fish avoided waters beyond these limits
6.0	7.2	Optimum range for fish eggs
1.0	---	Mosquito larvae were destroyed
3.3	4.7	Mosquito larvae will live within this range
7.5	8.4	Best range for algae growth
7.0	Neutral	
8.5	Biologically productive	
5.5	Damaging, indicates acid rain, acid mine drainage	
6.0 - 9.0	Ok for aquatic life	

Alkalinity is a measurement expressing the amount and types of dissolved compounds that serve to make water more alkaline than acidic. It relates to the water's ability to buffer acid referred to as "buffering capacity". Alkalinity should be thought of as an expression of how much the water is capable of neutralizing introduced acid rather than exactly how acidic or alkaline the water is (as is expressed through a pH measurement).

Calcium and magnesium carbonates and bicarbonates, such as found in limestone (karst) geology, are the alkaline components found in natural waters. Therefore limestone streams have high buffering capacity and are not as easily effected by acid rain, acid mine drainage and the like. If a stream has a low alkalinity reading, it would mean the stream's buffering capacity is low and that the stream would undergo a quicker shift to being more acidic should acid be introduced. Alkalinity therefore is an important means of defining and discussing the stream's ability to maintain itself in regards to its acidic/alkaline makeup and consequently its aquatic life.

Natural waters range between 20 – 200 mg/L Limestone streams (calcium carbonate geology) = 75 mg/L and higher Readings of 230 mg/L at "limestoner" Donegal Creek, Lancaster Co., PA are common Below 20 mg/L should raise concern

Dissolved oxygen refers to the volume of oxygen that is contained in the water. Oxygen enters water by way of aquatic plant photosynthesis and by the transfer of oxygen across the air-water interface. Wave action and riffle areas in streams serve to aerate the water. The amount of dissolved oxygen water can hold depends on the water's temperature and salinity and the atmospheric pressure at the water's particular elevation. The warmer the water, the less dissolved oxygen it can hold. Freshwater holds more oxygen than does saltwater. The higher the altitude, the less dissolved oxygen water can hold.

Dissolved oxygen of course is used for animal respiration – and plant respiration. It is also involved in microbes aerobically decomposing organic matter. Typically higher levels of dissolved oxygen equate to greater diversity of plant and animal life in the stream; whereas fewer creatures are tolerant and capable of dealing with low oxygen levels.

Coldwater fishery streams should have a minimum of 7 mg/L Warmwater fishery streams should have a minimum of 5 mg/L Lakes and ponds should have a minimum of 4 mg/L

Nitrate is a form of nitrogen. Nitrogen makes up 78% of the atmosphere as gaseous molecular nitrogen, but most plants can use it only in fixed forms of nitrate and ammonium. Nitrate and nitrite are inorganic ions occurring naturally as part of the nitrogen cycle (Smith, 1990).

The nitrogen cycle is composed of four processes. Three of the processes - fixation, ammonification and nitrification - convert gaseous nitrogen into useable chemical forms. The fourth process, denitrification, converts fixed nitrogen back to the unusable gaseous nitrogen state (Smith, 1990).

Nitrification forms nitrate and nitrite from ammonia. Nitrate can be present in water at higher concentrations than nitrite and ammonia without harming the aquatic system. Nitrate ions are easily released from soil unlike phosphate and ammonia. High levels of nutrients such as nitrate and phosphate lead to increased plant growth which ultimately leads to greater amounts of plant decay and the loss of dissolved oxygen – a process known as eutrophication.

Human consumption limit = 10.0mg/L Warmwater fishery limit = 90.0 mg/L Health hazard to juvenile mammals = 20 mg/L and greater

Phosphate is the form of phosphorous normally found in natural water conditions. In turn there are three kinds of phosphates: organic, orthophosphate and condensed. Organic phosphates are found in plant and animal tissues. Orthophosphate and condensed phosphate are inorganic and readily bond to soil particles.

Testing for total phosphate involves putting the water sample through an acid heat digestion process in order to convert all phosphate to dissolved orthophosphate. Excessive phosphate leads to an unnatural increase in algae and aquatic plant growth and the accelerated eutrophication of lakes and ponds. The sudden die off of these massive crops of algae and aquatic plants, due to decomposing bacteria respiration, leads to critical drops in dissolved oxygen.

Recommended maximum for rivers and streams = 0.1 mg/L
Accelerated eutrophication process in lakes = 0.025 mg/L
Amount of phosphate-phosphorus in most uncontaminated lakes - 0.01 - 0.03 mg/L

Ammonia, like nitrate, is a form of nitrogen. Danger to aquatic life depends on temperature, pH and length of exposure along with dissolved oxygen and carbon dioxide levels. The higher the pH and the warmer the temperature, the more toxic the ammonia. Also, ammonia is much more toxic to fish and aquatic life when the water contains very little dissolved oxygen and carbon dioxide.

General limit = 0.002 mg/L
Fish gill damage = 0.06 mg/L
Indicates polluted water = 0.1 mg/L
Trout and salmon begin to die = 0.2 mg/L
Kills carp = 2.0 mg/L

Sediment and **turbidity**

By volume, sediment is the largest freshwater pollutant in Pennsylvania. Sediment is composed of organic and inorganic particles of various sizes. The series of sediment-induced changes that can occur in a water body may change the composition of an aquatic community (Wilber, 1983). First, a large volume of suspended sediment will reduce light penetration, thereby suppressing photosynthetic activity of phytoplankton, algae, and macrophytes. This leads to fewer photosynthetic organisms available to serve as food sources for many invertebrates. As a result, overall invertebrate numbers may also decline, which may then lead to decreased fish populations.

In addition, sediment may interfere with essential functions of organisms. The numbers of filter-feeding invertebrates will decline if their filter mechanisms are choked by suspended particles (James, 1979). Some zooplankton suffer decline due to clogged feeding mechanisms (McCabe, 1985). Likewise, fish may suffer clogging and abrasive damage to gills and other respiratory surfaces. Abrasion of gill tissue triggers excess mucous secretion, decreased resistance to disease, and a reduction or complete cessation of feeding (Wilber, 1983).

Suspended sediment may also affect predator-prey relationships by inhibiting the predator's visual abilities.

In natural water, fish avoid areas of high-suspended solids when possible by hiding in quieter pools or moving away from the source of sediment. Thus, although experimental studies may suggest certain degrees of injury to aquatic fauna in a given level of turbidity, the actual effects observed may be less pronounces because of the avoidance behavior.

Reproductive success may decline with an increase in fine sediment. If spawning habitats are altered by sediment deposition, fish may be unable to lay eggs and/or their eggs may be smothered because of the lack of water circulation around the egg and resulting decrease in oxygenation.

Benthic macroinvertebrates requiring a low-silt substrate will suffer a similar fate. Deposited sediments may obscure sources of food, habitat, hiding places and nesting sites (Wilber, 1983). Most aquatic insects will simply drift with the current out of the affected area. Silt-loving macroinvertebrate communities and consequently those able to withstand low dissolved oxygen levels will replace benthic macroinvertebrates requiring a low-silt substrate.

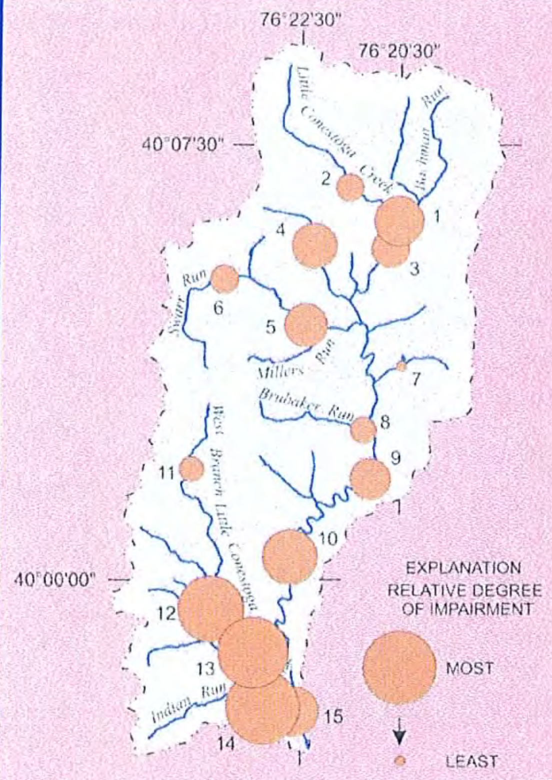
TURBIDITY
Limit for rivers = <100 NTU
10 day average for aquatic life - no problem = <25 NTU
Maximum for swimming = 5 NTU

The September 1998 United States Geological Survey study closely examined nitrate, total phosphorous, and ammonia concentrations. Nitrate concentrations ranged from 2.56 to 13.2 mg/L (Durlin and Schaffstall, 1998). This range is directly related to the predominant land use in the Little Conestoga Creek Basin (watershed) and the associated underlying bedrock. Sites in the lower basin having greater than 80% agricultural land use had the highest nitrate concentrations (11.7 – 13.2 mg/L). Elevated nitrate concentrations, in relation to the other sites, were also measured at al the remaining predominately agricultural (greater than 80%) subbasins. Nitrate concentration at these sites ranged from 7.31 to 9.61 mg/L. Sites 1, 12, 13 and 14 had nitrate concentrations that approximated or exceeded the nitrate drinking water standard. Nitrate in drinking water at levels in excess of 10 mg/L can result in methemoglobinemia (blue-baby syndrome) in bottle-fed infants up to 6 months old (USGS, 1998).

Probably because of the predominantly agricultural land use in the basin, nitrate concentrations were sufficiently elevated (Significantly above 0.3 mg/L) to cause increased plant productivity that could lead to reduced levels of oxygen in ponds. Levels of oxygen that are too low can adversely affect or be fatal to aquatic organisms (USGS, 1998).

A comparison between nitrate data from Site 15 (5.77 mg/L) and data from a similarly located site in a 1976 base-flow study (3.96 mg/L) indicates a small positive difference in nitrate concentration (Brezina, 1980). Another study in 1985 measured an 8.57 mg/L nitrate concentration in the Little Conestoga Creek north of the confluence with the West Branch (McMorran, 1986).

The heaviest nitrate loads entering Little Conestoga Creek were at Site 1 (166 lb/d), Site 12 (272 lb/d) and Site 13 (366 lb/d). Even though Site 14 (Indian Run) had the highest nitrate concentration, the nitrate load was not excessive because of the relatively small stream flow (USGS, 1998).



Site number on figure 1	Total nitrogen, in milligrams per liter as nitrogen	Total phosphorus, in milligrams per liter as phosphorus	Relative degree of nutrient impairment, as a percentage of most impaired nutrient water quality
1	9.88	0.048	68
2	8.60	[1]<.01	38
3	8.90	.027	52
4	7.60	.053	62
5	5.85	.061	59
6	5.58	.028	39
7	2.66	[1]<.01	14
8	4.50	.031	36
9	5.42	.058	56
10	4.04	.097	72
11	2.89	.039	34
12	13.30	.060	90
13	12.06	.081	96
14	13.46	.077	100
15	6.21	.073	68

[1] Set to 0.005 for use in calculations.

Figure 6. Relative degree of nutrient impairment, as percentage of most impaired nutrient water quality, at sites sampled in the Little Conestoga Creek Basin, Lancaster County, Pa., on Sept. 13, 1997.

USGS 1998 Graphic

To further characterize the degree of nutrient impairment in the Little Conestoga Creek Basin, phosphorous concentrations were evaluated. Phosphorus concentrations were evaluated at sites in the basin were consistently below the 0.1 mg/l recommended upper limit for total phosphorus established by USEPA. More than 50% of the total phosphorus at all sites was comprised of dissolved phosphorus. This indicates that the phosphorus originated from groundwater base flow or from the flushing of dissolved phosphorus from the soil rather than from suspended phosphorus, which is bound to stream sediment (USGS, 1998).

Daily phosphorus loads leaving the tributaries and Main Stem of the Little Conestoga Creek Basin are small in comparison to the respective nitrate loads. The cumulative phosphorus load from Site 15, at the mouth of the basin, was 11 lb/d. The phosphorus load nearly doubled between Main Stem Sites 9 and 10 because of a rise in phosphorus concentration. The cause of this rise was not determined and be related to several factors, such as leaking sewer pipes, fertilizer application, or stormwater runoff (USGS, 1998).

Concentration of dissolved ammonia ranged from less than 0.015 to 0.079 mg/L. Evaluation for ammonia toxicity to aquatic life at Site 8-15 determined for ammonia concentrations were not sufficiently high to be harmful to fish (USGS, 1998).

The Senior Environmental Corps and "Stream Team" from the Lancaster Academy routinely monitor four locations within the Little Conestoga Creek Watershed. These locations are near RETTEW monitoring stations #4 (Main Stem below confluence with West Branch), #6 (West Branch), #14 (Swarr Run, but one farm below the RETTEW site) and #19 (Main Stem upstream of Miller Road).

Both groups monitor for alkalinity, dissolved oxygen, pH, conductivity, air temperature, water temperature, nitrate, phosphate, flow and sulfate. Alkalinity measurements at all stations were 160 mg/L or greater indicating good buffering capacity for acid precipitation and good biological productivity potential. Power of hydrogen (pH) readings are typically alkaline (7 to 8.6), except for a few high 6 ratings (6.5 to 7.0) at times on the Main Stem at monitoring station #4. Dissolved oxygen readings at all station have been 7.0 mg/L or better. Nitrate and phosphate readings are similar to the 1998 USGS findings in regards to how the stations compare with each other, but Senior Environmental Corps readings of nitrates have been consistently higher in concentration; the end result is the same however – that being the Little Conestoga tends to have a nitrate overload problem.

Water temperatures readily agree with the fish assembles found there in regards to warmwater and coldwater species. One interesting note is that water temperatures on the Main Stem above Miller Road near East Petersburg Borough are just slightly warmer in the summer months (22° C – 71.7° F) than are tolerated by coldwater species. This shows promise that indeed this section of stream could potentially be good "trout water" if stream restoration focusing on thermal pollution takes place. Restoring forested riparian buffers in this area could really make a difference in the aquatic community, changing it potentially from a coolwater fishery to a coldwater fishery as was likely the original/natural case.

RARE, THREATENED AND ENDANGERED SPECIES

> *The last word in ignorance is the man who says of an animal or plant "what good is it?". If the land mechanism as a whole is good, then every part is good, whether we understand it or not. If the biota, in the course of aeons has built something we like but do not understand, then who but a fool would discard seemingly useless parts? To keep every cog and wheel is the first precaution of intelligent tinkering.*
>
> \- Aldo Leopold (1949)

In Pennsylvania, the Pennsylvania Natural Diversity Inventory (PNDI) program is the means by which rare, threatened and endangered animals and plants are inventoried, tracked and protected. PNDI is also associated with the protection of unique natural communities and outstanding geologic features.

The Pennsylvania Department of Natural Resources, Pennsylvania Game Commission, Pennsylvania Fish and Boat Commission, United States Fish and Wildlife Service and Pennsylvania Biological Survey are all associated with Pennsylvania's PNDI program. Each agency provides the program's huge database with up to date information; thus the inventory is ongoing and ever changing.

Mr. Robert Corbin, Conservation Data Manager with the Bureau of Forestry, Pennsylvania Department of Natural Resources, was most helpful in providing information regarding rare, threatened and endangered species within the Little Conestoga Creek Watershed.

According to Corbin, PNDI's database indicates the presence and/or historical presence of 5 species/features of concern. They are as listed below:

Geologic feature	Invertebrate fossil animals	
Bird	Yellow-crowned night heron (*Nyctanassa violacea*)	Threatened
Bird	King Rail (*Rallus elegans*)	Endangered
Plant	Limestone petunia (*Ruellia strepens*)	Threatened
Plant	Lance fog-fruit (*Phyla lanceolata*)	Undetermined

The purpose of this particular chapter is not to provide a specific location for the various rare, threatened and endangered species within the watershed. PNDI withholds specific locations for security and protection reasons. However this chapter is intended to make the Little Conestoga Watershed Alliance aware of the fact that these species and features are within the watershed. Hopefully the Alliance can remain cognizant of their existence and be on the lookout for possible impacts. By understanding what each specie or feature is, the Alliance may be able to recognize potential impacts and serve as a first line of defense. The Alliance membership may in fact discover or reestablish a new or historic finding.

Invertebrate Fossil Animals

There are various invertebrate fossil beds within the watershed. For years, Franklin and Marshall College geology professors and students have known about and frequented such fossil beds within the Millers Run Sub-watershed.

Trilobite fossils are routinely found in the watershed if you know where to look and what to look for.

Yellow-crowned night heron (*Nyctanassa violacea*)

This bird is similar in size and body configuration to the closely related black-crowned night heron, except that the yellow-crowned has slightly longer legs (standing height about 1.5-feet). It has a yellow patch on its head, a gray body, and a black and white face. The call, a strident *kwawk*, is slightly higher-pitched than that of the black-crowned.

Yellow-crowned night herons hunt mainly at night but also at times during the day. They eat frogs, fish, salamanders, lizards, and insects. They nest colonially, sometimes with other herons (in rookeries). The stick nest is built in a tree or shrub and may be lined with fine twigs, rootlets, or leaves. Both sexes build, or they may re-use an old nest. This species is more secretive in its nesting habits than our other herons, with the exception of the bitterns. Eggs: 3-4 smooth, pale bluish-green, unmarked. Incubation is by both sexes.

In spring, yellow-crowned night herons migrate through our state in April and early May. In summer, they are breeding residents in the southeastern area; most nesting that does occur is concentrated in Cumberland, Lancaster, and Montgomery counties. In fall, they are rare August-October migrants; and they winter principally in the southern U.S., Middle America, and South America. (PA Game Commission – Wildlife Notes)

The Pennsylvania Department of Conservation and Natural Resources

THREATENED

Yellow-Crowned Night Heron

Nycticorax violaceus

Photo Credit: A. & E. Morris, VIREO

IDENTIFYING CHARACTERISTICS: Adults are 22 to 28 inches in length, from bill tip to tail tip, gray with black head and a whitish cheek patch and crown. Eyes are red and legs yellowish. Immature is brown, finely spotted and streaked with white buff.

BIOLOGY-NATURAL HISTORY: Pennsylvania lies at the northern fringe of this species' breeding range, which is mainly in the south-central United States. It nests singly or in small groups in the lower reaches of the Susquehanna. A typical clutch contains three or four eggs. Nesting starts as early as April. By mid-summer most young have fledged. Crayfish are a major part of this bird's diet.

PREFERRED HABITAT: Feeds mainly along small shallow streams. Nests in brush or trees, usually sycamores, found on islands or along streams. Most nests found in recent years are along the Susquehanna River and its tributaries, in Lancaster County.

REASONS FOR BEING THREATENED: As a breeding bird, the combination of rarity and tendency to nest in small groups makes this species particularly vulnerable to local habitat disturbance or loss. The largest nesting colony known in Pennsylvania, representing more than half the state's known breeding population, is on a small river island. The integrity of this site and nearby shallow-water feeding areas are threatened by a proposed dam. Degradation of water quality, along with loss of the primary food source – crayfish – is an ever-present threat.

MANAGEMENT PRACTICES: Known nest sites for this species are monitored and potential new sites need to be surveyed. Whenever possible, nesting habitats need to be protected.

King Rail (*Rallus elegans*)

A large, rusty rail with a long, slender bill; twice the size of a Virginia Rail, or about that of a small hen. Similar to Clapper Rail but more rusty; prefers fresh marshes.

Height: 15-19-inches (38-48-centimeters)

Voice: A low, grunting bup-bup, bup-bup-bup, etc., or chuck-chuck-chuck.

Range: East U.S. to Cuba, Mexico (rarely). Migrant in North.

Habitat: Fresh and brackish marshes, rice fields, swamps. In winter, sometimes salt marshes.

Nesting: 6-16 spotted buff eggs in a deep bowl of grass, often with surrounding marsh grass pulled down and woven into a dome.

DCNR The Pennsylvania Department of Conservation and Natural Resources

ENDANGERED

King Rail

Rallus elegans

Photo Credit: Lawrence Wales, Cornell Lab of Ornithology

IDENTIFYING CHARACTERISTICS: The king rail is so named because of its large size and bright coloration. This plump chicken-sized bird is a bright rusty color. They range from 15 to 19 inches in height and have 21- to 25-inch wingspans. Males are larger than females. Bills are long, slightly decurved, and yellow with brown tips. These birds are extremely secretive and would rather run than fly to escape detection. They are rarely seen, therefore, and are most often located by their loud calls, a resonant grunting bup-bup, bup, bup, bup, more rapid at the end.

BIOLOGY-NATURAL HISTORY: King rail nests are platforms up to nine inches in diameter, six to 18 inches above the water. They are built of grasses, sedges and cattails in shallow water marshes, and roadside ditches. From six to 15 pale, slightly spotted brown eggs are laid in a shallow depression of the nest. Overhead cover is often pulled over the nest. Young are able to fly about 60 days after hatching. Wading in shallow water, king rails feed on crustaceans, small fish, frogs and insects. In winter, food items consist of grains – particularly rice – and berries.

PREFERRED HABITAT: This rail lives in freshwater and brackish marshes and roadside ditches in eastern North America, primarily along the Atlantic coast. It is a very rare breeder in the few larger marshes remaining in Pennsylvania.

