WATERSHED CHARACTERIZATION

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1.0 Project Overview and Background

1.1 Introduction

The *Black Creek Watershed Characterization* provides a description of Black Creek's watershed area and the condition of natural resources and the built environment within that area. This characterization is the first component of a comprehensive watershed management plan for the Black Creek watershed. The characterization includes:

- Description of the watershed and its constituent subwatersheds, land use and land cover, demographics, natural resources, and infrastructure;
- Evaluation of existing water quality data, run-off characteristics and pollutant loadings, including the identification of critical knowledge gaps pertaining to these subject areas; and
- Identification of pollution sources, sources of water quality impairment, and potential threats to water quality and watershed hydrology and ecology.

In addition to the watershed characterization, subsequent project components will together comprise an overall strategy to protect and restore water quality and quantity within the Black Creek watershed. These components include:

- A community education and outreach program on water quality and quantity and watershed protection issues;
- Identification of management strategies and prioritization of projects and other actions for watershed protection and restoration;
- Identification of land and water use controls for water quality and quantity management and roles and responsibilities of governmental and non-governmental organizations; and
- An implementation strategy, including the identification of watershed wide and site specific projects and other actions necessary to protect and restore water quality.

This *Black Creek Watershed Characterization* report is intended to facilitate these subsequent tasks by establishing a reliable inventory of existing and available information to apply or build upon, as well as to identify any significant knowledge gaps that may be present.

This project is being conducted simultaneously and in conjunction with watershed planning efforts for its neighboring watershed, the Oatka Creek watershed. While these two watersheds share many similar traits and while planning efforts are being conducted concurrently and under the same auspices in both watersheds, each watershed planning project is intended to function independently of the other. The outcomes of both watershed planning efforts will, wherever possible, identify methods and strategies to share responsibilities in the management of both watersheds.

Project Advisory Committees for each of these two watersheds were formed in August of 2009 in order to guide preparation and eventual implementation of the completed watershed management plans. The committees are comprised of a variety of watershed stakeholders, including interested citizens, members of the Black Creek Watershed Coalition and the Oatka Creek Watershed Committee, municipal representatives, and representatives from a variety of public agencies and non-governmental and community-based organizations. These groups have been and will continue to work together to develop joint water quality planning goals and implementation strategies wherever feasible, including leveraging resources and assets jointly whenever such efficiencies can be identified.

This report is based on existing reports and studies, including the *Black Creek Watershed State of the Basin Report* (2003) and other pertinent documents.[1] It is not the intent to duplicate the information that was established through these earlier efforts. Rather, information considered vital or useful to the watershed management planning process is re-organized in a manner that facilitates its application to future watershed planning and restoration efforts and improves its overall accuracy and utility.

Section 1.0 Endnotes

[1] *Black Creek Watershed State of the Basin* (2003). [Online] In *Black Creek Watershed Coalition*. Retrieved 12/1/10 from http://www.blackcreekwatershed.org/bcstate.htm.

2.0 Description of the Study Area

The Black Creek watershed lies within the Lower Genesee River Basin – part of the larger Lake Ontario Drainage Basin – and occupies 129,422 acres (202.22 sq. miles) across portions of Wyoming, Genesee, Orleans and Monroe Counties of New York State. Of the 17 major watersheds that comprise the Genesee River Basin, the Black Creek watershed has the third largest drainage area, constituting approximately 8% of the entire Genesee River Basin.

Section 2.0 of this report is intended to provide the reader with an understanding of the study area as well as how a watershed can be defined and delineated. Subsequent sections of this Characterization report will provide more detailed information on various aspects of the watershed and its condition as well as the extent of our knowledge in these areas.

2.1 Watershed Delineation

A watershed may be described as a geographic area of land drained by a river and its tributaries to a single point. Watershed boundaries are typically defined by the highest ridgeline around the stream channels that meet at the lowest point of the land; it is at this point where water flows out of the watershed into a larger river, lake or ocean. Watershed scale is an important consideration, particularly for watershed planning. Watersheds can be small and represent a single tributary within a larger drainage network or be quite large and cover thousands of square miles.

2.1.1 Hydrologic Units

In order to clearly delineate watersheds within the United States, the United States Geologic Survey (USGS) began developing the hydrologic unit system. Originally created in the 1970s and modified several times since then, hydrologic unit boundaries define the aerial extent of surface water drainage to a point (i.e., a watershed). Working in conjunction with the USGS, the National Resource Conservation Service (NRCS – a division of the US Department of Agriculture) has delineated all watersheds in the continental United States based on this standard hierarchical system.[2]

Today, hydrologic units are uniformly classified through six levels. Each hydrologic unit is identified by a unique hydrologic unit code (HUC) number consisting of two to twelve digits based on the six levels of classification. In addition to hydrologic unit codes, each hydrologic unit has been assigned a name corresponding to the principal hydrologic feature(s) within the unit. In the absence of such features, the assigned name will reflect a cultural or political feature within the unit. The intent of this system is to provide a useful framework of hydrologic delineation that facilitates watershed planning and restoration for managers and analysts across a wide geographic area.

The hydrologic unit system of watershed delineation as it applies to the Black Creek watershed is illustrated in Table 2.1 and Figures 2.1 and 2.2 on the following pages.

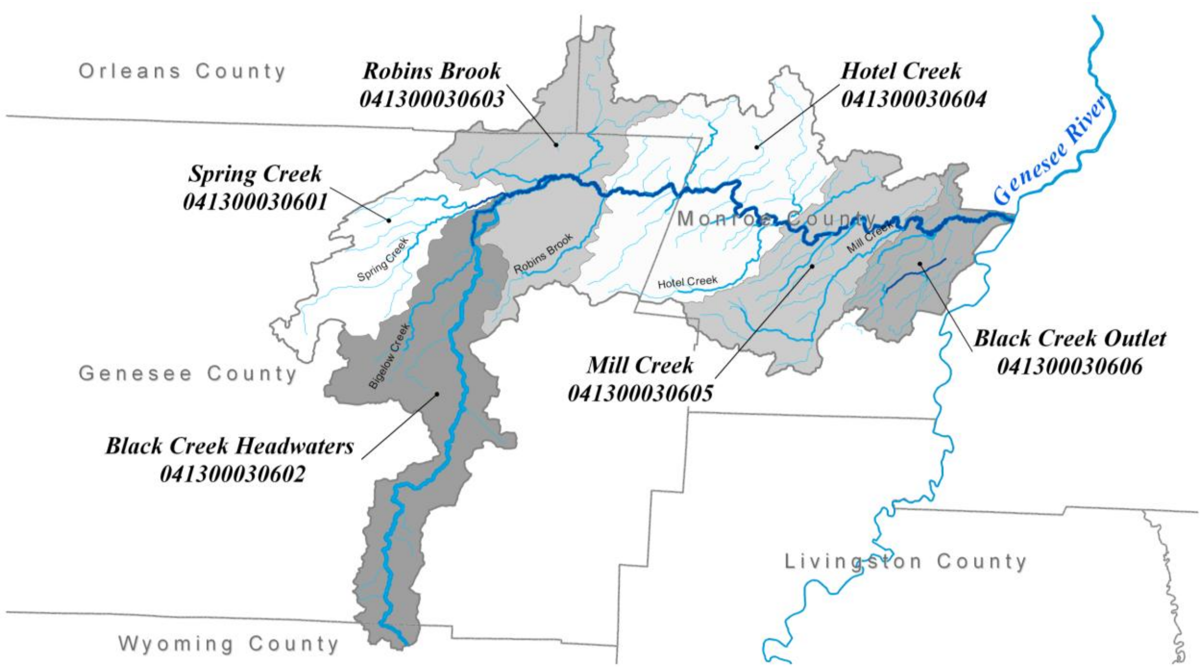
Figure 2.1: The Genesee River Basin and the Black Creek Watershed