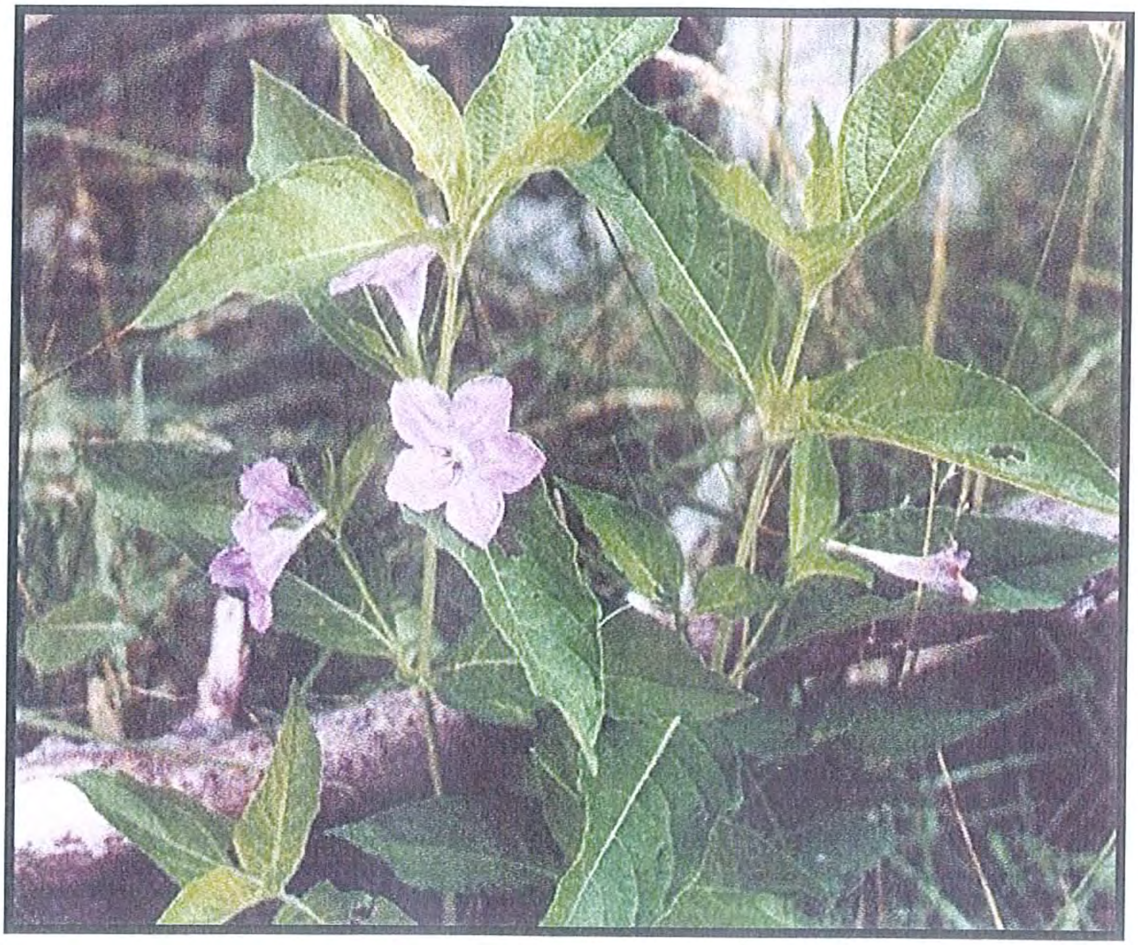
REASONS FOR BEING ENDANGERED: King rails were never common in Pennsylvania, but annual reports indicate the bird today is much less abundant than historically. This apparent decline is considered to be due primarily to losses of marshland habitat.

MANAGEMENT PROGRAMS: As with many other endangered and threatened species, the king rail needs wetlands in order to exist. Maintaining stable water levels during the summer will enhance the species' breeding success here.

Limestone petunia (*Ruellia strepens*)

Lance fog-fruit (*Phyla lanceolata*)

Ruellia strepens L.



Family - *Acanthaceae*

Stems - To 1m tall, erect, simple or branching, herbaceous, somewhat angled, glabrous or with pubescence in vertical rows.

Leaves - Opposite, petiolate, ovate, ovate-lanceolate, to oblong, typically entire or merely crenulate, glabrous to sparsely hairy, to 15cm long, 6cm wide. Petiole typically winged.

Inflorescence - One or two flowers, on peduncle, from leaf axils near middle of stem. Flowers subtended by a pair of foliaceous bracts.

Flowers - Corolla zygomorphic, to +5cm long, +/-4cm broad, 5-lobed, typically blue. Corolla tube with a constricted portion at base. Constriction white, to 2.5cm long, 3mm in diameter. Expanded portion of corolla tube to +1cm long, 1cm in diameter, pubescent. Corolla lobes +/-1.5cm long and broad, glabrous internally, pubescent externally with some glandular pubescence near the base. Stamens 4, didynamous, adnate at the apex of the constricted portion of the corolla tube. Filaments white, 1.3cm long, sparse pubescent at the base, glabrous above. Anthers yellow, 3mm long. Style -4cm long, sparse pubescent below, white. Stigma 2-lobed, curled. Ovary superior, with some glandular pubescence at apex near style, 4mm long, 1.3mm in diameter, conic, 2-locular. Calyx tube to 5mm long, 5-lobed. Lobes linear-lanceolate, 2-3cm long, 3mm broad, with long and short glandular pubescence, entire, erect. Capsules brown, glabrous, to 2cm long, explosively dehiscing.

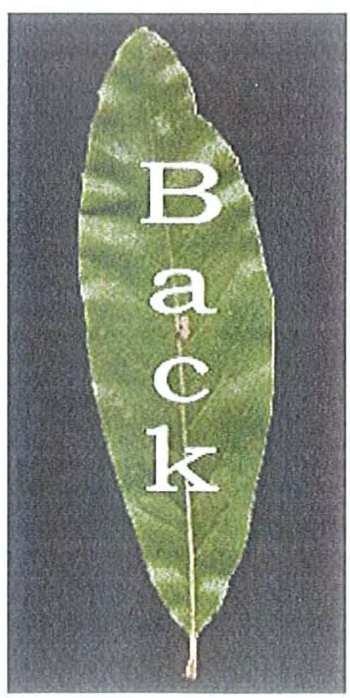
Flowering - May - October.

Habitat - Waste ground, disturbed sites, moist, open woods, streambanks.

Origin - Native to U.S.

Other info. - Although the corolla looks regular, it is typically zygomorphic, with one petal being slightly larger than the other four. The flowers of this species only last for one day but the plant produces many flowers while in bloom. This species is common and reminds many people of the non-related "Petunia" of cultivation.
Steyermark lists three forms for the plant based on flower color and size. Form ***strepens*** is shown above. Form ***alba*** **Steyermark** has a white corolla. Form ***cleistantha*** **(Gray) McCoy** has cleistogamous flowers but may not be a distinct form, rather a phase of form ***strepens***.

Photograph taken at the Kansas City Zoo, 5-28-99.



USDA Natural Resources Conservation Service

PLANTS Profile

Phyla lanceolata (Michx.) Greene
lanceleaf fogfruit

Symbol:	PHLA3
Group:	Dicot
Family:	Verbenaceae
Growth Habit:	Vine Forb/herb
Duration:	Perennial
U.S. Nativity:	Native

Printer-Friendly Version

Classification Distribution Images Invasive Links More Info Noxious Related Taxa Synonyms Wetland

Plant Photographs:

View all *Phyla* thumbnails at the PLANTS Gallery

More Information About lanceleaf fogfruit

classification

source & reference

Plant Synonyms:

PHLA3 ***Phyla lanceolata*** **(Michx.) Greene**

LILA10 *Lippia lanceolata* Michx.

LILAR *Lippia lanceolata* Michx. var. *recognita* Fern. & Grisc.

PHLAR *Phyla lanceolata* (Michx.) Greene var. *recognita* (Fern. & Grisc.) Soper

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Plant Distribution by State

Phyla lanceolata (Michx.) Greene

PHLA3

See county distributions for

© Image generated using gd 1.8

the following states by clicking on them below or on the map.

AR	CA*	FL*
IL	IA	KS
KY	MI	MO
NC	SC	SD
TN*	VA	WV
WI*		

* Offsite source.

Alabama	Florida	Kentucky	Missouri	North Carolina	Tennessee
Arizona	Georgia	Louisiana	Nebraska	Ohio	Texas
Arkansas	Illinois	Maryland	Nevada	Oklahoma	Utah
California	Indiana	Michigan	New Jersey	Pennsylvania	Virginia
Colorado	Iowa	Minnesota	New Mexico	South Carolina	West Virginia
Delaware	Kansas	Mississippi	New York	South Dakota	Wisconsin

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Related Taxa:

Phyla lanceolata (Michx.) Greene

View 31 genera in Verbenaceae, 7 species in *Phyla*

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Classification:

Phyla lanceolata (Michx.) Greene

Click on a scientific name below to expand it in the PLANTS Classification Report.

Kingdom	Plantae – Plants
Subkingdom	Tracheobionta – Vascular plants
Superdivision	Spermatophyta – Seed plants
Division	Magnoliophyta – Flowering plants
Class	Magnoliopsida – Dicotyledons
Subclass	Asteridae –
Order	Lamiales –
Family	Verbenaceae – Verbena family
Genus	*Phyla* Lour. – fogfruit
Species	*Phyla lanceolata* (Michx.) Greene – lanceleaf fogfruit

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Threatened and Endangered Plant Information:

This plant is protected by the U. S. federal government or a state. Common names are from state and federal lists. Click on a place name to get a complete protected plant list for that location.

New Jersey:
fogfruit Endangered

Pennsylvania:
fog-fruit Rare

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Wetlands Indicator Status:
Phyla lanceolata (Michx.) Greene

Nat. Ind.	Reg. 1	Reg. 2	Reg. 3	Reg. 4	Reg. 5	Reg. 6	Reg. 7	Reg. 8	Reg. 9	Reg. 0	Reg. A	Reg. C	Reg. H
FACW,OBL	OBL	FACW+	OBL	OBL	OBL	FACW	OBL	OBL	NO	FACW	NO	NO	NO

Interpreting wetland indicator status

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Other Species Accounts and Images:
Phyla lanceolata (Michx.) Greene

View species account from CalFlora.
View species account from USF Atlas of Florida Vascular Plants.
View taxonomic account from Integrated Taxonomic Information System (ITIS) for ITIS Taxonomic Serial Number 32196.
View species account or photographs from Wisconsin State Herbarium (UW-Madison).

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AQUATIC AND TERRESTRIAL HABITAT

An evaluation of habitat quality is critical to any assessment of ecological integrity and should be performed at each site at the time of the biological sampling. In general, habitat and biological diversity in rivers are closely linked (Raven, 1998).

RETTEW biologists performed a habitat assessment at each of the previously mentioned 28 monitoring stations (the same stations used for collecting macroinvertebrate and fishery data). Habitat investigations were performed using the United States Environmental Protection Agency's "rapid bioassessment protocols"; specifically the visual-based habitat assessment for low gradient streams (Form #3). A copy of the assessment procedure, taken from the United States Environmental Protection Agency's "Rapid Bioassessment Protocols for Use in Wadeable Streams and Rivers" is included in this writing so that the various assessed habitat parameters may be clearly understood by the reader.

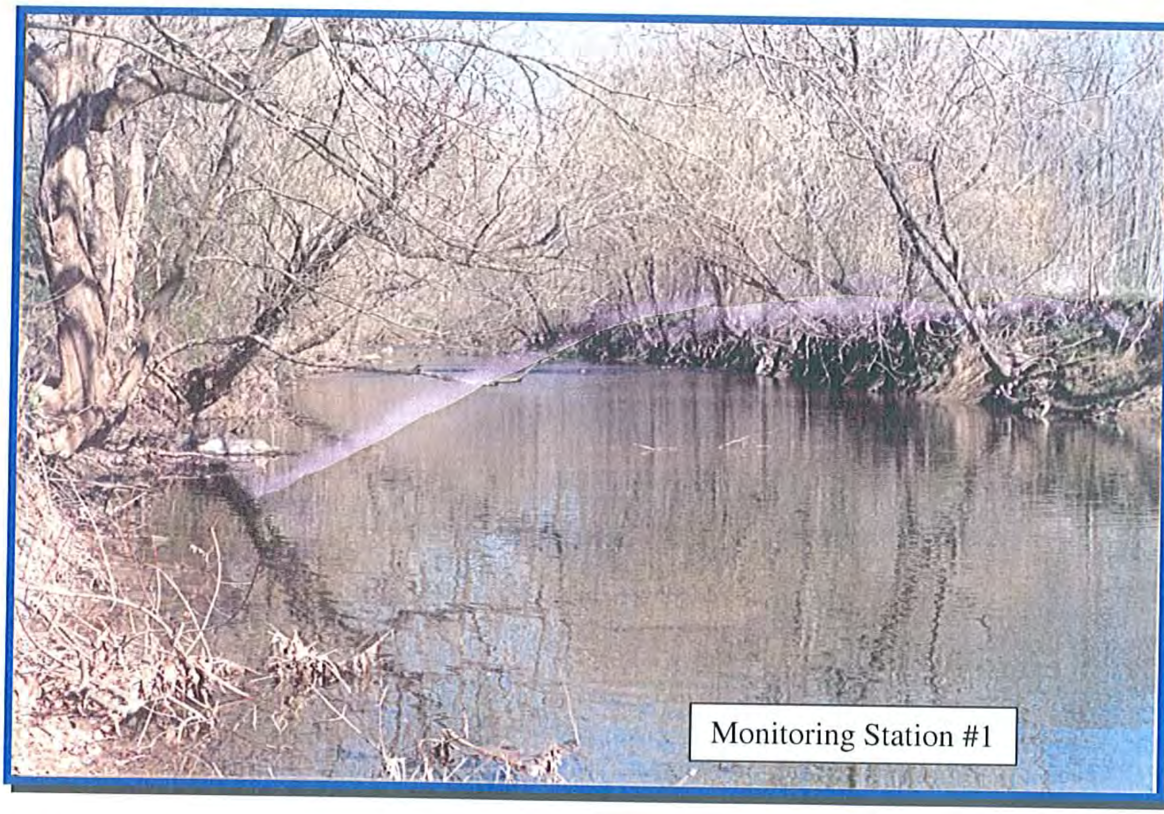
Habitat scores for each of the 28 monitoring stations is as follows:

LITTLE CONESTOGA CREEK – HABITAT SCORES

****The higher the number, the better the habitat component****

MONITORING STATION	EPIFAUNAL SUBSTRATE/ AVAILABLE COVER	POOL SUBSTRATE CHARACTERIZATION	POOL VARIABILITY	SEDIMENT DEPOSITION	CHANNEL FLOW STATUS	CHANNEL ALTERATION	CHANNEL SINUOSITY	BANK STABILITY	VEGETATIVE PROTECTION	RIPARIAN VEGETATIVE ZONE	TOTAL SCORE	RANKING (#1 being best station)
1	13	16	15	**17**	17	18	9	11	8	2	126	10
2	11	13	11	12	17	10	11	13	16	13	127	9
3	15	15	6	13	16	14	7	15	18	**17**	136	7
4	16	**18**	18	15	18	15	8	15	14	14	151	3b
5	17	16	18	15	16	19	14	10	12	12	149	4
6	18	14	17	15	17	16	8	9	8	9	131	8
7	13	12	10	11	18	12	6	9	7	3	101	15
8	19	**18**	**19**	15	18	18	6	**18**	**19**	**17**	167	2
9	17	16	15	15	18	17	6	16	11	4	135	8
10	10	13	14	13	18	12	10	10	11	12	123	11
11	8	16	14	13	16	14	13	14	17	16	151	3a
12	9	9	13	11	18	13	11	14	11	3	112	14
13	5	7	8	6	17	13	7	11	11	2	87	18
14	1	7	10	8	16	14	13	0	2	0	71	20
15	**20**	**18**	**19**	16	**19**	**20**	**17**	17	16	12	**174**	**1**

16	12	11	9	11	15	7	9	13	**19**	15	121	12
17	10	8	7	5	12	8	12	16	12	10	100	16
18	16	16	16	14	15	14	10	13	16	9	139	6
19	17	14	13	12	16	13	14	16	16	10	141	5
20	8	8	11	5	14	10	6	8	6	2	78	19a
21	4	6	5	6	11	10	6	12	10	8	78	19b
22	7	9	8	10	16	7	5	14	10	2	88	17
23	14	13	10	12	16	13	13	13	12	4	120	13
A1	14	13	13	12	15	13	9	16	10	8	123	N/A
A2	10	9	9	9	11	9	10	11	8	4	90	N/A
A3	13	13	10	11	16	14	9	12	14	10	122	N/A
A4	12	13	12	10	12	13	11	14	10	8	115	N/A
A5	17	17	10	15	15	18	13	14	18	12	149	N/A



Monitoring Station #1

Monitoring stations #1 and #2 are located on the Main Stem at the very bottom of the watershed, with station #1 being located at the confluence with the Conestoga River and station #2 being located approximately 5, 200-feet upstream at the mouth of Indian Run. Both stations exhibited similar in-stream habitat characteristics with station #2 having a better riparian zone of trees and shrubs along its banks. Both pools have sediment free substrates comprised of cobble, boulder and bedrock seams providing good cover for fish and aquatic insects.


Monitoring Station #2


Monitoring Station #3

Monitoring station #3 is located in Indian Run upstream of Indian Run Road. This section of stream flows through a wooded valley surrounded by farmland. The riparian zone surrounding this station is excellent, with a variety of native hardwood trees and shrubs providing an excellent forest buffer between the stream and cropland. Streambank erosion is typical of such a wooded setting and the substrate is fairly sediment free. The only shortcoming is the actual size of the stream. It is small - quite narrow and shallow (averaging less than 3-inches in depth); thus limiting the variety, numbers and size of fish. There are a few deeper pools (up to 1.5-feet deep) that harbored some larger white sucker.

Monitoring station # 4 is located on the Main Stem at the confluence with the West Branch. This station is located in a very scenic forested valley. Because of its undisturbed, natural stream channel and riparian zone condition, this location should be thought of and used as a reference and/or model for future restoration endeavors in the lower half of the Main Stem. This station exhibits all the "good things" one strives to restore when going about improvement projects – forest buffer, in-stream cover, stabile streambanks, sediment free substrate, riffle and pool habitats.

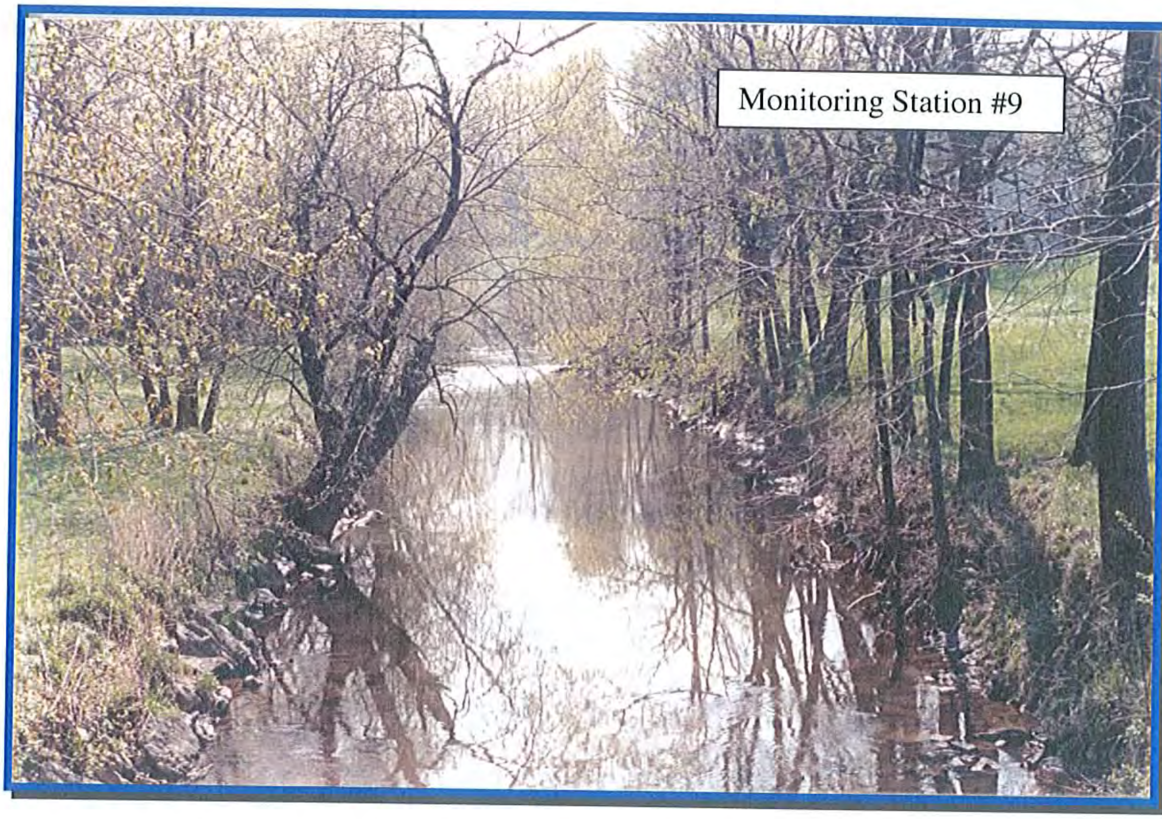
Monitoring Station #4

Monitoring station #5 is located on the West Branch approximately 1,000-feet upstream from the confluence with the Main Stem. Remnants of a breached earthen dam are evident in this location, with station #5 being located behind where the dam had once stood. The station is located in a forested valley. The northern streambank is very high (over 10-feet), vertical and eroding at an accelerated rate, while the southern streambank (located on the inside of the stream channel's bend) consists mainly of a large gravel bar gently sloping up into the adjoining woodland. Though the northern streambank is eroding, it none-the-less provides great fish habitat in its undercuts. Still an effort should be made to stabilize the northern bank.

Monitoring station #6 is located on the West Branch just upstream of Bender Mill Road in farm country. Here the West Branch is obviously impacted by the surrounding agricultural landuse. Streambank erosion is occurring on both banks and little exists in the way of a forest buffer; rather much of the area adjacent to the stream is either in pasture or consists of mowed grass fields. This reach of stream could be vastly improved by simply planting an adequate forest buffer.

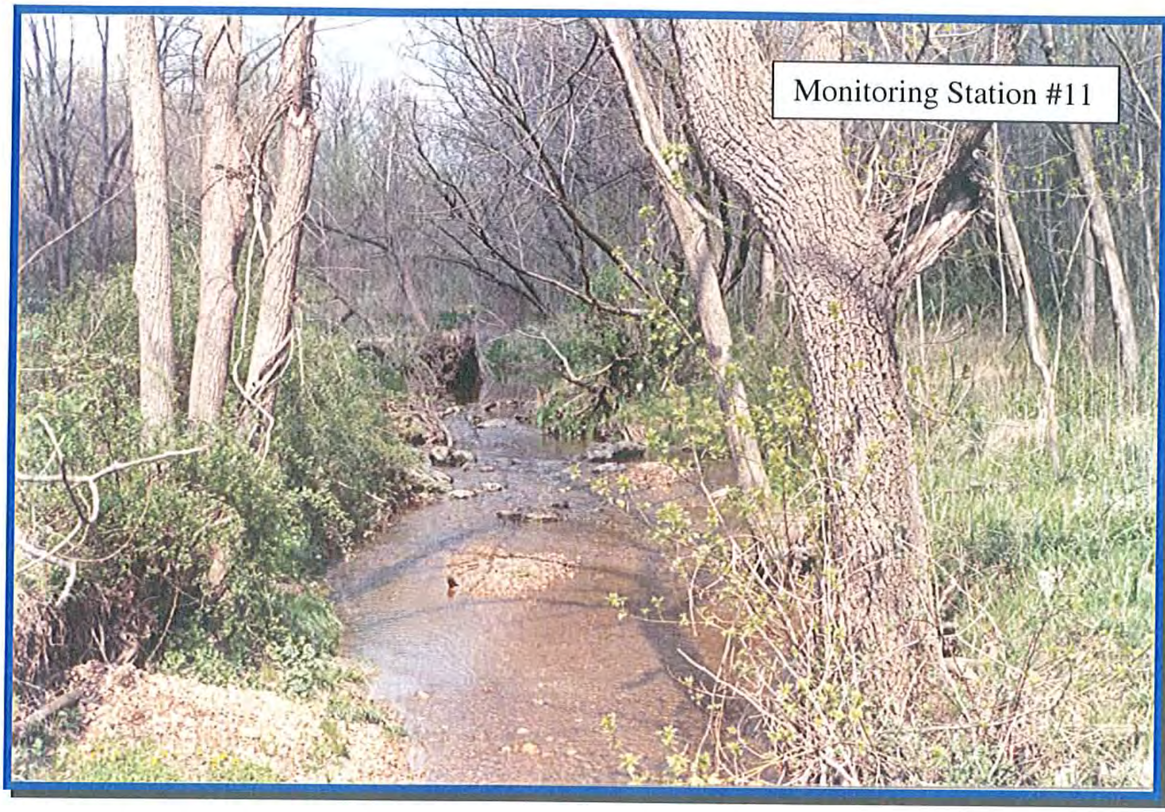
Monitoring station #7 is located in the West Branch headwaters immediately downstream of Route 464 "Columbia Avenue". This area is highly developed, consisting of commercial and residential landuse. This section of stream ranked rather low in all habitat categories. Stormwater from Columbia Avenue and the surrounding developed area certainly influences water quality in this location. A considerable amount of litter was observed in the stream in this location, as well as dump lawn clippings from area residents.

Monitoring station #8 is located on the Main Stem upstream of Route 999 "Blue Rock Road". The western streambank is steeply sloped and forested, while the eastern bank gives way to a large floodplain serving as backyards to adjoining properties. This reach a stream scored very high in most of the evaluated habitat parameters, coming in second best when compared with the other stations. Long deep pools with woody debris for fish cover characterized this location.



Monitoring station #9 is located on the Main Stem in Manor Park just downstream and south of Charlestown Road. Much of the stream in this area is immediately bordered by mowed lawn. Only a few larger trees line the streambank, native shrubs and other herbaceous plants are rare. Obviously the forest buffer in this area could be much improved. In-stream cover was adequate for smaller fish, but larger cover structure for larger fish such as Smallmouth bass was limited.

Monitoring station #10 is located on the Main Stem within Maple Grove Park just south and downstream from Route 462 "Columbia Avenue". This area has recently undergone some habitat improvement work consisting of a forest buffer planting and stream channel stability measures such as the rock cross-vane depicted in the above photograph. The habitat quality in this reach of stream should improve somewhat as the forest buffer matures. However, the western streambank below the Maple Grove Mill building consists of a vertical concrete wall that will likely continue to limit site recover unless it is removed and the natural streambank restored.



Monitoring station #11 is located on Brubaker Run within a park owned by East Hempfield Township approximately 1,300-feet upstream from the confluence with the Main Stem. This reach of stream is surrounded by a healthy forest buffer and for the most part is in a wooded setting. Brubaker Run, although a smaller stream, exhibits good habitat features in this location. Such is not the case further upstream where Brubaker Run is surrounded by commercial landuse.

Monitoring station #12 is located on the Main Stem immediately downstream of Route 23 "Marietta Pike". This section of stream is located in a residential setting where backyard lawns encroach right up to the top of the streambank, offering little in the way of forest buffer and riparian habitat. Habitat under the water and within the channel isn't any better. Much of the substrate is sediment laden and little overhead cover exists for larger fish.

Monitoring station #13 is located in an urban/commercially developed setting on the upstream side of the Old Harrisburg Pike near Park City. The lack of in-stream cover for fish and the tightly embedded, sediment laden substrate really limits fishery potential in this Main Stem reach. Litter was quite common. The majority of the Park City shopping complex does not have any sort of stormwater management in the way of detainment. The stream channel in this location shows signs of streambank erosion due to flashy stormwater flooding events. The stream channel is very wide compared to its overall depth and baseflow depth. The channel is overly wide to accommodate flashy flooding events.

Monitoring Station #14

The worst monitoring station in regards to habitat quality was station #14 located immediately downstream of State Road in East Hempfield Township. Station #14 is located in a pasture where dairy heifers have free access to Swarr Run. The pastureland is severely overgrazed and streambank erosion is excessive. Swarr Run's substrate in this local is sediment-laden and severely trampled by wading livestock. No other single farm within the entire Little Conestoga Creek Watershed exhibited such an overwhelming abuse of the stream and riparian zone. Other farms have "hot spots", like a small feed lot or exercise lot, but no other single farm impacts over one-half mile of stream corridor!


Monitoring Station #14


Monitoring Station #15

Ironically, the best monitoring station in regards to habitat quality was monitoring station #15 located upstream of State Road and station #14. The difference between stations #14 and #15 is dramatic; with channel width being the most apparent difference. The un-trampled stream channel at station #15 is less than half the width of the trampled stream channel at station #14. Station #15 is located in a sheep pasture that fortunately is not overgrazed. The stream isn't bordered by many trees and shrubs, but a good stand of filtering grasses and other herbaceous plants line the streambanks. The streambanks are stabile and do not show signs of accelerated erosion, though they are undercut in some locations providing excellent overhead cover for fish. The substrate in the riffle areas is fairly void of sediment.


Monitoring Station #16

Monitoring station #16 is located on the Main Stem just downstream from Flory's Mill south of Route 283. Below Flory's Mill, the stream channel is unaltered and flows through a forested area whereas at Flory's Mill, the stream is artificially channeled and actually flows under a portion of the old mill building. Station #16 had suitable in-stream habitat for larger fish and is a popular stocked trout fishing location.

Monitoring station #17 is located on a small un-named tributary just south of Route 283 on the Kolb Farm. The un-named tributary enters the Main Stem just below Flory's Mill. In 1997, students from the Lancaster County Academy installed streambank fencing and planted trees and shrubs along this pastured section of stream. The pasture had previously been overgrazed and streambank erosion due to excessive cattle trampling resulted. Since the fencing project, the stream has shown signs of recovery. The streambanks are re-vegetated and the channel is being to narrow and deepen. This section of stream should improve as the planted forest buffer matures and the stream purges itself of its previous sediment load.

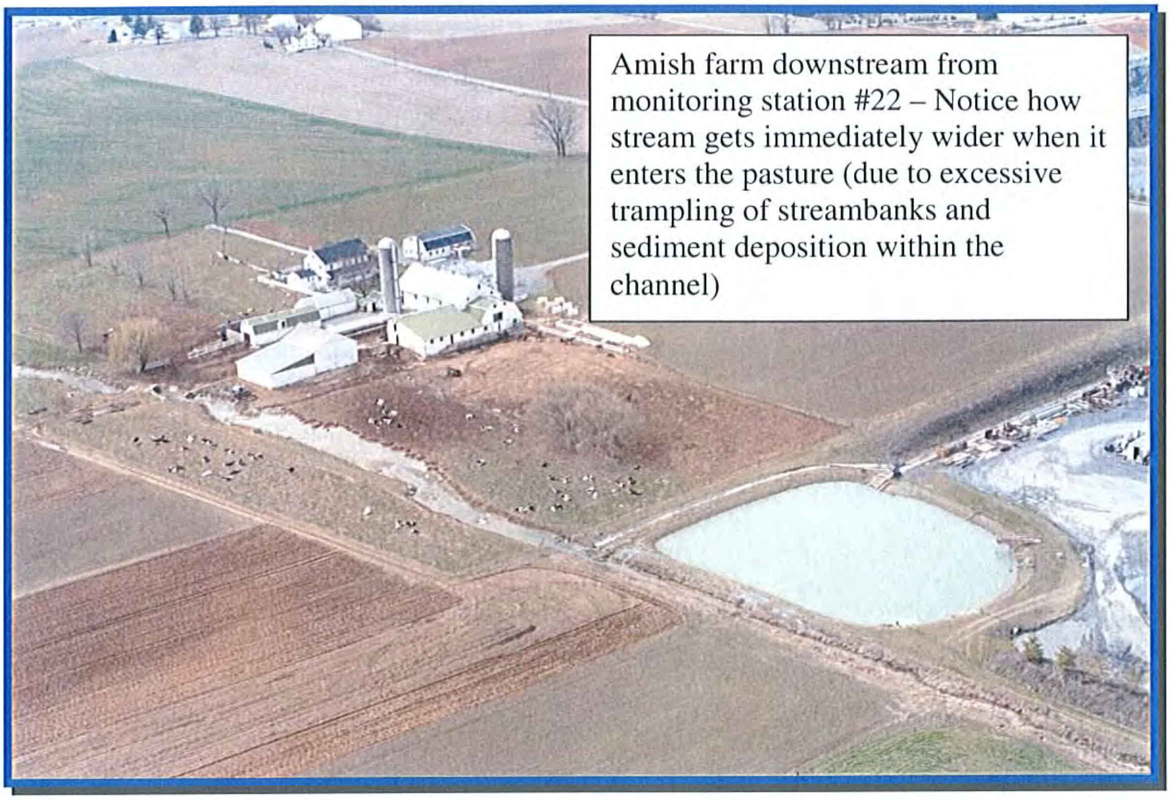
Monitoring station #18 is located on the Main Stem on property owned by PPL just north of Route 72 "Manheim Pike". In 1997, PPL completed a stream restoration project involving a forest buffer planting and installation of in-stream channel stability controls designed by consulting firm LandStudies of Lititz, Pennsylvania. This section of stream is recovering quite nicely. The various channel stability controls (rock weirs, cross-vanes and root wads) seem to be functioning properly, providing both stability and riffle/pool habitats for fish. The Little Conestoga Watershed Alliance should consider this restoration work a prime example of properly designed and installed in-stream channel stability control measures.

Monitoring station #19 is located on the Main Stem just above Miller Road east of East Petersburg Borough. This area shows great promise for a future trout fishery. In-stream cover for fish is excellent. Much of the immediate upstream area is wooded and/or fallow. The area also contains several springs that serve to recharge the stream and steady cool water temperatures.

Monitoring station #20 is located on Bachman Run immediately upstream of Fruitville Pike in the Wetherburn residential development. Currently this reach of stream is in poor condition. The substrate is heavily sediment laden. Little exists in the way of a forest buffer, only a few trees in backyard lawns line the eastern bank. Much of the eastern streambank from Fruitville Pike upstream to Route 772 "Petersburg Road" (a distance of approximately 2,300-feet) is grass lawn. A crop field that is usually planted in either corn or soybeans, but is slated for residential development in the near future borders the western bank. The Little Conestoga Watershed Alliance has received a Growing Greener Grant in the amount of $52,125.00 to restore Bachman Run more-or-less from Fruitville Pike upstream to Route 772 "Petersburg Road". Residents of Wetherburn and developer Barry Hogan are supportive of the restoration project.

Monitoring station #21 is located on Bachman Run just north and upstream of Koser Road in the Wetherburn North development. In the spring and summer of 2002, Donegal Trout Unlimited and Little Conestoga Watershed Alliance members planted various trees and shrubs along this section of stream and established a good rapport with area residents. As was discussed earlier in this writing, the flow in this section of stream is heavily influenced by pumped water (or the lack of it) from Rohrer's Quarry located upstream. When the quarry pumps are running, the stream has plenty of flow and offers adequate cover and suitable habitat for fish. However when the pumps are off, the water nearly vanishes from the stream channel during the summer months, making the stream an unsuitable habitat for fish. Upstream sink holes and East Petersburg's drawing of water from a municipal well also likely play a role in the fluctuation of baseflow volume. This entire situation deserves closer attention and investigation.

Monitoring station #23 is located in the very headwaters of Bachman Run above Rohrer's Quarry. This spring fed section of Bachman Run supports a fishery though the channel itself has been realigned to follow property lines. The section of stream along Rohrer's Quarry is well vegetated with herbaceous plants, but lacks trees and shrubs. The stream itself appears healthy. The substrate is sediment free and the streambanks are stabile. The stream however takes an immediate turn for the worst when it exits the quarry property and enters into the adjoining downstream Amish farm. The stream flows through an exercise/turnout lot for dairy cattle where it surely collect animals waste during storm events and direct defecation into the water by wading livestock. Piles of manure and household trash were observed in back of the barn along the stream; to be easily washed away downstream with the next sizable storm event.



Amish farm downstream from monitoring station #22 – Notice how stream gets immediately wider when it enters the pasture (due to excessive trampling of streambanks and sediment deposition within the channel)

Monitoring Station #23

Monitoring station #23 is located in the headwaters of the Main Stem at Route 772 "Petersburg Road/Graystone Road". Downstream of Route 772, habitat conditions are fair as the stream flows through fallowing pastureland. Above Route 772, the stream is bordered on the west by East Petersburg Water Authority's pump station and to the east by residential properties.

Monitoring station #A1 is located on an un-named tributary located just north of Charlestown Road in Manor Township. The above pictured section of stream (where station #A1 is located) was the site of a recent (spring 2002) stream restoration project by the Little Conestoga Watershed Alliance. RETTEW Associates, Inc. provided project design and construction oversight. This section of stream previously suffered from severe streambank erosion due to ill-managed stormwater and the encroachment of lawn mowers into the riparian zone. The restoration project included a forest buffer planting, bioengineering, and the installation of rock weirs, mud sills and boulder placements to provide channel stability and fish habitat. After one growing season and some rather intense storm events, all improvements seem to be doing fine.

Monitoring stations #A2, #A3 #A4 and #A5 are all located further upstream from station #A1.


Monitoring Station #A4


Monitoring Station #A5

Municipality	Recommendations Stemming from Municipal Comprehensive Plan
Lancaster County	1. Preserve, conserve, and improve surface and groundwater resources for human and non-human use.
City of Lancaster	Adopted 1993- 1. Direct storm water runoff into ground water recharge facilities and not into the sanitary sewer system.
East Hempfield Township	Adopted January 1994- 1. Prohibit use of on-lot utilities to accommodate growth areas, as Township will ultimately be asked to extend utilities or retrofit package system when on-lot systems fail; 2. Promote the use of clustering to provide more usable open space within each development; 3. Protect sensitive, unique and/or valuable environmental features throughout the Township; 4. Seek to protect remaining concentrations of woodland; 5. Identify means to assure that adequate water quality and quantity is provided for domestic use and firefighting purposes; and 6. Require adequate storm water management measures that prevent adverse impact to surrounding properties and watercourses.
East Petersburg Borough	None
Lancaster Township	Adopted September 16, 2002- 1. Following up on the success of the award winning Little Conestoga Creek restoration project in Maple Grove Park by identifying opportunities and seeking grant funding for additional, similar projects in the Township; 2. Using modifications sparing when they deal with the impacts to natural resources; 3. Develop a series of education articles for publication on the Township web site and in the newsletter detailing the importance of riparian buffers, wetlands, etc.; 4. Encouraging and supporting the formation of citizen preservation groups.
Lititz Borough	Adopted December 8, 1999- 1. Discussion of developing conservation corridors that protect natural and cultural features (such as creeks, 100-year floodplains, wetlands, steep slopes > 25% from negative impacts associated with development); 2. Consider requiring a 35 feet riparian or forested buffers along streams, creeks, and wetlands; 3. Consider specialized preservation techniques for well head and aquifer recharge areas, particularly the primary zones of influence; 4. Develop a riparian corridor preservation and streambank restoration; 5. As part of the Stormwater Management Ordinance establish riparian buffer and easement regulations under Best Management Practices; 6. Utilize a four-step process for the subdivision and land development of tracts containing primary or secondary conservation corridors; 7. Develop specific zoning regulations for parcels affected by the conservation corridors by allowing flexibility of lot sizes based on maximizing open space; and 8. Develop natural resource compensation re

Manheim Township	Adopted April 1995- 1. Protect environmentally sensitive land, water and wildlife resources that present development hazards or serve highly valuable ecological functions by requiring mitigation of adverse impacts or by regulating development in these areas; 2. Ensure that proposed development complies with State and Federal wetland regulations; 3. Minimum lot size requirements should be adequate to assure dilution of effluent for on-lot sewage disposal; 4. Protect groundwater recharge areas from land uses that generate harmful pollutants; 5. Promote land use patterns and practices that will protect water quality while allowing for the accommodation of development; and 6. Protect surface water from point-source pollution through sewage facilities planning that limits private on-site package treatment plants.
Manor Township	Adopted February 1999- 1. Encourage implementation of clustering and livable communities concepts in Township Zoning Ordinance in an effort to protect natural areas of the Township; 2. Encourage preservation of prime agricultural areas, floodplains, woodlands, stream valleys, historic areas, and areas of natural resource extraction; 3. Encourage the formation and/or continuation of watershed associations to address the problems of water quality at the local level and to maintain high quality streams; 4. Work to obtain open space easements to protect selected stream valleys and scenic areas of the Township; 5. Enforce regulations restricting development in the Township's designated floodplain areas; 6. Enforce zoning, subdivision and land development, and storm drainage ordinance provisions and enact new provisions, as needed, to minimize the adverse effects of stormwater runoff, soil erosion, and sedimentation from construction and/or agricultural activities; 7. Support the implementation of Lancaster Inter-municipal Committee Plans.
Millersville Borough	1. To conserve and protect important natural resources from degradation; 2. Revise Storm Water Management Ordinance to actively promote Best Management Practices; 3. Conserve the natural quality of the Conestoga Riverfront and "The Bush"; 4. Revise Subdivision and Land Development Ordinance to include standards to disperse storm water away from sinkholes, closed depressions and other karst topography; 5. Work with the LIMC and other appropriate parties to create resource conservation greenways along the Conestoga and Little Conestoga Creek.
Mountville Borough	None
Penn Township	Adopted June 1993 and Updated in September 2000- 1. Develop a special subdivision and land development process to identify presence or absence of primary or secondary conservation areas at the time of subdivision or land development; 2. Develop a 35 foot riparian or forested buffer along the streams, creeks, and wetlands; 3. Utilize a four-step process for the subdivision and/or development of tracts containing primarily or secondary conservation areas; 4. Develop specific regulations for parcels affected by the conservation corridors; 5. Utilize Best Management Practices for the protection of the conservation areas; 6. Provide developers not affected by primary or secondary conservation areas but with the desire to integrate open space into the development, to utilize the same subdivision and land development

	process and zoning provision by right; 5. Consider the adoption of a local Subdivision and Land Development Ordinance; and 6. Monitor and update where needed On-lot Sewage Disposal Management Programs.
Warwick Township	Adopted December 8, 1999- 1. Discussion of developing conservation corridors that protect natural and cultural features (such as creeks, 100-year floodplains, wetlands, steep slopes > 25% from negative impacts associated with development); 2. Consider requiring a 35 feet riparian or forested buffers along streams, creeks, and wetlands; 3. Consider specialized preservation techniques for well head and aquifer recharge areas, particularly the primary zones of influence; 4. Develop a riparian corridor preservation and streambank restoration; 5. As part of the Stormwater Management Ordinance establish riparian buffer and easement regulations under Best Management Practices; 6. Utilize a four-step process for the subdivision and land development of tracts containing primary or secondary conservation corridors; 7. Develop specific zoning regulations for parcels affected by the conservation corridors by allowing flexibility of lot sizes based on maximizing open space; and 8. Develop natural resource compensation re
West Hempfield Township	Adopted 2001- 1. Consider necessary amendments to the Zoning Ordinance and Subdivision and Land Development Ordinance to allow for more innovative features of conservation design developments, and neo-traditional developments. Sections that may need updating include street design, to allow for pavement width reductions for traffic calming in addition to stormwater benefits from reduced impervious coverage, to encourage looping streets over single-ended cul-de-sacs, and to permit alternative single-ended street designs storm water management, to allow for the use of non-structural Best Management Practices, and to require groundwater recharge of the "first flush" of storm water runoff, and to give credit for use of porous pavement and landscaping; 2. Encourage the use of the Township's Open Space Design Option to protect critical and sensitive land and water resources; 3. Continue to administers the Township's Zoning and Subdivision and Land Development Ordinances provisions intended to protect the Township's natural and cultural resources, including those provisions related to the use of floodplains, wetlands, steep slopes, and other resources; 4. Consider enhancements to the Township's wetland provisions to require that the Township undertake review of wetland permit applications filed with the Department of Environmental Protection (DEP) (which is not currently done), and that this review be accomplished concurrently with DEP review. This will promote better coordination between DEP and the Township for this resource's protection; 5.

	Consider establishing a Riparian Buffer Area Overlay District that establishes a minimum setback from the Township's streams, river, and ponds in which riparian vegetation can flourish, so that their aesthetic and environmental values are conserved. This setback should be the minimum necessary to support a viable riparian habitat, such as 75 feet, and measured from the streambank, from the normal watermark of ponds, or from the wetland edge; 6. Develop and implement a voluntary pollution prevention program directed to residential land uses. This would address the importance of regular on-lot sewage disposal (OLDS) inspection and maintenance, as well as the elimination of OLDS discharges that can result in groundwater pollution (e.g. home hobby chemicals); 7. Develop and implement a voluntary pollution prevention geared toward agricultural sources of ground and surface water contaminants; 8. Amend the Township's Storm Water Management Ordinance to require that all stormwater be treated with the methods that are now commonly used throughout Lancaster County or at a minimum the Commonwealth's Best Management Practices; 9. Better manage erosion and soils exposed during construction, and the resulting downgradient and downstream sedimentation that adversely impacts water quality, watersheds, and wetlands; and 10. Develop voluntary restoration programs with landowners of critical fisheries and wildlife habitat areas contributing resources in the form of planting and/or working with volunteer organizations such as Boy/Girl Scouts.