Figure 2.1. *The Genesee River Basin is divided into two separate 8-digit hydrologic units – the Upper (HUC No. 04130002) and the Lower (HUC No. 04130003). The Black Creek watershed lies within the Lower Genesee River Basin and is identified as a 10-digit hydrologic unit (HUC No. 0413000306).*

Table 2.1: The Hydrologic Unit System of Watershed Delineation Applied to the Black Creek Watershed

HUC Classification Level	HUC Name	HUC #
2 digit HUC – First level (Region)	Great Lakes Region of the United States	**04**
4 digit HUC – Second level (Subregion)	Southwestern Lake Ontario	04**13**
6 digit HUC – Third level (Accounting unit)		0413**00**
8 digit HUC – Fourth level (Cataloguing unit)	Lower Genesee River	041300**03**
10 digit HUC – Fifth level (Watershed)	Black Creek Watershed	04130003**06**
12 digit HUC – Sixth level (Subwatershed)	• *Spring Creek Subwatershed*	*0413000306**01***
	• *Black Creek Headwaters Subwatershed*	*0413000306**02***
	• *Robins Brook Subwatershed*	*0413000306**03***
	• *Hotel Creek Subwatershed*	*0413000306**04***
	• *Mill Creek Subwatershed*	*0413000306**05***
	• *Black Creek Outlet Subwatershed*	*0413000306**06***

Figure 2.2: The Black Creek Watershed and Associated "HUC12 Watersheds"



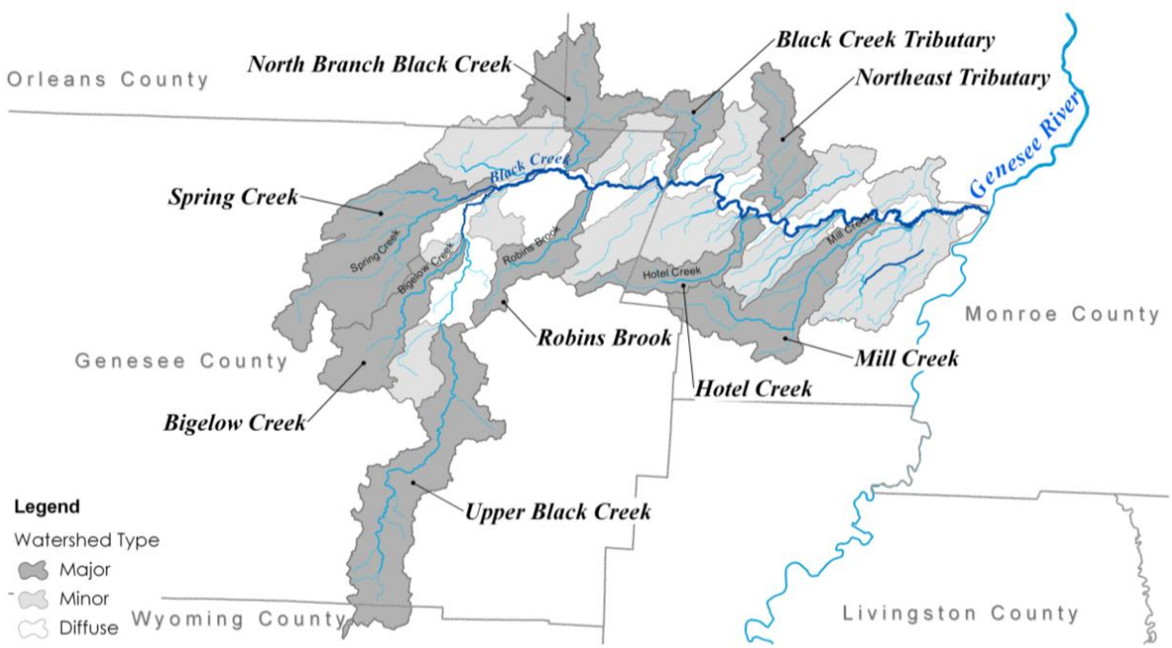
HUC12 subwatersheds may be more accurately described as *hydrologic units*. "Hydrologic unit" is a term used to describe a spatial unit that exhibits common characteristics, such as principal hydrologic features, land uses, or topography. Hydrologic units are not always synonymous with true hydrologic watershed boundaries. This is the case with HUC12 subwatersheds in the Black Creek watershed. As can be seen on Figure 2.2, 5 of the 6 HUC12 subwatershed boundaries actually traverse the Black Creek and include upland areas on both sides of the creek. While this is somewhat contrary to our understanding of a true hydrologic watershed or subwatershed, the HUC12 subwatershed delineation can nonetheless be useful for planning purposes due to the uniformity of their application across the continental United States.