Little Conestoga Watershed

Municipality	Comprehensive Plan		Zoning Ordinance		Subdivision and Land Development Ordinance		Stormwater Management Ordinance	
	Date	Current	Date	Current	Date	Current	Date	Current
City of Lancaster	1993	1992	1996	1996	1997	1997	12/11/01	1997
East Hempfield Township	Jan-94	1994	01/94-a3/15/01	1996	12/8/88-a10/19/89	1998	7/7/86	1989
East Petersburg Borough	None	1991	1990	1990	None	County	12/22/98	County
Lancaster Township	1996	1996	Void 1988	1989	Void	1982	Void	1982
Lititz Borough	Aug-89	1999	None	1994	3/30/93	1993	6/30/93	1993
Manheim Township	Apr-95	1995	1989-R10-01	1994	None	1998	None	1989
Manor Township	Oct-86	1999	3/6/00	2000	None	County	Use Lanc. Co. SWM	1999
Millersville Borough	None	2000	1/16/02 draft	1995	1975-A7/1992	1992	7/14/88	1988
Mountville Borough	1970	1975	7/75-A3/8/99	1991	None	County	2/8/99	County
Penn Township	2/24/92	1993	6/28/93-A1/5/98	1993	1999	1999	1995	1995
Warwick Township	None	1999	None	1993	1997	1993	2-Apr	1991
West Hempfield Township	None	1992	12/5/00	1994	Sep-90	1990	1987	1987

MUNICIPALITY	COMP PLAN	SLDO	SWM	ZONING	PARK PLAN
East Hempfield Township -29	1994	1988	1989	1996	1993 18 , 1994
East Petersburg Borough -22	1991	County		1990	1993 18
Lancaster City -33	1992	1997		1996	1993 18 , 1998
Lancaster Township -34	1996	1982		1989	1993 18 , 1988
Lititz Borough -37	1999 4	1993	1993	1994	1995
Manheim Township -39	1995	1989		1994	1993 18 , 1998
Manor Township -41	1999	County	1999	2000	1990, 1993 18 , 2000
Millersville Borough -44	2000	1992	1988	1995	1993 18
Mountville Borough (47)	1975	County		1991	none
Penn Township (50)	1993 8	1999	1995	1993	none
Warwick Township -60	1999 4	1993	1991	1993	none
West Hempfield Township -30	1992 1	1990	1987	1994	1989

SALDO Ordinance Summary

Those municipalities within the LCCW provide some criteria for showing stormwater facilities bordering and within those sites to be developed. The majority of these municipalities require that floodplains and significant features to be shown also.

Except for the Millersville Borough, provisions are provided for development and alteration within the floodplain. However, this isn't the case for Wetland areas. Only those municipalities covered by the Lancaster County SALDO, the City of Lancaster, Lancaster Township, and the Lititz Borough have provisions for determination and alteration of wetlands.

The majority of the municipalities require some sort of open space/recreation areas for all subdivision or land development projects. The City of Lancaster, Lancaster Township, and Manheim Township additionally promote the development of greenways within their respective lands.

MUNICIPALITY	PLAN REQUIREMENTS	FLOODPLAIN	ALLOWABLE FLOODPLAIN STRUCTURES	WETLANDS	OPEN SPACE AND RECREATION AREAS
Lancaster County	Bodies of water, floodplains, existing/proposed SWM controls, and highly erosive soils within 200' of site	Surface drainage easements to be provided; 100-year floodplain delineated for all watercourses	SWM management facilities; stream improvements solely to improve aquatic life and are approved by the PA Fish Commission; farm ponds; flood-proofing/flood reduction structures to protect existing buildings, public&private utility facilites, except buildings, water-oriented uses (except buildings) - docks, piers, boat launching ramps, hatcheries; water-monitoring devices; culverts, bridges, an their approaches for floodplain crossings by streets, access drives, and driveways	No encroachment into, the regrading of, or the placement of fill in wetlands shall be permitted. Developers must submit evidence that the PA DEP (Burea of Dams and Waterway Safety) and the USACOE have be contacted to determine the ability of state and federal wetland regulations	All land development and subdivison plans to provide open space/recreation areas.
City of Lancaster	Stormwater conveyance systems, floodplains, wetlands, watercourses, and possible hazardous materials area immediately adjacent or on site	Drainage Right-of-way to be provided; 100-year floodplain delineated in all floodprone areas; 500-year floodplain where production/storage of dangerous materials/substances is proposed;	No development or encroachment shall occur in the 100-year floodplain or approximate floodplain that will result in any increase in flood levels during the base flood discharge or the one hundred year flood. Those dwellings or development in floodprone areas shall have an evacuation plan on file with the appropriate Disaster Preparedness Authority. All new water, sanitary, storm, gas, oil and petroleum supply and storage systems shall be designed to preculd the infiltration of floodwaters into systems and discharges into flood waters	Floodplains & floodprone areas to be evaluated for wetlands; any impacts to wetlands shall require the appropriate permits	Open space areas required for subdivisons that will accomidate more than 100 people; encourage developers to preserve the Conestoga River Greenway

East Hempfield Township	Storm sewers and stormwater management facilities within 200' of site and on site; and information required by the East Hempfield Township SWMO (watercourses, drainage facilities, floodplains and other significant features witing the property)	Surface drainage easements to be provided; See East Hempfield Township Zoning Ordinance	See East Hempfield Township Zoning Ordinance	N/A	N/A
East Petersburg Township	See Lancaster County	See Lancaster County	See Lancaster County	See Lancaster County	See Lancaster County
Lancaster Township	Floodplains, watercourses, wetlands, significant environmental areas, and existing/proposed SWM facilities within 200' of site and on site	Easement for 100-year design rainfall event for watercourses; see Lancaster Township Zoning Ordinance	See Lancaster Township Zoning Ordinance	A wetland study shall be performed for all sites. Any fill into wetlands requires permits. Wetland mitigation areas to be shown on plans.	All land development and subdivison plans to provide open space/recreation areas; four greenways identified
Lititz Borough	Floodplains, wetlands, existing/proposed SWM controls, and highly erosive soils within 200' of site and on site	Easement for 100 year design rainfall for watercourse, drainageway, channel or streams; Floodplain/floodway shall be establised and preserved per the Zoning ordinance	Floodway shall be free of all structures, fill and other encroachments	A wetland study shall be performed for all sites. Any fill into wetlands requires permits. Wetland mitigation areas to be shown on plans.	Encouraged to provide park and recreation land; comply zoning ordinace
Manheim Township	Watercourses, floodplains, significant features, and storm sewers within 200' of site and on site	Easements provided for all watercourses; 100-year floodplain delineated for all watercourses	Agricultural uses, recreational areas (without structures), preservation areas, blinds for hunting/observing, E&S and SWM management facilities; stream improvements solely to improve aquatic life and are approved by the PA Fish Commission; farm ponds; public utility facilites, except buildings; township projects	N/A	All land development and subdivison plans to provide open space/recreation areas; greenways to be provided (see Comprehensive Plan)
Manor Township	See Lancaster County	See Lancaster County	See Lancaster County	See Lancaster County	See Lancaster County

Millersville Borough	Watercourses, floodplains, significant features, and storm sewers within 200' of site and on site	N/A	N/A	N/A	N/A
Mountville Borough	See Lancaster County	See Lancaster County	See Lancaster County	See Lancaster County	See Lancaster County
Warwick Township	Watercourses, aqueducts, and existing SWM controls within 200' of site; watercourses, floodplains, storm drains/sewers, wetland and other environmentally sensitive areas on site	Easements to be provided for surface water facilities; Floodplain/floodway shall be identified on plan. Also, refer to Zoning ordinance	Floodway shall be free of all structures, all structures located within the floodplain fringe shall be floodproofed to the floodplain corridor, development within the floodplain fringe shall have an evacaution plan	N/A	All land development and subdivison plans to provide open space/recreation areas
West Hempfield Township	SWM controls within 200' of site and on site	Surface drainage easements to be provided; 100-year floodplain delineated for all watercourses	SWM management facilities; stream improvements solely to improve aquatic life and are approved by the PA Fish Commission; farm ponds; flood-proofing/flood reduction structures to protect existing buildings, public&private utility facilites, except buildings, water-oriented uses (except buildings) - docks, piers, boat launching ramps, hatcheries; water-monitoring devices; culverts, bridges, an their approaches for floodplain crossings by streets, access drives, and driveways	N/A	Provide open space/recreation areas for subdivision that provide for ten or more dwellings

Municipality	Water Quality	Water Quantity
ACT 167	Recommendations - Infiltration/Retention in areas of Hydrologic Group A& B soils, disconnected roof drains, permeable parking and sidewalks, wetlands	Reduce all post-development peak stormwater runoff to 50% of the pre-develoment peak stormwater runoff for the 2, 5, 10, 25, 50, and 100-year storms
Lancaster County	Innovative SWM and recharge facilities may be proposed: rooftop storage, drywells, cisterns, diversion structures, aeration of lawns, holding tanks, infiltration structures, stream channel storage, in line storage in storm sewers, and grading patterns.	Post-development peak stormwater runoff shall not exceed the pre-development peak stormwater runoff for the 2, 10, 25, 50, and 100-year storms
City of Lancaster	Innovative SWM and recharge facilities may be proposed: detention/retention basin, roop-top storage, parking lot ponding, seepage/infiltration structures, concrete lattice block surfaces, grassed swales, underground reserviors, routed flow over grass, decreased impervious surface coverage. First Flush (the first one inch of a ny 24 hour storm) standards in areas served solely by combined sewers.	Within the LCCW, comply with ACT 167, reduce all post-development peak stormwater runoff to 50% of the pre-develoment peak stormwater runoff for the 2, 5, 10, 25, 50, and 100-year storms unless the pre-existing hydrograph is not exceed at all points, within the Conestoga River and Mill Creek watersheds the post-development peak stormwater runoff shall not exceed the pre-development peak stormwater runoff for the 2, 25, and 100-year storms
East Hempfield Township*	Innovative SWM and recharge facilities may be proposed: rooftop storage, drywells, cisterns, diversion structures, aeration of lawns, holding tanks, infiltration structures, stream channel storage, in line storage in storm sewers, and grading patterns.	Reduce the post-development peak stormwater runoff to 100% or less of the pre-development peak stormwater runoff for the 10 and 100-year storms
East Petersburg Township	Innovative SWM and recharge facilities may be proposed: detention/retention basin, roop-top storage, parking lot ponding, seepage/infiltration structures, concrete lattice block surfaces, grassed swales, underground reserviors, routed flow over grass, decreased impervious surface coverage	Reduce all post-development peak stormwater runoff to 50% of the pre-develoment peak stormwater runoff for the 2, 5, 10, 25, 50, and 100-year storms

Lancaster Township	Innovative SWM and recharge facilities may be proposed: detention/retention basin, roop-top storage, parking lot ponding, seepage/infiltration structures, concrete lattice block surfaces, grassed swales, underground reserviors, routed flow over grass, decreased impervious surface coverage	Comply with ACT 167, reduce all post development peak stormwater runoff to 50% of the pre-develoment peak stormwater runoff for the 2, 5, 10, 25, 50, and 100-year storms
Lititz Borough	Innovative SWM and recharge facilities shall be used whenever and wherever feasible to protect adjoining properties; to control the volume of water leaving the site; to remove pollutants from leaving the site; or to provide for recharge of ground water supplies	Reduce the post-development peak stormwater runoff to 100% or less of the pre-development peak stormwater runoff for the 2 and 10-year storms and to 50% of the pre-develoment peak stormwater runoff for the 25, 50, and 100-year storms
Manheim Township	Innovative SWM and recharge facilities may be proposed: detention/retention basin, roop-top storage, parking lot ponding, seepage/infiltration structures, concrete lattice block surfaces, grassed swales, underground reserviors, routed flow over grass, decreased impervious surface coverage, constructed wetlands, best management practices	Reduce all post-development peak stormwater runoff to 50% of the pre-develoment peak stormwater runoff for the 2, 5, 10, 25, 50, and 100-year storms
Manor Township	Innovative SWM and recharge facilities may be proposed: detention/retention basin, roop-top storage, parking lot ponding, seepage/infiltration structures, concrete lattice block surfaces, grassed swales, underground reserviors, routed flow over grass, decreased impervious surface coverage	Comply with ACT 167, reduce all post development peak stormwater runoff to 50% of the pre-develoment peak stormwater runoff for the 2, 5, 10, 25, 50, and 100-year storms unless the pre-existing hydrograph is not exceed at all points
Millersville Borough	Innovative SWM and recharge facilities may be proposed: detention/retention basin, roop-top storage, parking lot ponding, seepage/infiltration structures, concrete lattice block surfaces, grassed swales, underground reserviors, routed flow over grass, decreased impervious surface coverage	Post-development peak stormwater runoff shall not exceed the pre-development peak stormwater runoff for the 2, 10, 25, and 100-year storms

Mountville Borough	Innovative SWM and recharge facilities may be proposed: detention/retention basin, roop-top storage, parking lot ponding, seepage/infiltration structures, concrete lattice block surfaces, grassed swales, underground reserviors, routed flow over grass, decreased impervious surface coverage	Comply with ACT 167, reduce all post development peak stormwater runoff to 50% of the pre-develoment peak stormwater runoff for the 2, 10, 25, and 100-year storms unless the pre-existing hydrograph is not exceed at all points
Penn Township	Innovative SWM and recharge facilities may be proposed: detention/retention basin, roop-top storage, parking lot ponding, seepage/infiltration structures, concrete lattice block surfaces, grassed swales, underground reserviors, routed flow over grass, decreased impervious surface coverage	Post-development peak stormwater runoff shall not exceed the pre-development peak stormwater runoff for the 2, 5, 10, 25, 50, and 100-year storms. Comply with ACT 167 once it is adopted.
Warwick Township	Innovative SWM and recharge facilities may be proposed: detention/retention basin, roop-top storage, parking lot ponding, seepage/infiltration structures, concrete lattice block surfaces, grassed swales, underground reserviors, routed flow over grass, decreased impervious surface coverage	If detention/retention basins are used, reduce the post-development peak stormwater runoff to 75% or less of the pre-development peak stormwater runoff for the 2 and 10-year storms and to less than 100% of the pre-develoment peak stormwater runoff for the 25, 50, and 100-year storms. If stormwater is just conveyed through the site, the post-development peak runoff shall not exced the pre-development peak runoff for the 2, 10, 25, 50, and 100-year storms
West Hempfield Township	Innovative SWM and recharge facilities may be proposed: detention/retention basin, roop-top storage, parking lot ponding, seepage/infiltration structures, concrete lattice block surfaces, grassed swales, underground reserviors, routed flow over grass, decreased impervious surface coverage	Comply with the ACT 167 within the LCCW, otherwise the Post-development peak stormwater runoff shall not exceed the pre-development peak stormwater runoff for the 2, 10, and 100-year storms

* currently revising swm ordinance

Municipality	Recommendations Stemming from Zoning Ordinances
Lancaster County	N/A
City of Lancaster	Adopted 1996- 1. Contains a Park and Open Space District, which protects and preserves public park lands, greenways, riparian areas, and natural environments; and 2. An Overlay Floodplain District is applicable to all zones in the City with specific listing of permitted and special exceptions and variances for the 100 and 500 year floodplain as well as the approximate floodplain area.
East Hempfield Township	As amended February 28, 1998- 1. An overlay floodplain zone is applied to all zones in the Township listing permitted, special exception, and prohibited uses- the zone encompasses the one hundred year flood as identified in the flood insurance study prepared for East Hempfield Township by the Federal Insurance Administration, dated March 29, 1979; 2. An Open Space Design Option requiring no less than thirty percent of the total tract devoted to open space uses; and 3. Cluster Developments are permitted by conditional use in the R-1 and R-2 Districts to blend residential development in areas with substantial natural sensitivity.
East Petersburg Borough	February 6, 1990- 1. An Overlay Floodplain Zone is applicable to all zones in the Borough listing permitted and prohibited uses- the zone encompasses the 100 and 500 year floodplain as well as all alluvial soils as listed under the Lancaster County Soil Survey; and 2. Cluster Development is a conditional use on minimum lot sizes of two acres or greater in both the R-2 and R-3 district allowing 20% open space for the former and 30% for the latter of which the floodplain cannot be included in the required open space.
Lancaster Township	Adopted February 8, 1999 as amended October 11, 1999- 1. A floodplain overlay district is applied to all water courses with the boundaries of the district extending to the 500 year floodplain and shall be established by a study of watershed conditions-permitted, special exception and prohibited uses are provided; 2. A filter strip is required between any watercourse and any tilled land. Such strip shall be a minimum of fifteen feet; 3. A riparian forest buffer shall extend inland one hundred feet from the top of the bank of any water course or one hundred and twenty-five feet from the centerline of the watercourse; 4. Performance standards are provided for agricultural, home occupations, industrial uses that affect quality of groundwater; 5. Open Space Design Option is a permitted use in the R-S, R-1, R-2, and R-3 Districts provided minimum restricted open space ranging from sixty to twenty-five percent; and 6. Designated greenways shall extend in one hundred feet from the top of the water course bank or one hundred and twenty-five feet from the centerline of the watercourse to facilitate the preservation of areas and provide linkages of inter-municipal trails in adjacent municipalities (bodies of water included- Little Conestoga Creek, Conestoga River, Unnamed tributary to Conestoga River southwest of Millersville Road and adjacent to Millersville Borough, and unnamed tributary to the Conestoga River on the northeast side of Millersville Road.

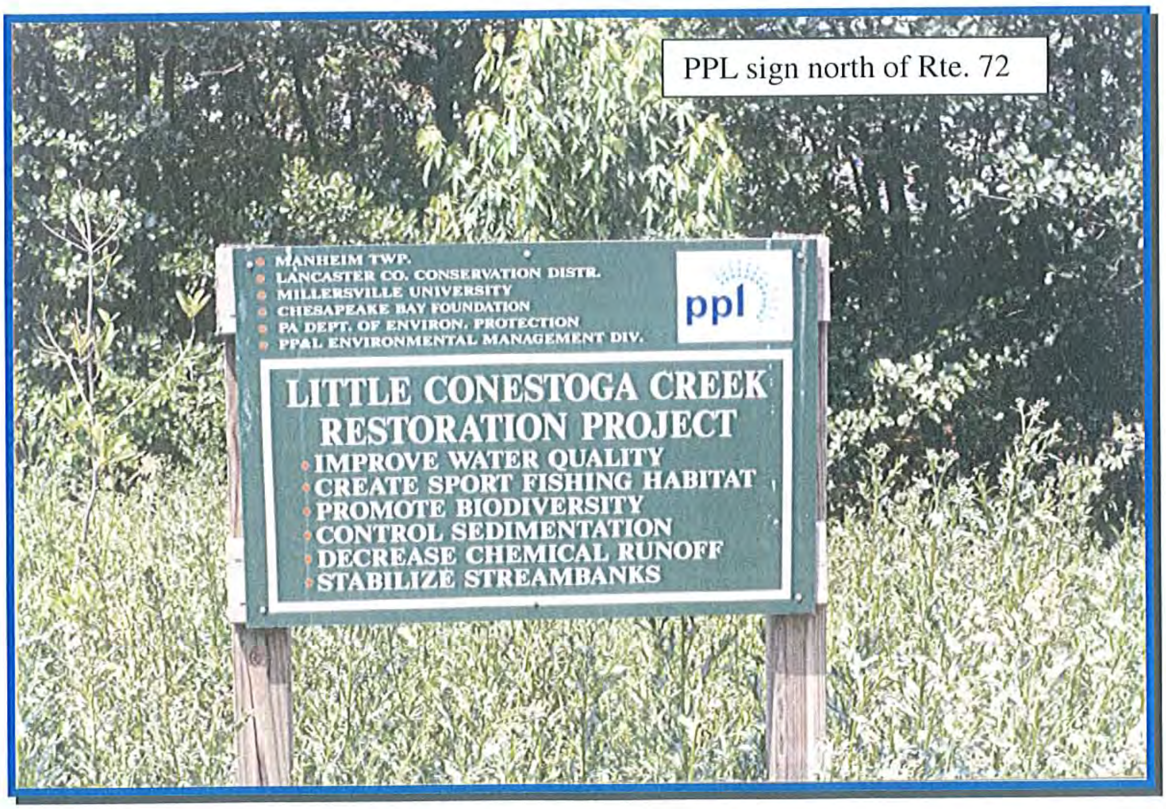
Lititz Borough	Revised November 1994- 1. A floodplain overlay district shall be applied to all zoning districts in the Borough listing of all permitted, prohibited, conditional and by special exception uses within the district- the overlay district encompasses that defined by the 100 year flood in the Flood Insurance Study for the Borough.
Manheim Township	Adopted 1989 as amended April 8, 2002- 1. Cluster Developments are permitted as a conditional use in the R-1, R-2 , R-3 and R-4 Zone on lots with a ten acre minimum with thirty percent of the total tract devoted to common open space depending on the district; 2. Transfer of Development Rights is provided as an option with sending areas located in the Agricultural District and receiving areas are located in R-1 and R-2 districts- the purpose for this concept is to protect the prime agricultural soils and agricultural character of the lands in the Agricultural District by shifting development from that area to the receiving areas of the Township; 3. A floodplain overlay district shall be applied to all zoning districts in the Township- a listing of all permitted, prohibited, or by specific permission within the district- the overlay district encompasses that defined by the 100 year flood as determined by a study performed by a licensed professional registered with the Commonwealth or the latest revisions of the Department of Housing and Urban Development, FEMA Flood Insurance study for Manheim Township dated 1979, revised January 1, 1982.
Manor Township	Adopted March 6, 2000- 1. A Conservation Zone is provided to protect and facilitate preservation of the natural forest areas, steep slopes, stream and creek valleys, lakes, and floodplains in the Township; 2. A floodplain overlay district is applied to all water courses with the boundaries of the district extending to the 500 year floodplain as defined by the Flood Insurance Study prepared for Manor Township by the Federal Insurance Administration dated 1979-and shall be established by a study of watershed conditions-permitted, special exception and prohibited uses are provided; and 3. Cluster Developments are permitted by special exception in the RL, RM, RH, and MHC Zone on lots with a two acre minimum with a range of twenty to thirty percent of the total tract devoted to common open space depending on the district.
Millersville Borough	Adopted July 25, 1995- 1. Overlay district protecting the 100-Year Floodplain and any soils possessing alluvial or floodplain soils with a listing of Permitted and Prohibited Uses and 2. Cluster development is provided for in the R-1, R-2, and R-1A districts as a conditional use on tracts 10 acres or greater requiring not less than thirty percent of the entire tract to set aside as open space.
Mountville Borough	Adopted July 14, 1975 as amended through May 14, 2002- 1. A floodplain area is established as the low, flat area adjoining and including any water or drainage course, or body of water subject to periodic flooding or overflow and shall include soils delineated as alluvial soils in the Lancaster County Soil Survey and include those area delineated as flood prone area in the FIA Flood Hazard Boundary Map dated July 19, 1974;

Penn Township	Adopted 1993 as amended November 26, 2001- 1. Cluster Developments are permitted by conditional use in the R-2 and R-3 Districts to blend residential development in areas with substantial natural sensitivity; 2. An overlay floodplain zone is applied to all zones in the Township listing permitted, special exception, and prohibited uses- the zone encompasses the one hundred year flood as identified in the flood insurance study prepared for Penn Township by the Federal Insurance Administration, dated March 2, 1981; 3. A Conservation Zone is provided to protect and facilitate preservation of the natural forests, wetlands, aquifers, and floodplains in the Township. 4. All agricultural uses shall comply with the Pennsylvania "Nutrient Management Act" of 1993, as may be amended; 5 Conservation Cluster Development is also provided where a minimum sixty percent of the development shall be devoted to open space.
Warwick Township	Adopted August 30, 1993 as amended through April 4, 2001- 1. An overlay floodplain zone is applied to all zones in the Township listing permitted, special exception, and prohibited uses- the zone encompasses the one hundred year flood as identified in the flood insurance study prepared for Warwick Township by the Federal Insurance Administration, dated May 19, 1980; 2. Transfer of Development Rights is provided as an option with sending areas located in the A district to approved receiving areas within the Township- the purpose for this concept stems from permanently protecting prime farmland, sensitive natural areas, and rural community character and place development where higher density is appropriate; 3. Cluster developments are permitted by conditional use in the R-1 and R-2 Districts with at least thirty percent of the tract shall be devoted to common open space; 4. Conservation cluster developments are permitted by conditional use in the C district with at least seventy-five of the tract shall be devoted to common open space;
West Hempfield Township	Adopted 1988 as amended December 5, 2000- 1. A floodplain overlay district is applied to all areas in the Township based on the 100 and 500 year floodplains as defined by the Flood Insurance Study for the Township as well as those area identified by the Army Corps of Engineers or the United States Geological Survey- all permitted and special exception uses are provided; 2. Wetlands shall comply with the applicable rules and regulations of the United States Army Corps of Engineers and the Department of Environmental Resources for the Commonwealth; 3. Performance Standards have been established in districts where agriculture is permitted as well as landscaping and screening which aid in the protection of the waters of the Commonwealth; 4. An Open Space Design Option is allowed as a conditional use under the R, RR, R-1, R-2, and R-3 Districts which provides for a minimum restriction of open space ranging from 60% to 25%; and 5. Transfer of Development Rights is provided as an option with sending areas located in the R and RR districts with a minimum lot size of 25 acres and receiving areas are located in R-1, R-2, and R-3 districts- the purpose for this concept stems from permanently protecting prime farmland, sensitive natural areas, and rural community character and place development where higher density is appropriate.

COMPLETED RESTORATION PROJECTS

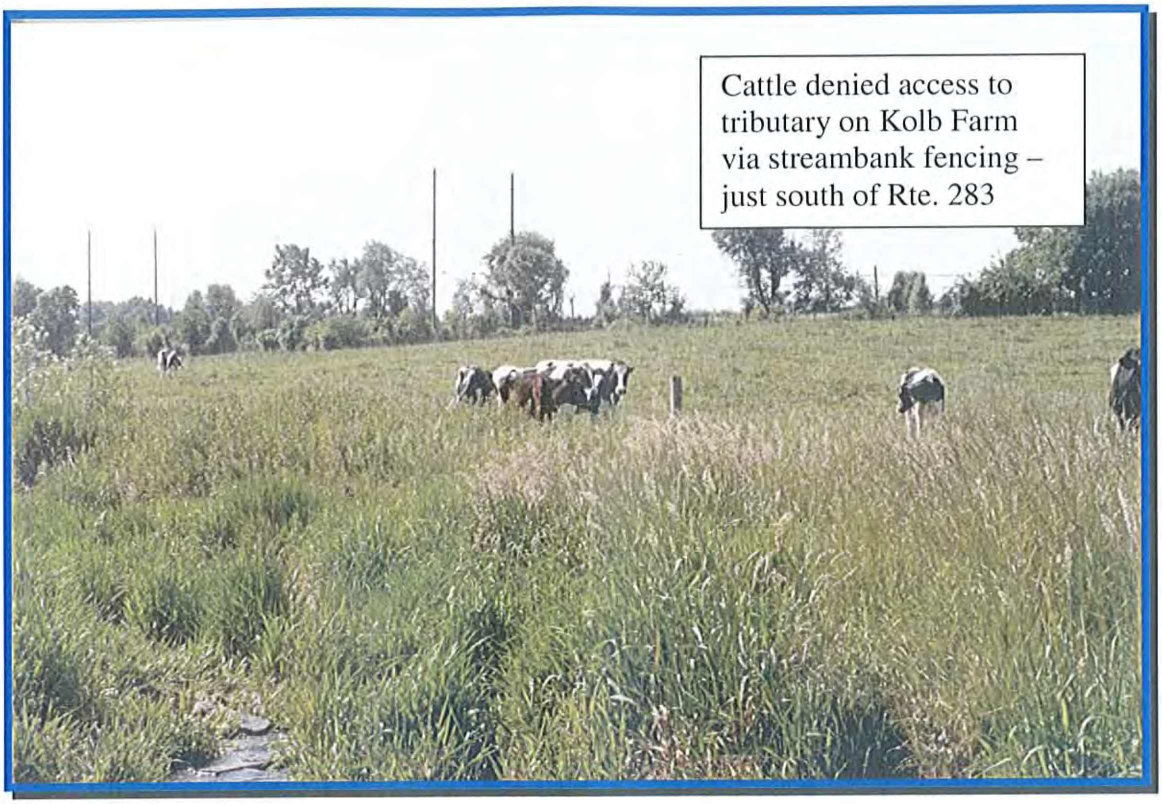
Several stream restoration projects have been completed or are in the midst of design and construction within the Little Conestoga Creek Watershed.

The earliest of these completed projects includes a 1997 streambank stabilization, fish habitat improvement and forest buffer planting and establishment on the Main Stem just upstream of Route 72 "Manheim Pike" on property owned by PPL. The project was design by Mark Gutshall of LandStudies, Lititz, Pennsylvania. The project is a fine example of some of the earliest "natural stream design" work completed in Lancaster County. Years later, this project is performing well and certainly can be deemed a success. PPL continues to do an excellent job maintaining the planted forest buffer and has established a "no mow" zone along the riparian corridor. Every spring, PPL sponsors a trout fishing derby that is a big hit with local youth anglers. PPL would make a great partner in the Little Conestoga Creek Alliance's pursuit of stream restoration.



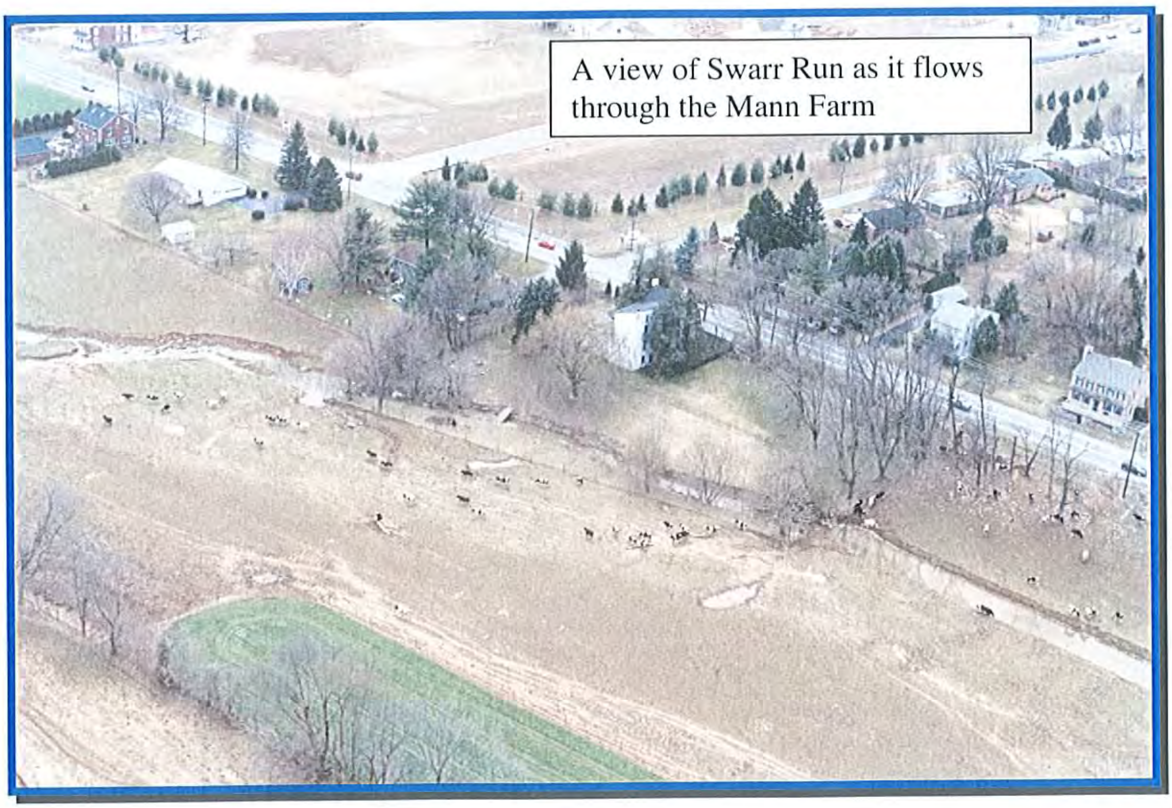
PPL sign north of Rte. 72

In 1997, students from the Lancaster County Academy with assistance from the Lancaster County Conservation District and the Chesapeake Bay Foundation installed streambank fencing and planted a forest buffer on the Melvin Kolb Farm located just south of Route 283. For years, the main pasture on the farm, which contains an un-named tributary, was overgrazed. Dairy cattle had free access to the stream; trampling the streambanks and often defecating directly into the water while wading. The stream channel was degraded to the point it was more appropriate to refer to it as a muddy ditch rather than a stream. But all that change due to the Academy's "Stream Team". Now the stream is in the process of repairing itself – riding itself of its sediment load and shoring up its banks with grasses, shrubs and trees. Cattle only have access to the stream at stabilized stone ford crossings. The project is easily viewed heading eastbound on Route 283.


Cattle denied access to tributary on Kolb Farm via streambank fencing – just south of Rte. 283

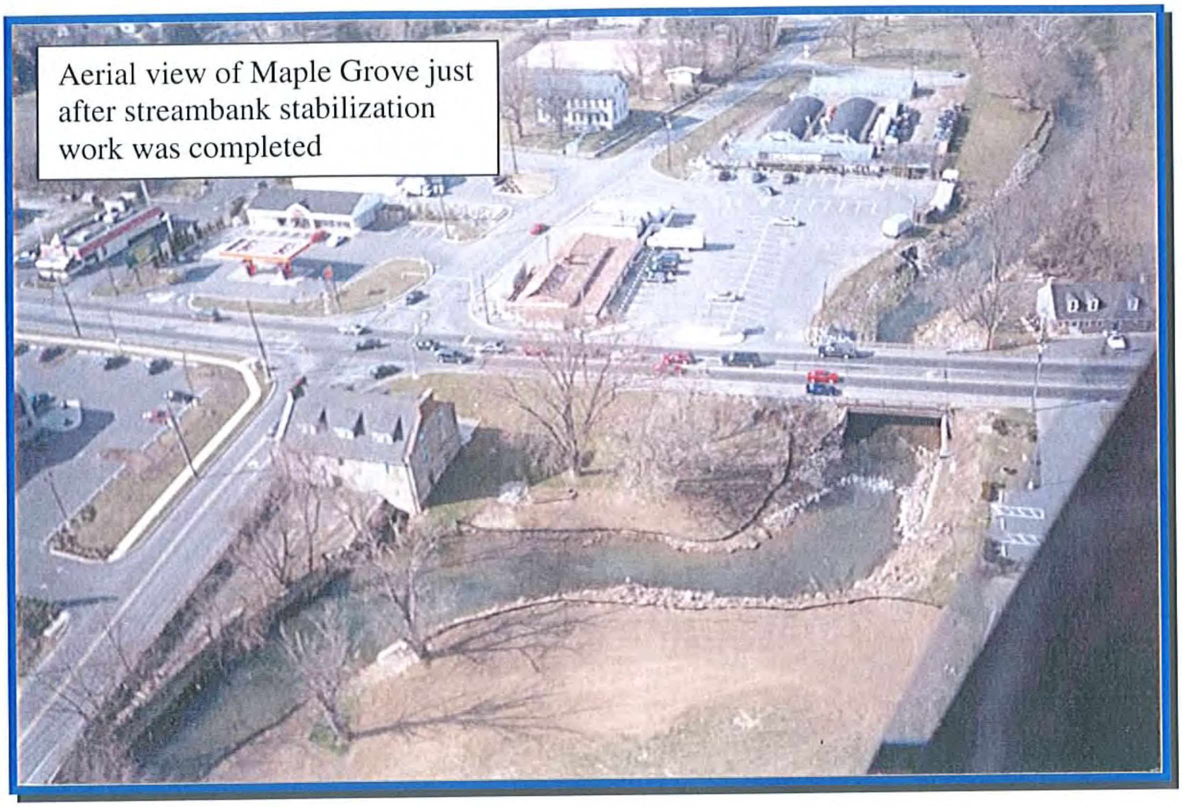
Beginning in 1999, "The Goldenberg Group" (owners of Red Rose Commons) began to implement an invasive plant removal and spraying program within the Dillerville Swamp as a condition of their issued "Joint Permit" between the United States Army Corps of Engineers and the Pennsylvania Department of Environmental Protection. The Joint Permit was necessary because of some unavoidable stream and wetland encroachments during the construction of Red Rose Commons. As a condition of the permit, The Goldenberg Group agreed to eradicate Purple loosestrife (*Lythrum salicaria*) which had successfully taken over huge areas within the swamp, displacing native wetland plant species in the process. Dillerville Swamp was at one time the largest naturally existing wetland within Lancaster County. The swamp included all of what is now Red Rose Commons, much of K-Mart and the portion of Route 30 between the two shopping centers. With the successful removal of loosestrife, perhaps native species will once again re-vegetate and bring biodiversity back to this once outstanding wetland habitat.

In 1999, the Lancaster County Conservation District began discussions with A.K. Mann and family regarding the state of their farm at the intersection of Old Harrisburg Pike and State Road in East Hempfield Township. The District managed to secure a federal Section 319 grant (Section 319 of the Clean Water Act) through the Pennsylvania Department of Environmental Protection for the installation of streambank fencing, streambank stabilization and forest buffer plantings. The farm is rented to a local dairy farmer who uses the pastureland for grazing dairy heifers - a lot of dairy heifers! Swarr Run is severely degraded as it flows through the pastureland. The manure pit on the farm is too small for the number of livestock and isn't properly maintained nor cleaned out as necessary to prevent overflowing. The streambanks are severely trampled and bare of vegetation. The substrate is smothered in sediment and blooms of algae due to excessive nitrogen introduced to the water. To date, no physical improvements have yet been made and farming practices remain the same. However restoration plans have been prepared and encroachment permits have been issued to allow the improvement work. Hopefully restoration work will begin in the summer of 2003.

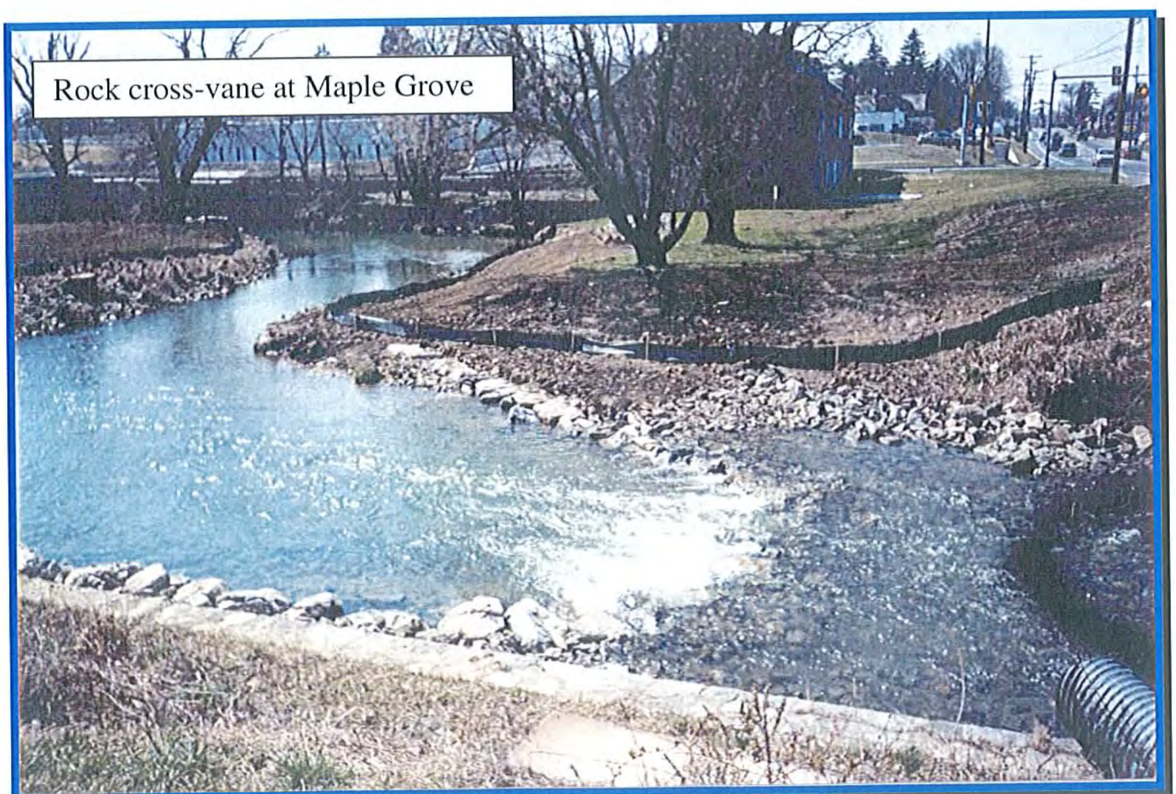


A view of Swarr Run as it flows through the Mann Farm

In 2001, Lancaster Township with help from the Little Conestoga Watershed Alliance, The Girls Scouts of America, The Boy Scouts of America and design assistance from RETTEW Associates, Inc. completed a restoration project along the Main Stem at Maple Grove Park just south of Route 462 "Columbia Avenue". Natural stream design restoration work included fish habitat improvements, streambank stabilization, bioengineering and forest buffer establishment. The project was successful and received the "Governor's Award for Watershed Stewardship" in April of 2002.



Aerial view of Maple Grove just after streambank stabilization work was completed



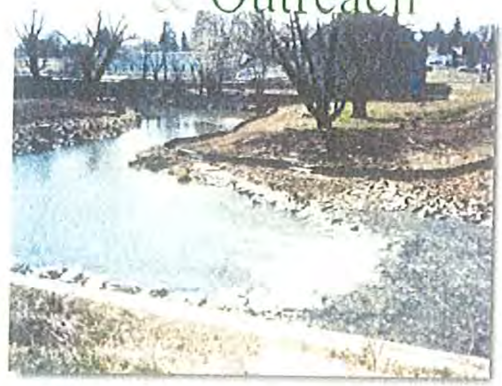
Rock cross-vane at Maple Grove

Fascine installation at Maple Grove – A "bioengineering" technique

RETTEW
ASSOCIATES INC.

2002 GOVERNOR'S AWARD FOR Watershed Stewardship

Education & Outreach



"It's your stream, it's your river, it's your bay — help do something about it." This was Lancaster Township's call-to-arms to preserve local waterways and its slogan for the Maple Grove Park Riparian Restoration Project.

Armed with a $31,000 Chesapeake Bay Small Projects Grant awarded by the National Fish and Wildlife Foundation and the U.S. Environmental Protection Agency, Lancaster County residents, local businesses, students and scouting groups joined forces to restore a section of the Little Conestoga Creek flowing through Maple Grove Park.

The volunteers worked to address storm water runoff, soil erosion and sedimentation — problems that have increased because of recent land development. Repairing this section of the stream involved excavating floodway fills and depositions to increase floodwater storage capacity, re-grading and creating a buffer along eroded streambanks and installing rock vane and channel deflector structures for erosion prevention.

The township engaged the public by offering hands-on volunteer workshops and field trips. Project kick-off meetings featured slide and video presentations regarding stream restoration techniques. Colorful directory signs erected at the project site and flyers, letters and workshop schedules distributed throughout the community helped generate significant media coverage for the restoration project. Lancaster Township disseminated public service announcements through local newspapers and television stations, WGAL and FOX, and promoted activities on its website www.twp.lancaster.pa.us. More than 5,000 households received invitation letters, schedules and flyers publicizing project events.

By the time the project was completed, Lancaster Township not only had made great strides in restoring its watershed, but also sparked environmental awareness in the community that will continue beyond the lifespan of the Maple Grove Park Riparian Restoration Project itself. In the future, Lancaster Township and the Little Conestoga Watershed Alliance will use Growing Greener grant funds to perform a comprehensive watershed assessment.

ENVIRONMENTAL RESULTS:

- 1,050 feet of stream ecosystem restored
- 1.2 acres of forested riparian buffer created
- 148 cubic yards of stabilized soils conserved

LANCASTER TOWNSHIP
1240 Maple Avenue
Lancaster, PA 17603

CONTACT:
William Adams
(717) 291-1213
(717) 291-6818 (fax)
wadams@twp.lancaster.pa.us
www.twp.lancaster.pa.us

2002 GOVERNOR'S AWARD FOR WATERSHED STEWARDSHIP

MARK SCHWEIKER
GOVERNOR
COMMONWEALTH OF PENNSYLVANIA

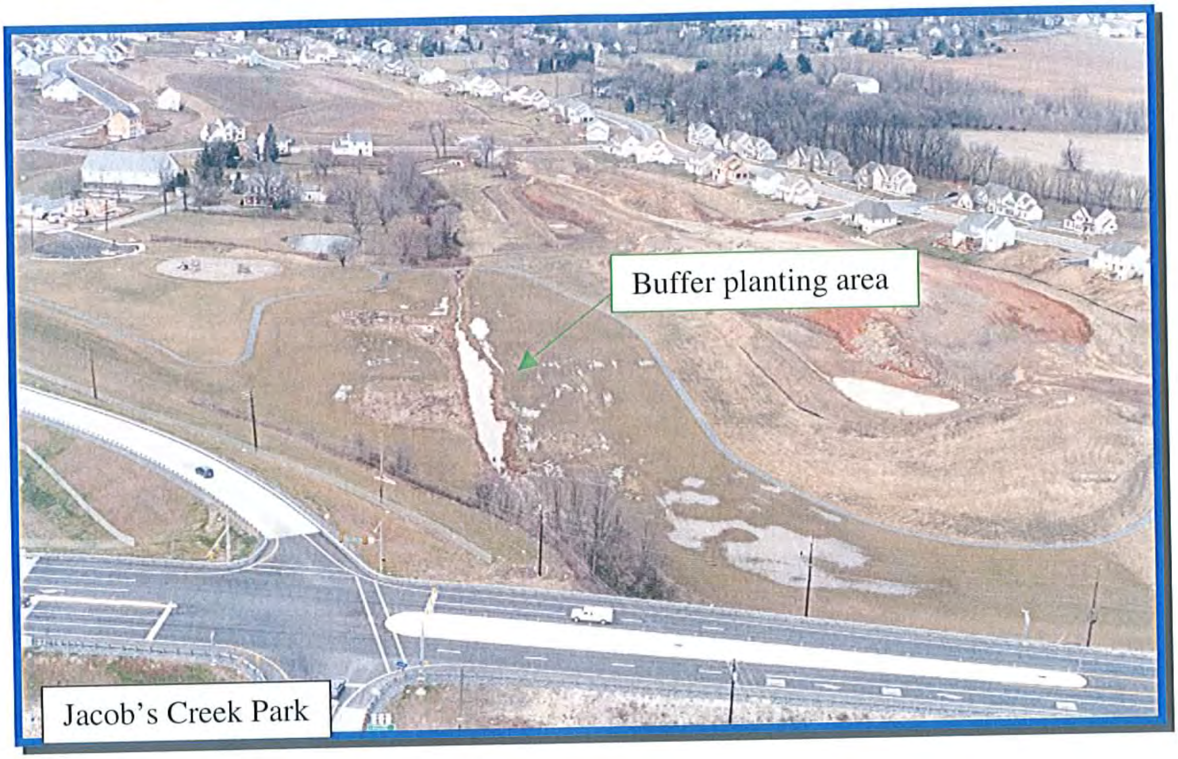
DAVID E. HESS
SECRETARY
DEPARTMENT OF ENVIRONMENTAL PROTECTION

"Caring people made the difference in Lancaster Township's riparian restoration project. The volunteers did indeed take to heart the theme of the project: 'It's your stream, it's your river, it's your bay!' They were the difference!"

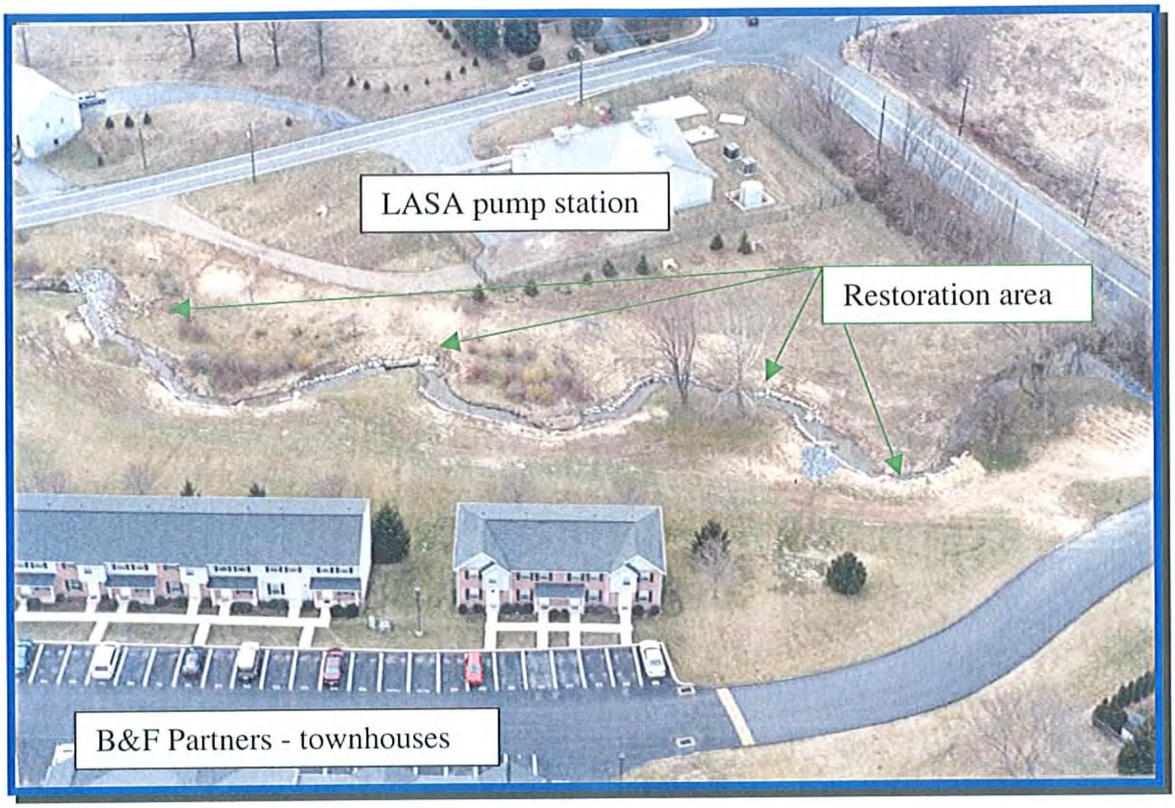
Helen S. Adams
Chair, Board of Supervisors
Lancaster Township

RETTEW Associates Inc.
3020 Columbia Avenue, Lancaster, PA 17603
(717) 394-3721 Fax (717)394-1063 E-mail: rettew@rettew.com Web site: www.rettew.com
Bethlehem, PA Camp Hill, PA Pottsville, PA York, PA Margaretville, NY as RETTEW Engineering & Surveying, P.C.

In the spring of 2002, members from the Little Conestoga Watershed Alliance planted 675 native trees and shrubs at Jacobs Creek Park (located just north of Route 30) along an unnamed tributary to the Little Conestoga Creek Main Stem. East Hempfield Township donated $6,000.00 in support of the riparian forest buffer project for the purchase of trees, shrubs and related planting materials.



In fall of 2001 and spring of 2002, the Little Conestoga Watershed Alliance completed their first official "Growing Greener" sponsored stream restoration project on a small un-named tributary located on property owned by the Lancaster Area Sewer Authority and B&F Partners. The project is located on the north side of Charlestown Road near the intersection with Fairway Drive. The $24,500.00 grant funded streambank stabilization, fish habitat improvements, forest buffer establishment and the assessment of the remaining upstream reaches outside the immediate restoration area.



In August of 2002, the Little Conestoga Watershed Alliance received notice that two Section 319 grant proposals (Section 319 of the Clean Water Act) had been approved for funding. The first grant ($159,233.00) involves streambank stabilization/channel restoration work to be performed on Millers Run where ill-managed stormwater is causing extreme erosion problems. The second grant ($52,125.00) is for establishing a forest buffer, removing a log jam and fixing several sections of eroded streambank along Bachman Run within a residential neighborhood.

FUTURE RESTORATION ENDEAVORS

There is no doubt the Little Conestoga Creek Watershed is significantly impaired, offering (to say the least) substantial restoration and improvement opportunity for those willing to tackle the endeavor.

Fortunately, the Little Conestoga Watershed Alliance has accepted the challenge. But such a daunting task can seem overwhelming at times. Completed restoration projects can seem small and insignificant when compared to the vast amounts of remaining work. With this in mind, it is vitally important the Little Conestoga Watershed Alliance keeps things in proper perspective and approach ever existing problems at a reasonable pace to avoid frustration and fatigue.

One of the first realizations the Alliance needs to face is the fact that they cannot "fix" the watershed by themselves. Outside help is required; thus partners with similar interests are required. The Alliance doesn't have to do all the work, if they are capable of getting others interested in their restoration endeavor.

Secondly, the Alliance didn't make the "mess" to begin with. The intentions of the Alliance are simply to "fix" what others have "broke" (and doing so on a volunteer basis). Therefore any restoration accomplishment, whether how big or small, is in fact an accomplishment and a step in the right direction. Take pride in both the small and large victories!

Thirdly, a watershed such as the Little Conestoga Creek Watershed will never be completely restored. It's too involved and ever changing within its 65.5-square miles. There will always be another problem to fix. This is not to say great strides cannot be made and significant restoration as a whole occur– indeed it can! Rather the point is that there will always be problems to various degrees requiring corrective action. Therefore, the ultimate goal of restoring the watershed is to have the "good" outweigh, outperform and cancel out the "bad".

Fourthly, not everyone will appreciate and fall in love with the idea of restoring the Little Conestoga Creek – namely those who are singled out as being behind the problems. Winning over stubborn landowners and educating watershed stakeholders and public officials will be an ongoing challenge.

Lastly and most importantly, follow the restoration plan. There is a logical progression to stream and watershed restoration. Generally speaking, it is wise to concentrate work in one or two sub-watersheds rather than skipping around the entire watershed. Sub-watersheds the size of which they are broken down in the report writing are manageable. When working in each sub-watershed, it is wise to begin restoration work in the headwaters and proceed downstream in a contiguous fashion thereby "fixing" the stream as you go. What you want to avoid is some sort of restoration project mid-watershed that is rendered insignificant or useless because of still existing problems upstream.

PRIORITIZING DISCOVERED PROBLEMS

RESTORATION STRATEGY PRIORITIZED ON A SUB-WATERSHED BASIS

CRITICALLY IMPAIRED SUB-WATERSHEDS

Bachman Run **Manheim Township**

- A tributary within the Little Conestoga Creek Main Stem Sub-watershed
- Residential stormwater related impacts

Millers Run **East Hempfield Township**

- Severe property damage
- Residential stormwater related impacts

Swarr Run **East Hempfield Township**

- Agricultural related impacts
- Residential stormwater related impacts

West Branch **Manor Township**

- Agricultural related impacts

RESTORATION STRATEGY BY SUB-WATERSHED - BEGINNING IN HEADWATERS AND PROCEEDING DOWNSTREAM

Brubaker Run **East Hempfield Township**

High Priority Stormwater management and water quality retrofits within Old Sycamore Industrial Park, Sycamore Business Complex and Centerville Industrial Park

High Priority Streambank erosion, lack of forest buffer @ J. Wilson and Donna J. Hershey farm, 2715 Columbia Avenue

High Priority Streambank erosion, farmed/cropped right up to the stream channel, sedimentation from cropland @ Herley Industries, Inc. property, Running Pump Road

High Priority Streambank erosion, forest buffer could be improved @ John I. Hartman, Jr. farm, 2452 Marietta Avenue

High Priority Streambank erosion, lack of forest buffer though stream is located in fallowing pasture @ WMP Ltd. property, 206 Rohrerstown Road

High Priority	Littering, channelized stream, thermal pollution, parking lot contaminants, stormwater quality BMP retrofit possibilities @ Stauffers of Kissel Hill store, Millersville Road
Medium Priority	Streambank erosion, lack of forest buffer @ Church of the Apostles, 1842 Marietta Avenue
Low Priority	Littering associated with homeowners with Regency Square and Glenbrook developments
Low Priority	Removal of exotic, invasive plant species with the East Hempfield Township Park
Low Priority	In-stream habitat improvements downstream of Glenbrook Court
Indian Run	**Manor Township**
Medium Priority	Sporadic pasturelands where livestock has free access to stream, streambank erosion, lack of forest buffer from the headwaters downstream to Indian Run Road
High Priority	Free cattle access to stream, streambank erosion @ Richard C. Falk, Jr. farm, 1004 Breneman Road
Low Priority	Sporadic streambank erosion downstream of Indian Run Road
Medium Priority	Free cattle access to stream @ Allan R. Herr farm, 707 Walnut Hill Road, located right at the mouth of Indian Run
Millers Run	**East Hempfield Township**
Medium Priority	Sporadic streambank erosion from headwaters downstream to Westminster Drive @ School Lane Estates development
High Priority	Severe streambank erosion due to lack of stormwater management, stormwater quality BMP retrofit possibilities, lack of forest buffer, floodway encroachments by landowners, stream channel incised – needs to be re-introduced to floodway and floodplain from Westminster Drive @ School Lane Estates development downstream to Sylvan Road *There is an on-going Growing Greener Project within this area as of this writing*

High Priority	Severe streambank erosion, sedimentation from Sylvan Road downstream to Old Harrisburg Pike @ Joseph F. and Dianne M. Mast property, 1059 Sylvan Road and @ Sylvan View Farms PT property currently undergoing subdivision ("Village Grande At Millers Run"), 2348 Harrisburg Pike
High Priority	Encourage East Hempfield Township to be most pro-active within this sub-watershed with specific interest in retrofitting/installing stormwater controls and water quality BMPs – Also encourage off-site mitigation of stormwater management facilities to headwater areas
Swarr Run	**East Hempfield Township**
High Priority	Severe streambank erosion and lack of forest buffer @ East Hempfield Sports Complex owned by East Hempfield Township
High Priority	Lack of forest buffer, sporadic streambank erosion @ Larry J. Booth farm, 1046 Snapper Road
High Priority	Lack of forest buffer, streambank erosion @ Gregory A. Meinzer property, 580 Church Street
High Priority	Lack of forest buffer, evidence of past stream relocation, existing wetland impacts, currently farmed but owned by Hempfield School District just upstream of Church Street, property at 478 Church Street
Medium Priority	Retrofit stormwater basins with water quality BMPs at Hempfield High School and Middle School
High Priority	Free cattle access to stream, streambank erosion, lack of forest buffer, sedimentation from cropland @ Titus B. Stoner farm, 3207 Bowman Road
Medium Priority	Free cattle access to stream, streambank erosion, lack of forest buffer, sedimentation from cropland @ Benjamin S. Landis farm, 1361 Nissley Road
Medium Priority	Stormwater retrofits @ Olde Forge Crossing residential subdivision
Medium Priority	Lack of forest buffer, streambank erosion @ Lloyd B. Denlinger property, 3060 Harrisburg Pike

Medium Priority Free sheep access to stream, sporadic streambank erosion, lack of forest buffer @ farm owned by Centaurus LLC, 2148 State Road

High Priority Free cattle access to stream, severe streambank erosion, lack of in-stream cover, lack of forest buffer, sedimentation from cropland, occasional manure spills due to overflowing manure storage @ Mann Family Partnership II farm, 2701 State Road

As of this writing, there is an ongoing 319 Grant Project for this farm – owners currently working with Lancaster County Conservation District

High Priority Free cattle access to stream, severe streambank erosion, lack of in-stream cover, lack of forest buffer, sedimentation from cropland, manure introduction from feedlot @ Clair D. Landis farm, 1366 Colebrook Road

Medium Priority Sporadic streambank erosion @ Robert Z. Getz property

Medium Priority Sporadic streambank erosion, lack of forest buffer, lack of in-stream cover @ Golden Meadows, Inc. property

Medium Priority Sporadic streambank erosion, lack of forest buffer, lack of in-stream cover @ The TC Lancaster West Co. property, 1-419 Colonial Crest Drive

Medium Priority Sporadic streambank erosion, lack of forest buffer, lack of in-stream cover, stormwater basin water quality BMP retrofits @ Mennonite Home Inc. property, 2001 Harrisburg Pike

Medium Priority Sporadic streambank erosion, lack of forest buffer, lack of in-stream cover, littering @ MGA Acquisition LP property, 2000 Swarr Run Road

West Branch **Manor Township**

High Priority Streambank erosion, lack of forest buffer, sedimentation from cropland, farmed right up to stream channel @ Fieldcrest Associates property, 292 Hershey Mill Road

High Priority Streambank erosion, lack of forest buffer, sedimentation from cropland, farmed right up to stream channel @ H. James Shearer farm, 388 Hershey Mill Road

High Priority Streambank erosion, lack of forest buffer, sedimentation from cropland, cattle have free access to stream @ Nelson H. Hershey farm, 420 Rohrer Road

High Priority Streambank erosion, lack of forest buffer, sedimentation from cropland, cattle have free access to stream @ J. Clayton Charles, Jr. farm, 229 Habecker Church Road

High Priority Streambank erosion, lack of forest buffer, sedimentation from cropland, cattle have free access to stream @ Elmer S. Sensenig, Jr. farm, 228 Habecker Church Road

High Priority Streambank erosion, lack of forest buffer, sedimentation from cropland, cattle have free access to stream @ David E. Charles farm, 3101 Charlestown Road

High Priority Streambank erosion, lack of forest buffer, sedimentation from cropland, cattle have free access to stream @ P. Kenneth Rohrer farm, 3052 Charlestown Road

High Priority Streambank erosion, lack of forest buffer, sedimentation from cropland, cattle have free access to stream @ Marlin S. Harnish farm, 3421 Blue Rock Road

High Priority Streambank erosion, lack of forest buffer, sedimentation from cropland, cattle have free access to stream @ Wilmer D. Rohrer, Inc. farm, 3390 Blue Rock Road

Medium Priority Lack of forest buffer, lack of in-stream habitat, localized sedimentation problem due to dam at the George B. Mann farm @ Chanastocka Nature Sanctuary owned by the Lancaster County Conservancy

As of this writing, this area was proposed for restoration funding to the Growing Greener Program in February 2003

High Priority Remove dam blockage @ George B. Mann farm lane (see above)

Unnamed Tributary intersecting West Branch @ Chanastocka Nature Sanctuary
(Properties listed from headwaters of tributary downstream to the confluence with the West Branch)

High Priority Streambank erosion, lack of forest buffer, sedimentation from cropland, cattle have free access to stream @ Simeon S. Glick farm, 503 Habecker Church Road

High Priority Streambank erosion, lack of forest buffer, sedimentation from cropland, cattle have free access to stream @ Norman Shertzer farm, 530 Habecker Church Road

High Priority Streambank erosion, lack of forest buffer, sedimentation from cropland, cattle have free access to stream @ Clyde E. Kreider farm, Charlestown Road

High Priority Streambank erosion, lack of forest buffer, sedimentation from cropland, cattle have free access to stream @ Jay V. Funk farm, 3593 Blue Rock Road

High Priority Streambank erosion, lack of forest buffer, sedimentation from cropland, cattle have free access to stream @ Wilmer D. Rohrer Inc. farm, Blue Rock Road

Medium Priority Streambank erosion @ Wendell L. Funk property

Listing now returning to the main West Branch downstream of Chanastocka Nature Sanctuary

High Priority Small pasture and grasslands immediately upstream and downstream from Bender Mill Road, severe streambank erosion, lack of forest buffer

High Priority Streambank erosion, lack of forest buffer, sedimentation from cropland, cattle have free access to stream @ James R. Barley farm, Bender Mill Road

High Priority Streambank erosion, lack of forest buffer, sedimentation from cropland, cattle have free access to stream @ Joan A. Witmer farm, Letort Road

High Priority Streambank erosion, lack of forest buffer, sedimentation from cropland @ David H. Frey farm, 704 Stehman Church Road

Medium Priority Agricultural related impacts from David H. Frey farm downstream to confluence with Main Stem – Includes following farms:

Letort Valley Farms, 400 Owl Bridge Road
Michael H. Walmer, North Cherry Street
Gregory J. Breslin, 523 Stehman Church Road
Ronald E. Hunt, 465 Stehman Church Road

Main Stem of Little Conestoga Creek

Municipality	Influence
East Hempfield Township	**Major Influencing Municipalities**
Lancaster Township	
Manheim Township	
Manor Township	
Penn Township	**Minor Influencing Municipalities**
Warwick Township	
Lancaster City	
East Petersburg Borough	
Lititz Borough	
Millersville Borough	

High Priority — Streambank erosion, lack of forest buffer, sedimentation from cropland, stream has been channelized @ Dale M. Nolt farm, 307 Bucknoll Road

High Priority — Streambank erosion, lack of forest buffer, sedimentation from cropland, stream has been channelized @ Noah W. Kreider & Sons Farm, 1461 Lancaster Road

High Priority — Streambank erosion, lack of forest buffer, sedimentation from cropland, stream has been channelized @ Kevin L. Nolt farm, 1603 Lancaster Road

Medium Priority — Lack of forest buffer @ Oakwood Properties, 1276 Lititz Road

High Priority — Streambank erosion, lack of forest buffer, free cattle access to stream @ Allen D. Esbenshade farm, 882 Lititz Road – owner did do some rip-rapping of streambank along Lititz Road

High Priority — Streambank erosion, lack of forest buffer, free cattle access to stream @ Gilbert B. Lyons farm, 1026 Lititz Road

Medium Priority — Binkley & Ober, Inc. quarry and McMinn's Asphalt @ Lancaster Road (Rte. 72) – McMinn's parking lot and staging area yielding contaminants to quarry discharge – mainly fine limestone dusts, litter and thermal pollution – high rates of stormwater runoff from McMinn's parking lot – no stormwater detention – Binkley & Ober, Inc. owns next property downstream from McMinn's Asphalt where a water quality basin and/or wetland treatment system could be installed

High Priority — Streambank erosion, free cattle access to stream, lack of forest buffer @ C. Gordon Ober farm, Quarry Road

High Priority Streambank erosion, free cattle access to stream, lack of forest buffer @ Benuel L. Petersheim farm, 709 Petersburg Road

Medium Priority Fallowing pasture, sporadic streambank erosion, possibility to improve forest buffer and in-stream habitat @ Wetherburn North ETAL, Fruitville Pike (Mr. Barry Hogan) – just upstream of confluence with tributary Bachman Run

Medium Priority Fallowing pasture, sporadic streambank erosion, possibility to improve forest buffer and in-stream habitat @ Peter B. Rohrer farm, 2544 Fruitville Pike and Ruth H. Rohrer farm, 2686 State Road – these farmsteads are right at the confluence with tributary Bachman Run

Bachman Run – Tributary within the Main Stem Sub-watershed
(Properties listed from headwaters of Bachman Run downstream to its confluence with the Main Stem)

High Priority Rohrer's Quarry – Currently in midst of upgrading sediment basin which should greatly improve pumping influence to Bachman Run – Depending upon storm events and groundwater levels, the quarry pumps large quantities of water from the quarry pit into the stream thus dramatically controlling flow volumes within the upper reaches of Bachman Run – sometimes the stream has water in it and some times it doesn't during the summer months

High Priority Streambank erosion, littering, introduction of manure due to poor barnyard management, lack of forest buffer, free cattle access to stream, sinkholes in substrate of stream @ David K. King farm, 929 Erbs quarry Road

High Priority Streambank erosion, sedimentation from cropland, sinkholes in substrate of stream @ James R. Buckwalter farm, 511 Snyder Road – very serious problem with sinkholes at this farm and David K. King farm

Medium Priority Retrofit stormwater quality BMPs within the following residential developments:

Milton Estates	Buckfield	Stonehenge
Wetherburn North	Mill Pond	Kingspointe
Flyway Business Park		

These developments do have stormwater management detention basins so flooding is not a problem

High priority Streambank erosion, lack of forest buffer, free cattle access to stream @ Philip W. Eyster farm, Buckwalter Road

High Priority Streambank erosion, sedimentation from cropland @ Buckwalter Farm LLC, 860 Buckwalter Road

Medium Priority Streambank erosion, lack of forest buffer, lawn clippings dumped into stream, floodway encroachments @ Wetherburn and Jeb Family LTD Partnership immediately upstream of Fruitville Pike

A Growing Greener Project is currently funded and under design in this area

Listing now returning to the Main Stem of the Little Conestoga Creek below its confluence with the Bachman Run Tributary

Medium Priority Horse farm – pasture could use streambank fencing and forest buffer, sporadic streambank erosion @ Harry J. Fogarty farm, 2620 Miller Road

High Priority Remove dam at PPL, Inc. upstream of Mannheim Pike (Route 72), also improve forest buffer and in-stream cover in area of dam

Medium Priority Retrofit stormwater quality BMPs @ Yellow Freight downstream of Manheim Pike (Route 72)

Medium Priority Lack of forest buffer, lack of in-stream cover @ Florys Mill

Unnamed tributary that enters Main Stem of the little Conestoga just below Florys Mill

High Priority Streambank erosion, sedimentation from nursery and greenhouse operation, lack of forest buffer @ Lloyd M. Lapp nursery, 1472 Stevens Street

Medium Priority Streambank erosion, sedimentation from cropland @ Hershey T. Rohrer, Jr. farm, 1572 State Road

High Priority Streambank erosion, lack of forest buffer, free cattle access to stream @ Vernon H. Charles farm, 2249 Leabrook Road

High Priority Streambank erosion, lack of forest buffer, sedimentation from cropland, processing of corn product waste generating a liquid waste that is routinely irrigated on cropland where it evidently washes into stream via storm events – BOD problems suspected – a yeasty, fermenting smell is very discernable in the substrate sediments at Route 283 – Need to involve PADEP @ Clyde H. Kreider farm, 2278 Leabrook Road

Listing now returning to the Main Stem of the Little Conestoga Creek below its confluence with the unnamed tributary at Florys Mill

High Priority Lack of forest buffer, water quality BMP retrofits with Granite Run Corporate Center

High Priority Thermal pollution, stormwater management and water quality retrofits at Park City

High Priority Severe streambank erosion, lack of forest buffer, very poor in-stream cover/habitat for aquatic life @ Mennonite Home, Inc.

High Priority Severe streambank erosion, lack of forest buffer, lack of in-stream cover @ Mark N. Ashley farm, 1048 W. Roseville Road

Main Stem of the Little Conestoga Creek downstream of Route 30

Medium Priority Water quality issues with pond and waterfowl, nutrient loading @ Longs Park

Medium Priority Sporadic streambank erosion, various locations where forest buffer could be improved, in-stream cover/habitat for aquatic life (especially Smallmouth bass could be greatly improved) @ the following properties:

Deisley Family LTD Partnership, 1418 Harrisburg Pike
Lancaster County Solid Waste, Farmingdale Road
Lancaster Malleable Castings, Harrisburg Pike
Franklin & Marshall College

High Priority Streambank erosion, lack of forest buffer, very poor in-stream habitat for aquatic life @ Windsor Court LP, 1821 Hidden Lane

High Priority Streambank erosion, lack of forest buffer, very poor in-stream habitat for aquatic life @ National Properties, Inc., 1707 Marietta Avenue

Medium Priority Retrofit stormwater quality BMPs within the following residential developments:

Barrcrest	Glenbrook
School Lane Hills	Woodlawn

Medium Priority Maintain recently planted riparian forest buffer and monitor in-steam structures @ Maple Grove Park

Medium Priority Retrofit stormwater quality BMPs within the following residential developments:

Stone Mill Manor Mobile Home Park	Pheasant Ridge
Canterbury Place	West Ridge

High Priority Work with the Conestoga Country Club and educate them in regards to the watershed restoration effort – They have been observed dumping their lawn clipping and yard wastes directly into the Little Conestoga Creek! Streambank stability and in-stream habitat are also concerns within the country club property

Medium Priority Streambank erosion/stability issues with falling trees, lack of forest buffer, poor in-stream habitat for aquatic life (habitat could greatly be improved for Smallmouth bass) @ Manor Township Park

High Priority Remove large log jam @ Benjamin H. Shertzer farm, 271 Blue Rock Road

Submitted for Growing Greener funding in February, 2003

High Priority Remove Frantz Mill Dam @ Ironstone Ridge Road

Low Priority Farms and properties downstream of Frantz Mill Dam

OTHER CONCERNS, SOLUTIONS AND STRATEGIES

COST ANALYSIS (ESTIMATED) AND FUNDING SOURCES

Streambank Fencing

Indian Run **Manor Township**

1. Sporadic pasturelands where livestock has free access to stream, streambank erosion, lack of forest buffer from the headwaters downstream to Indian Run Road

Fencing	10,000-feet		$ 20,000.00
Forest buffer	8.0-acres (35-feet width, both sides)		$ 8,000.00
Streambank stabilization, in-stream habitat			$ 30,000.00
Engineering, consulting			$ 10,000.00
		TOTAL	**$ 68,000.00**

2. Free cattle access to stream, streambank erosion @ Richard C. Falk, Jr. farm, 1004 Breneman Road

Fencing	2,600-feet		$ 5,200.00
Forest buffer	0.5-acres (35-feet width, both sides)		$ 500.00
Streambank stabilization, in-stream habitat			$ 4,000.00
Engineering, consulting			$ 2,000.00
		TOTAL	**$ 11,700.00**

3. Free cattle access to stream @ Allan R. Herr farm, 707 Walnut Hill Road, located right at the mouth of Indian Run

Fencing	2,600-feet		$ 5,200.00
Forest buffer	1.8-acres (35-feet width, both sides)		$ 1,800.00
Streambank stabilization, in-stream habitat			$ 8,000.00
Engineering, consulting			$ 3,000.00
		TOTAL	**$ 18,000.00**

Swarr Run **East Hempfield Township**

4. Free cattle access to stream, streambank erosion, lack of forest buffer, sedimentation from cropland @ Titus B. Stoner farm, 3207 Bowman Road

Fencing	3,600-feet	$ 7,200.00
Forest buffer	2.5-acres (35-feet width, both sides)	$ 2,500.00
Streambank stabilization, in-stream habitat		$ 13,000.00
Engineering, consulting		$ 5,000.00
	TOTAL	**$ 27,700.00**

5. Free cattle access to stream, streambank erosion, lack of forest buffer, sedimentation from cropland @ Benjamin S. Landis farm, 1361 Nissley Road

Fencing	3,150-feet	$ 6,300.00
Forest buffer	2.2-acres (35-feet width, both sides)	$ 2,200.00
Streambank stabilization, in-stream habitat		$ 6,000.00
Engineering, consulting		$ 3,000.00
	TOTAL	**$ 17,500.00**

6. Free sheep access to stream, sporadic streambank erosion, lack of forest buffer @ farm owned by Centaurus LLC, 2148 State Road

Fencing	525-feet	$ 1,050.00
Forest buffer	0.4-acres (35-feet width, both sides)	$ 400.00
Streambank stabilization, in-stream habitat		$ 6,000.00
Engineering, consulting		$ 3,500.00
	TOTAL	**$ 10,950.00**

7. Free cattle access to stream, severe streambank erosion, lack of in-stream cover, lack of forest buffer, sedimentation from cropland, manure introduction from feedlot @ Clair D. Landis farm, 1366 Colebrook Road

Fencing	3,000-feet	$ 6,000.00
Forest buffer	2.0-acres (35-feet width, both sides)	$ 2,000.00
Streambank stabilization, in-stream habitat		$ 30,000.00
Engineering, consulting		$ 10,000.00
	TOTAL	**$ 48,000.00**

West Branch   **Manor Township**

8. Streambank erosion, lack of forest buffer, sedimentation from cropland, cattle have free access to stream @ Nelson H. Hershey farm, 420 Rohrer Road

Fencing	3,750-feet		$ 7,500.00
Forest buffer	2.6-acres (35-feet width, both sides)		$ 2,600.00
Streambank stabilization, in-stream habitat			$ 10,000.00
Engineering, consulting			$ 6,000.00
		TOTAL	**$ 26,100.00**

9. Streambank erosion, lack of forest buffer, sedimentation from cropland, cattle have free access to stream @ J. Clayton Charles, Jr. farm, 229 Habecker Church Road

Fencing	2,400-feet		$ 4,800.00
Forest buffer	1.7-acres (35-feet width, both sides)		$ 1,700.00
Streambank stabilization, in-stream habitat			$ 8,000.00
Engineering, consulting			$ 5,000.00
		TOTAL	**$ 19,500.00**

10. Streambank erosion, lack of forest buffer, sedimentation from cropland, cattle have free access to stream @ Elmer S. Sensenig, Jr. farm, 228 Habecker Church Road

Fencing	2,700-feet		$ 5,400.00
Forest buffer	4.0-acres (35-feet width, both sides)		$ 4,000.00
Streambank stabilization, in-stream habitat			$ 12,000.00
Engineering, consulting			$ 4,500.00
		TOTAL	**$ 25,900.00**

11. Streambank erosion, lack of forest buffer, sedimentation from cropland, cattle have free access to stream @ David E. Charles farm, 3101 Charlestown Road

Fencing	1,200-feet		$ 2,400.00
Forest buffer	0.8-acres (35-feet width, both sides)		$ 800.00
Streambank stabilization, in-stream habitat			$ 3,000.00
Engineering, consulting			$ 1,500.00
		TOTAL	**$ 7,700.00**

12. Streambank erosion, lack of forest buffer, sedimentation from cropland, cattle have free access to stream @ P. Kenneth Rohrer farm, 3052 Charlestown Road

Fencing	2,700-feet		$ 5,400.00
Forest buffer	1.9-acres (35-feet width, both sides)		$ 1,900.00
Streambank stabilization, in-stream habitat			$ 9,000.00
Engineering, consulting			$ 3,500.00
		TOTAL	**$ 19,800.00**

13. Streambank erosion, lack of forest buffer, sedimentation from cropland, cattle have free access to stream @ Marlin S. Harnish farm, 3421 Blue Rock Road

Fencing	3,450-feet		$ 6,900.00
Forest buffer	2.4-acres (35-feet width, both sides)		$ 2,400.00
Streambank stabilization, in-stream habitat			$ 13,000.00
Engineering, consulting			$ 4,500.00
		TOTAL	**$ 26,800.00**

14. Streambank erosion, lack of forest buffer, sedimentation from cropland, cattle have free access to stream @ Wilmer D. Rohrer, Inc. farm, 3390 Blue Rock Road

Fencing	4,500-feet		$ 9,000.00
Forest buffer	3.0-acres (35-feet width, both sides)		$ 3,000.00
Streambank stabilization, in-stream habitat			$ 16,000.00
Engineering, consulting			$ 4,500.00
		TOTAL	**$ 32,500.00**

Unnamed Tributary intersecting West Branch @ Chanastocka Nature Sanctuary
(Properties listed from headwaters of tributary downstream to the confluence with the West Branch)

15. Streambank erosion, lack of forest buffer, sedimentation from cropland, cattle have free access to stream @ Simeon S. Glick farm, 503 Habecker Church Road

Fencing	3,450-feet		$ 6,900.00
Forest buffer	2.4-acres (35-feet width, both sides)		$ 2,400.00
Streambank stabilization, in-stream habitat			$ 5,000.00
Engineering, consulting			$ 1,500.00
		TOTAL	**$ 15,800.00**

16. Streambank erosion, lack of forest buffer, sedimentation from cropland, cattle have free access to stream @ Norman Shertzer farm, 530 Habecker Church Road

Fencing	3,900-feet		$ 7,800.00
Forest buffer	2.7-acres (35-feet width, both sides)		$ 2,700.00
Streambank stabilization, in-stream habitat			$ 11,000.00
Engineering, consulting			$ 4,500.00
		TOTAL	**$ 26,000.00**

17. Streambank erosion, lack of forest buffer, sedimentation from cropland, cattle have free access to stream @ Clyde E. Kreider farm, Charlestown Road

Fencing	2,250-feet		$ 4,500.00
Forest buffer	1.5-acres (35-feet width, both sides)		$ 1,500.00
Streambank stabilization, in-stream habitat			$ 6,000.00
Engineering, consulting			$ 2,500.00
		TOTAL	**$ 14,500.00**

18. Streambank erosion, lack of forest buffer, sedimentation from cropland, cattle have free access to stream @ Jay V. Funk farm, 3593 Blue Rock Road

Fencing	2,700-feet		$ 5,400.00
Forest buffer	1.8-acres (35-feet width, both sides)		$ 1,800.00
Streambank stabilization, in-stream habitat			$ 7,000.00
Engineering, consulting			$ 3,000.00
		TOTAL	**$ 17,200.00**

19. Streambank erosion, lack of forest buffer, sedimentation from cropland, cattle have free access to stream @ Wilmer D. Rohrer Inc. farm, Blue Rock Road

Fencing	2,850-feet		$ 5,700.00
Forest buffer	2.0-acres (35-feet width, both sides)		$ 2,000.00
Streambank stabilization, in-stream habitat			$ 7,500.00
Engineering, consulting			$ 3,000.00
		TOTAL	**$ 18,200.00**

Listing now returning to the main West Branch downstream of Chanastocka Nature Sanctuary

20. Streambank erosion, lack of forest buffer, sedimentation from cropland, cattle have free access to stream @ James R. Barley farm, Bender Mill Road

Fencing	3,000-feet	$ 6,000.00
Forest buffer	2.0-acres (35-feet width, both sides)	$ 2,000.00
Streambank stabilization, in-stream habitat		$ 15,000.00
Engineering, consulting		$ 5,000.00
	TOTAL	**$ 28,000.00**

21. Streambank erosion, lack of forest buffer, sedimentation from cropland, cattle have free access to stream @ Joan A. Witmer farm, Letort Road

Fencing	1,200-feet	$ 2,400.00
Forest buffer	0.7-acres (35-feet width, both sides)	$ 700.00
Streambank stabilization, in-stream habitat		$ 6,000.00
Engineering, consulting		$ 2,000.00
	TOTAL	**$ 11,100.00**

Main Stem of Little Conestoga Creek

22. Streambank erosion, lack of forest buffer, free cattle access to stream @ Allen D. Esbenshade farm, 882 Lititz Road – owner did do some rip-rapping of streambank along Lititz Road

Fencing	3,000-feet	$ 6,000.00
Forest buffer	2.0-acres (35-feet width, both sides)	$ 2,000.00
Streambank stabilization, in-stream habitat		$ 11,000.00
Engineering, consulting		$ 5,000.00
	TOTAL	**$ 24,000.00**

23. Streambank erosion, lack of forest buffer, free cattle access to stream @ Gilbert B. Lyons farm, 1026 Lititz Road

Fencing	500-feet	$ 1,000.00
Forest buffer	0.7-acres (35-feet width, both sides)	$ 700.00
Streambank stabilization, in-stream habitat		$ 2,000.00
Engineering, consulting		$ 3,000.00
	TOTAL	**$ 6,700.00**

24. Streambank erosion, free cattle access to stream, lack of forest buffer @ C. Gordon Ober farm, Quarry Road

Fencing	2,100-feet	$ 4,200.00
Forest buffer	1.4-acres (35-feet width, both sides)	$ 1,400.00
Streambank stabilization, in-stream habitat		$ 9,000.00
Engineering, consulting		$ 3,500.00
	TOTAL	**$ 18,100.00**

25. Streambank erosion, free cattle access to stream, lack of forest buffer @ Benuel L. Petersheim farm, 709 Petersburg Road

Fencing	3,000-feet	$ 6,000.00
Forest buffer	2.0-acres (35-feet width, both sides)	$ 2,000.00
Streambank stabilization, in-stream habitat		$ 25,000.00
Engineering, consulting		$ 7,500.00
	TOTAL	**$ 40,500.00**

Bachman Run – Tributary within the Main Stem Sub-watershed
(Properties listed from headwaters of Bachman Run downstream to its confluence with the Main Stem)

26. Streambank erosion, littering, introduction of manure due to poor barnyard management, lack of forest buffer, free cattle access to stream, sinkholes in substrate of stream @ David K. King farm, 929 Erbs quarry Road

Fencing	1,650-feet	$ 3,300.00
Forest buffer	1.1-acres (35-feet width, both sides)	$ 1,100.00
Streambank stabilization, in-stream habitat		$ 20,000.00
Engineering, consulting		$ 6,000.00
	TOTAL	**$ 30,400.00**

27. Streambank erosion, lack of forest buffer, free cattle access to stream @ Philip W. Eyster farm, Buckwalter Road

Fencing	3,600.00-feet	$ 7,200.00
Forest buffer	2.5-acres (35-feet width, both sides)	$ 2,500.00
Streambank stabilization, in-stream habitat		$ 10,000.0
Engineering, consulting		$ 3,500.00
	TOTAL	**$ 23,200.00**

Listing now returning to the Main Stem of the Little Conestoga Creek below its confluence with the Bachman Run Tributary

28. Horse farm – pasture could use streambank fencing and forest buffer, sporadic streambank erosion @ Harry J. Fogarty farm, 2620 Miller Road

Fencing	3,000-feet	$ 6,000.00
Forest buffer	2.0-acres (35-feet width, both sides)	$ 2,000.00
Streambank stabilization, in-stream habitat		$ 15,000.00
Engineering, consulting		$ 4,500.00
	TOTAL	**$ 27,500.00**

Unnamed tributary that enters Main Stem of the Little Conestoga just below Florys Mill

29. Streambank erosion, lack of forest buffer, free cattle access to stream @ Vernon H. Charles farm, 2249 Leabrook Road

Fencing	3,300-feet	$ 6,600.00
Forest buffer	2.3-acres (35-feet width, both sides)	$ 2,300.00
Streambank stabilization, in-stream habitat		$ 12,000.00
Engineering, consulting		$ 3,500.00
	TOTAL	**$ 24,400.00**

Stormwater Improvements

Brubaker Run East Hempfield Township

1. Stormwater management and water quality retrofits within Old Sycamore Industrial Park, Sycamore Business Complex and Centerville Industrial Park

Requires further study and planning	**$ 20,000.00**

2. Littering, channelized stream, thermal pollution, parking lot contaminants, stormwater quality BMP retrofit possibilities @ Stauffers of Kissel Hill store, Millersville Road

Requires further study and planning	**$ 20,000.00**

Millers Run East Hempfield Township

3. Severe streambank erosion due to lack of stormwater management, stormwater quality BMP retrofit possibilities, lack of forest buffer, floodway encroachments by landowners, stream channel incised – needs to be re-introduced to floodway and floodplain from Valley View Drive @ School Lane Estates development downstream to Sylvan Road

Requires further study and planning		$ 35,000.00
Estimated construction/implementation		$ 240,000.00
	TOTAL	**$ 275,000.00**

Swarr Run East Hempfield Township

4. Retrofit stormwater basins with water quality BMPs at Hempfield High School and Middle School

Requires further study and planning		$ 15,000.00
Estimated construction/implementation		$ 80,000.00
	TOTAL	**$ 95,000.00**

5. Stormwater retrofits @ Olde Forge Crossing residential subdivision

Requires further study and planning		$ 40,000.00
Estimated construction/implementation		$ 250,000.00
	TOTAL	**$ 290,000.00**

6. Sporadic streambank erosion, lack of forest buffer, lack of in-stream cover, stormwater basin water quality BMP retrofits @ Mennonite Home Inc. property, 2001 Harrisburg Pike

Requires further study and planning		$ 30,000.00
Estimated construction/implementation		$ 200,000.00
	TOTAL	**$ 230,000.00**

Main Stem of Little Conestoga Creek

7. Binkley & Ober, Inc. quarry and McMinn's Asphalt @ Lancaster Road (Rte. 72) – McMinn's parking lot and staging area yielding contaminants to quarry discharge – mainly fine limestone dusts, litter and thermal pollution – high rates of stormwater runoff from McMinn's parking lot – no stormwater detention – Binkley & Ober, Inc. owns next property downstream from McMinn's Asphalt where a water quality basin and/or wetland treatment system could be installed

Requires further study and planning		$ 25,000.00
Estimated construction/implementation		$ 150,000.00
	TOTAL	**$ 175,000.00**

Bachman Run – Tributary within the Main Stem Sub-watershed
(Properties listed from headwaters of Bachman Run downstream to its confluence with the Main Stem)

8. Retrofit stormwater quality BMPs within the following residential developments:

Milton Estates	Buckfield	Stonehenge
Wetherburn North	Mill Pond	Kingspointe
Flyway Business Park		

Requires further study and planning

Listing now returning to the Main Stem of the Little Conestoga Creek below its confluence with the Bachman Run Tributary

9. Retrofit stormwater quality BMPs @ Yellow Freight downstream of Manheim Pike (Route 72)

Requires further study and planning		$ 40,000.00
Estimated construction/implementation		$ 250,000.00
	TOTAL	**$ 290,000.00**

Listing now returning to the Main Stem of the Little Conestoga Creek below its confluence with the unnamed tributary at Florys Mill

10. Lack of forest buffer, water quality BMP retrofits with Granite Run Corporate Center

Requires further study and planning		$ 10,000.00
Estimated construction/implementation		$ 30,000.00
	TOTAL	**$ 40,000.00**

11. Thermal pollution, stormwater management and water quality retrofits at Park City

Requires further study and planning

Main Stem of the Little Conestoga Creek downstream of Route 30

12. Water quality issues with pond and waterfowl, nutrient loading @ Longs Park

Requires further study and planning	**$ 15,000.00**

13. Retrofit stormwater quality BMPs within the following residential developments:

Barrcrest	Glenbrook
School Lane Hills	Woodlawn

Requires further study and planning

14. Retrofit stormwater quality BMPs within the following residential developments:

Stone Mill Manor Mobile Home Park	Pheasant Ridge
Canterbury Place	West Ridge

Requires further study and planning

Streambank Stabilization & Forest Buffers

Brubaker Run East Hempfield Township

1. Streambank erosion, lack of forest buffer @ J. Wilson and Donna J. Hershey farm, 2715 Columbia Avenue

Forest buffer	3.6-acres (35-feet width, both sides)	$ 3,600.00
Streambank stabilization, in-stream habitat	2,625-feet	$ 13,125.00
Engineering, consulting		$ 3,500.00
	TOTAL	**$ 20,225.00**

2. Streambank erosion, farmed/cropped right up to the stream channel, sedimentation from cropland @ Herley Industries, Inc. property, Running Pump Road

Forest buffer	1.8-acres (35-feet width, both sides)	$ 1,800.00
Streambank stabilization, in-stream habitat	1,350-feet	$ 6,750.00
Engineering, consulting		$ 2,500.00
	TOTAL	**$ 11,050.00**

3. Streambank erosion, forest buffer could be improved @ John I. Hartman, Jr. farm, 2452 Marietta Avenue

Forest buffer	4.3-acres (35-feet width, both sides)	$ 4,300.00
Streambank stabilization, in-stream habitat	3,075-feet	$ 15,000.00
Engineering, consulting		$ 3,000.00
	TOTAL	**$ 22,300.00**

4. Streambank erosion, lack of forest buffer though stream is located in fallowing pasture @ WMP Ltd. property, 206 Rohrerstown Road

Forest buffer	2.6-acres (35-feet width, both sides)	$ 2,600.00
Streambank stabilization, in-stream habitat	1,875-feet	$ 7,000.00
Engineering, consulting		$ 2,000.00
	TOTAL	**$ 11,600.00**

5. Streambank erosion, lack of forest buffer @ Church of the Apostles, 1842 Marietta Avenue

Forest buffer	1.8-acres (35-feet width, both sides)	$ 3,000.00
Streambank stabilization, in-stream habitat	1,350-feet	$ 10,000.00
Engineering, consulting		$ 4,500.00
	TOTAL	**$ 17,500.00**

Millers Run East Hempfield Township

6. Sporadic streambank erosion from headwaters downstream to Westminster Drive @ School Lane Estates development

Streambank stabilization, in-stream habitat 1,500-feet		$ 12,000.00
Engineering, consulting		$ 5,500.00
	TOTAL	**$ 17,500.00**

7. Severe streambank erosion, sedimentation from Sylvan Road downstream to Old Harrisburg Pike @ Joseph F. and Dianne M. Mast property, 1059 Sylvan Road and @ Sylvan View Farms PT property currently undergoing subdivision ("Village Grande At Millers Run"), 2348 Harrisburg Pike

Forest buffer 5.7-acres (35-feet width, both sides)		$ 5,700.00
Streambank stabilization, in-stream habitat 4,125-feet		$ 30,000.00
Engineering, consulting		$ 13,000.00
	TOTAL	**$ 48,700.00**

Swarr Run East Hempfield Township

8. Severe streambank erosion and lack of forest buffer @ East Hempfield Sports Complex owned by East Hempfield Township

Forest buffer 4.9-acres (35-feet width, both sides)		$ 4,900.00
Streambank stabilization, in-stream habitat 3,525-feet		$ 40,000.00
Engineering, consulting		$ 12,000.00
	TOTAL	**$ 56,900.00**

9. Lack of forest buffer, sporadic streambank erosion @ Larry J. Booth farm, 1046 Snapper Road

Forest buffer 1.6-acres (35-feet width, both sides)		$ 1,600.00
Streambank stabilization, in-stream habitat 1,200-feet		$ 8,000.00
Engineering, consulting		$ 3,000.00
	TOTAL	**$ 12,600.00**

10. Lack of forest buffer, streambank erosion @ Gregory A. Meinzer property, 580 Church Street

Forest buffer 1.0-acres (35-feet width, both sides)		$ 1,000.00
Streambank stabilization, in-stream habitat 800-feet		$ 7,000.00
Engineering, consulting		$ 3,500.00
	TOTAL	**$ 11,500.00**

11. Lack of forest buffer, evidence of past stream relocation, existing wetland impacts, currently farmed but owned by Hempfield School District just upstream of Church Street, property at 478 Church Street

Forest buffer	1.7-acres (B&B stock)		$ 7,000.00
Streambank stabilization, in-stream habitat	1,200-feet		$ 9,000.00
Wetland restoration			$ 40,000.00
Engineering, consulting			$ 18,000.00
		TOTAL	**$ 74,000.00**

12. Lack of forest buffer, streambank erosion @ Lloyd B. Denlinger property, 3060 Harrisburg Pike

Forest buffer	1.5-acres (35-feet width, both sides)		$ 1,500.00
Streambank stabilization, in-stream habitat	1,200.00-feet		$ 8,000.00
Engineering, consulting			$ 3,500.00
		TOTAL	**$ 13,000.00**

13. Sporadic streambank erosion @ Robert Z. Getz property

Streambank stabilization, in-stream habitat	1,350-feet		$ 10,000.00
Engineering, consulting			$ 3,500.00
		TOTAL	**$ 13,500.00**

14. Sporadic streambank erosion, lack of forest buffer, lack of in-stream cover @ Golden Meadows, Inc. property

Forest buffer	1.0-acres (B&B stock)		$ 3,000.00
Streambank stabilization, in-stream habitat	600-feet		$ 17,000.00
Engineering, consulting			$ 5,000.00
		TOTAL	**$ 25,000.00**

15. Sporadic streambank erosion, lack of forest buffer, lack of in-stream cover @ The TC Lancaster West Co. property, 1-419 Colonial Crest Drive

Forest buffer	2.0-acres (35-feet width, both sides)		$ 3,000.00
Streambank stabilization, in-stream habitat	1,200-feet		$ 18,000.00
Engineering, consulting			$ 7,000.00
		TOTAL	**$ 28,000.00**

16. Sporadic streambank erosion, lack of forest buffer, lack of in-stream cover, littering @ MGA Acquisition LP property, 2000 Swarr Run Road

Forest buffer	2.0-acres (35-feet width, both sides)		$ 3,000.00
Streambank stabilization, in-stream habitat	1,500-feet		$ 25,000.00
Engineering, consulting			$ 10,000.00
		TOTAL	**$ 38,000.00**

West Branch **Manor Township**

17. Streambank erosion, lack of forest buffer, sedimentation from cropland, farmed right up to stream channel @ Fieldcrest Associates property, 292 Hershey Mill Road

Forest buffer	1.5-acres (35-feet width, both sides)		$ 2,000.00
Streambank stabilization, in-stream habitat	1,050-feet		$ 35,000.00
Engineering, consulting			$ 12,000.00
		TOTAL	**$ 49,000.00**

18. Streambank erosion, lack of forest buffer, sedimentation from cropland, farmed right up to stream channel @ H. James Shearer farm, 388 Hershey Mill Road

Forest buffer	2.1-acres (35-feet width, both sides)		$ 3,000.00
Streambank stabilization, in-stream habitat	1,575-feet		$ 20,000.00
Engineering, consulting			$ 5,000.00
		TOTAL	**$ 28,000.00**

Unnamed Tributary intersecting West Branch @ Chanastocka Nature Sanctuary
(Properties listed from headwaters of tributary downstream to the confluence with the West Branch)

19. Streambank erosion @ Wendell L. Funk property

Streambank stabilization, in-stream habitat	525-feet		$ 5,000.00
Engineering, consulting			$ 3,000.00
		TOTAL	**$ 8,000.00**

Listing now returning to the main West Branch downstream of Chanastocka Nature Sanctuary

20. Small pasture and grasslands immediately upstream and downstream from Bender Mill Road, severe streambank erosion, lack of forest buffer

Forest buffer	1.3-acres (35-feet width, both sides)	$ 1,300.00
Streambank stabilization, in-stream habitat	750-feet	$ 15,000.00
Engineering, consulting		$ 6,000.00
	TOTAL	**$ 22,300.00**

21. Streambank erosion, lack of forest buffer, sedimentation from cropland @ David H. Frey farm, 704 Stehman Church Road

Forest buffer	2.5-acres (35-feet width, both sides)	$ 2,500.00
Streambank stabilization, in-stream habitat	2,325-feet	$ 12,000.00
Engineering, consulting		$ 4,500.00
	TOTAL	**$ 19,000.00**

Main Stem of Little Conestoga Creek

22. Streambank erosion, lack of forest buffer, sedimentation from cropland, stream has been channelized @ Dale M. Nolt farm, 307 Bucknoll Road

Forest buffer	1.9-acres (35-feet width, both sides)	$ 2,000.00
Streambank stabilization, in-stream habitat	1,350-feet	$ 8,000.00
Engineering, consulting		$ 3,500.00
	TOTAL	**$ 13,500.00**

23. Streambank erosion, lack of forest buffer, sedimentation from cropland, stream has been channelized @ Noah W. Kreider & Sons Farm, 1461 Lancaster Road

Forest buffer	2.6-acres (35-feet width, both sides)	$ 2,600.00
Streambank stabilization, in-stream habitat	1,875-feet	$ 9,000.00
Engineering, consulting		$ 3,500.00
	TOTAL	**$ 15,100.00**

24. Streambank erosion, lack of forest buffer, sedimentation from cropland, stream has been channelized @ Kevin L. Nolt farm, 1603 Lancaster Road

Forest buffer	1.9-acres (35-feet width, both sides)	$ 2,000.00
Streambank stabilization, in-stream habitat	1,350-feet	$ 8,000.00
Engineering, consulting		$ 3,500.00
	TOTAL	**$ 13,500.00**

25. Lack of forest buffer @ Oakwood Properties, 1276 Lititz Road

Forest buffer	0.6-acres (35-feet width, both sides)	**$ 600.00**

26. Fallowing pasture, sporadic streambank erosion, possibility to improve forest buffer and in-stream habitat @ Wetherburn North ETAL, Fruitville Pike (Mr. Barry Hogan) – just upstream of confluence with tributary Bachman Run

Forest buffer	3.6-acres (35-feet width, both sides)	$ 5,000.00
Streambank stabilization, in-stream habitat	2,625-feet	$ 15,000.00
Wetland enhancements		$ 25,000.00
Engineering, consulting		$ 12,000.00
	TOTAL	**$ 57,000.00**

27. Fallowing pasture, sporadic streambank erosion, possibility to improve forest buffer and in-stream habitat @ Peter B. Rohrer farm, 2544 Fruitville Pike and Ruth H. Rohrer farm, 2686 State Road – these farmsteads are right at the confluence with tributary Bachman Run

Forest buffer	2.0-acres (35-feet width, both sides)	$ 2,500.00
Streambank stabilization, in-stream habitat	1,500-feet	$ 12,000.00
Engineering, consulting		$ 8,000.00
	TOTAL	**$ 22,500.00**

Bachman Run – Tributary within the Main Stem Sub-watershed
(Properties listed from headwaters of Bachman Run downstream to its confluence with the Main Stem)

28. Streambank erosion, sedimentation from cropland, sinkholes in substrate of stream @ James R. Buckwalter farm, 511 Snyder Road – very serious problem with sinkholes at this farm and David K. King farm

Forest buffer	2.0-acres (35-feet width, both sides)	$ 2,000.00
Streambank stabilization, in-stream habitat	1,500-feet	$ 25,000.00
Engineering, consulting		$ 10,000.00
	TOTAL	**$ 37,000.00**

29. Streambank erosion, sedimentation from cropland @ Buckwalter Farm LLC, 860 Buckwalter Road

Forest buffer	1.0-acres (35-feet width, both sides)	$ 1,000.00
Streambank stabilization, in-stream habitat	750-feet	$ 6,000.00
Engineering, consulting		$ 2,500.00
	TOTAL	**$ 9,500.00**

Unnamed tributary that enters Main Stem of the little Conestoga just below Florys Mill

30. Streambank erosion, sedimentation from nursery and greenhouse operation, lack of forest buffer @ Lloyd M. Lapp nursery, 1472 Stevens Street

Forest buffer	2.6-acres (35-feet width, both sides)	$ 2,600.00
Streambank stabilization, in-stream habitat	1,875-feet	$ 14,000.00
Engineering, consulting		$ 5,000.00
	TOTAL	**$ 21,600.00**

31. Streambank erosion, sedimentation from cropland @ Hershey T. Rohrer, Jr. farm, 1572 State Road

Forest buffer	1.5-acres (35-feet width, both sides)	$ 1,500.00
Streambank stabilization, in-stream habitat	1,125-feet	$ 9,000.00
Engineering, consulting		$ 3,500.00
	TOTAL	**$ 14,000.00**

32. Streambank erosion, lack of forest buffer, sedimentation from cropland, processing of corn product waste generating a liquid waste that is routinely irrigated on cropland where it evidently washes into stream via storm events – BOD problems suspected – a yeasty, fermenting smell is very discernable in the substrate sediments at Route 283 – Need to involve PADEP @ Clyde H. Kreider farm, 2278 Leabrook Road

    Requires further investigation

Listing now returning to the Main Stem of the Little Conestoga Creek below its confluence with the unnamed tributary at Florys Mill

33. Severe streambank erosion, lack of forest buffer, very poor in-stream cover/habitat for aquatic life @ Mennonite Home, Inc.

Forest buffer	1.8-acres (35-feet width, both sides)	$ 4,000.00
Streambank stabilization, in-stream habitat	1,125-feet	$ 38,000.00
Engineering, consulting		$ 13,000.00
	TOTAL	**$ 55,00.00**

34. Severe streambank erosion, lack of forest buffer, lack of in-stream cover @ Mark N. Ashley farm, 1048 W. Roseville Road

    Requires further investigation – stream channel is split

Main Stem of the Little Conestoga Creek downstream of Route 30

35. Sporadic streambank erosion, various locations where forest buffer could be improved, in-stream cover/habitat for aquatic life (especially Smallmouth bass could be greatly improved) @ the following properties:

    Deisley Family LTD Partnership, 1418 Harrisburg Pike
    Lancaster County Solid Waste, Farmingdale Road
    Lancaster Malleable Castings, Harrisburg Pike
    Franklin & Marshall College

    Requires further investigation and discussion with owners

36. Streambank erosion, lack of forest buffer, very poor in-stream habitat for aquatic life @ Windsor Court LP, 1821 Hidden Lane

Forest buffer	1.2-acres (35-feet width, both sides)	$ 3,800.00
Streambank stabilization, in-stream habitat	900-feet	$ 15,000.00
Engineering, consulting		$ 6,500.00
	TOTAL	**$ 25,300.00**

37. Streambank erosion, lack of forest buffer, very poor in-stream habitat for aquatic life @ National Properties, Inc., 1707 Marietta Avenue

Forest buffer	1.4-acres (35-feet width, both sides)	$ 4,500.00
Streambank stabilization, in-stream habitat	1,050-feet	$ 25,000.00
Engineering, consulting		$ 9,000.00
	TOTAL	**$ 38,500.00**

38. Work with the Conestoga Country Club and educate them in regards to the watershed restoration effort – They have been observed dumping their lawn clipping and yard wastes directly into the Little Conestoga Creek! Streambank stability and in-stream habitat are also concerns within the country club property

    Requires further investigation and discussion with the owner

39. Streambank erosion/stability issues with falling trees, lack of forest buffer, poor in-stream habitat for aquatic life (habitat could greatly be improved for Smallmouth bass) @ Manor Township Park

Forest buffer	4.0-acres (35-feet width, both sides)	$ 8,000.00
Streambank stabilization, in-stream habitat	3,000-feet	$ 85,000.00
Engineering, consulting		$ 18,000.00
	TOTAL	**$ 111,000.00**

Other

Brubaker Run **East Hempfield Township**

1. Removal of exotic, invasive plant species with the East Hempfield Township Park

$ 9,000.00

2. In-stream habitat improvements downstream of Glenbrook Court

$ 20,000.00

West Branch **Manor Township**

3. Remove dam blockage @ George B. Mann farm lane (see above)

Engineering, consulting		$ 8,000.00
Estimated removal		$ 15,000.00
	TOTAL	**$ 23,000.00**

Listing now returning to the main West Branch downstream of Chanastocka Nature Sanctuary

4. Agricultural related impacts from David H. Frey farm downstream to confluence with Main Stem – Includes following farms:

   Letort Valley Farms, 400 Owl Bridge Road
   Michael H. Walmer, North Cherry Street
   Gregory J. Breslin, 523 Stehman Church Road
   Ronald E. Hunt, 465 Stehman Church Road

   Requires further investigation with assistance from the Lancaster County Conservation District

Listing now returning to the Main Stem of the Little Conestoga Creek below its confluence with the Bachman Run Tributary

5. Remove dam at PPL, Inc. upstream of Mannheim Pike (Route 72), also improve forest buffer and in-stream cover in area of dam

$ 12,000.00

Main Stem of the Little Conestoga Creek downstream of Route 30

6. Remove Frantz Mill Dam @ Ironstone Ridge Road

Engineering, consulting		$ 18,000.00
Estimate removal costs		$ 45,000.00
	TOTAL	**$ 63,000.00**

FISHERY MANAGEMENT OPTIONS

See Chapter V – Fishery Investigation for additional information and management strategy.

BUILDING PUBLIC SUPPORT

See Chapter X – Partnerships and Public Relations for additional information.

Education of Stakeholders in Watershed Stewardship

- Educational materials (signage, brochures, mailings)
- Watershed training and demonstrations projects
- Presentations in schools, colleges, municipalities
- Presentations to landowners

Litter clean-ups

Improve Water-Based Recreational Opportunities

- Explore trail, park and access possibilities
- Work with landowners to improve public access
- Improve trout fishery as recommended
- Improve bass fishery as recommended
- Explore canoeing and kayaking routes

Pursue media coverage opportunities

Ad Crable (Lancaster New Era – evening newspaper) has served the Little Conestoga Watershed Alliance well in the past and continues to express an interest in the Alliance's restoration efforts.

Ad Crable
New Era
717-481-6029
acrable@lnpnews.com

Kevin Johns (FOX 43 News) has provide on-site television news coverage in the past and has expressed an interest in covering other interesting events.

Kevin Johns
FOX 43 News
717-393-0043
717-290-07425

INTERACTING WITH LOCAL, COUNTY AND STATE GOVERNMENT

Work closely with the Lancaster County Conservation District in addressing agricultural related concerns

Lancaster County Conservation District
Room #6, Farm and Home Center
1383 Arcadia Road
Lancaster, PA 17601

- Streambank fencing
- Barnyard and feedlot problems
- Nutrient management (manure and fertilizer)
- Cropland erosion and resulting sedimentation
- Attend District Board meetings (monthly)
- Establish a liaison between the District and Little Conestoga Watershed Alliance

Develop and improve working relationship with municipalities

- Establish a liaison between the municipality and Little Conestoga Watershed Alliance
- Meet with municipalities and explain watershed concerns and partnering possibilities/opportunities (with assistance from RETTEW Associates, Inc.) Discuss ways in which municipalities could better accommodate watershed concerns (i.e. land development, zoning, stormwater management, comprehensive planning)
- Apply water quality BMPs on municipal owned properties

MONITORING PROGRESS

Professor Philip J. Nyhus of Franklin and Marshall College has expressed an interest in having his "Environmental Problems" class continue their monitoring and assessment endeavors in 2003 and beyond.

In February of 2003, Michelle Spitko, President of the Little Conestoga Watershed Alliance and Mark Metzler of RETTEW Associates, Inc. gave a presentation to the "new" class of junior and senior students, introducing them to the watershed and informing them of past and present assessment and restoration activities.

The 2003 class intends to continue the assessment study and various investigations begun by the 2002 class and report their findings to the Little Conestoga Watershed Alliance.

The Senior Environmental Corps is also continuing their monitoring activities within the watershed and is regularly represented at the Alliance's monthly meetings.

It is vital the Alliance maintain a working relationship with Franklin and Marshall College and the Senior Environmental Corps.