2.1.2 Hydrologic Subwatersheds

True hydrologic subwatersheds can be delineated by identifying the major and minor hydrologic features in the watershed and selecting their corresponding catchment boundaries. A catchment is the land area that contributes runoff to a drainage area; it is the smallest unit used to measure space in a watershed. GIS analysis identified 248 individual catchments within the Black Creek watershed which were used to draw the boundaries shown in Figure 2.2. Once these boundaries are identified, they can be categorized according to hydrologic features, land uses, topography or other units of analysis.

The boundaries shown in Figure 2.3 were first drawn by SUNY Brockport in the 2003 *Black Creek Watershed State of the Basin Report*. These boundaries have been updated here using more accurate spatial data. Nine major subwatersheds (labeled) and 23 minor subwatersheds were identified, along with significant diffuse drainage area in locations that lie adjacent to the main stem of the Black Creek. More information on subwatershed delineation and stream order classification can be found in Section 4.2 of this report. A larger version of Figures 2.2 and 2.3 are included in Appendix A of this report.

Figure 2.3: Hydrologic Subwatersheds of the Black Creek Watershed



2.2 Municipalities

The Black Creek watershed overlaps portions of four counties and 19 municipalities, seven of which account for less than 1% of the total watershed area. Table 2.2 lists each municipality that has land area within the Black Creek watershed, listed in ascending order.

Table 2.2: Municipal Watershed Acreage[3]

Municipality	County	Watershed Acres	Percent Share of Watershed	Percent of Municipality within Watershed
Town of Pavilion	*Genesee*	*0.00349*	*0.000003%*	*0.00002%*
*Scottsville Village**	*Monroe*	*2*	*0.002%*	*0.3%*
*Town of LeRoy**	*Genesee*	*178*	*0.1%*	*0.7%*
Bergen Village	Genesee	378	0.3%	100%
Churchville Village	Monroe	735	0.6%	100%
Town of Middlebury*	Wyoming	862	0.7%	4%
City of Batavia	*Genesee*	*892*	*0.7%*	*26%*
Town of Clarendon	Orleans	2,582	2.0%	11%
Town of Wheatland*	Monroe	4,108	3.2%	22%
Town of Ogden	Monroe	5,031	3.9%	22%
Town of Batavia	Genesee	5,210	4.0%	17%
Town of Sweden	Monroe	6,013	4.6%	30%
Town of Elba	Genesee	6,123	4.7%	28%
Town of Bethany*	Genesee	8,487	6.6%	37%
Town of Stafford*	Genesee	12,844	9.9%	64%
Town of Bergen*	Genesee	16,385	12.7%	95%
Town of Byron*	Genesee	18,963	14.7%	92%
Town of Chili	Monroe	19,323	14.9%	76%
Town of Riga	Monroe	21,308	16.5%	97%
Total Acreage		**129,422**	**100%**	--

Municipalities that have less than 1% of their total land area within the watershed are listed in italics; these will be excluded from detailed analysis in this report. The City of Batavia is also listed in italics. Although 26% of the City's total land area does rest within the watershed, nearly all stormwater that falls within city limits has been engineered to flow into the Tonawanda Creek watershed. The City will therefore receive limited analysis and focus within the scope of this watershed planning project. Finally, municipalities that are marked with an asterisk '*' also have significant land area within the Oatka Creek watershed and will therefore receive similar focus and analysis in that watershed's respective management plan.

Figure 2.4: Municipalities of the Black Creek Watershed

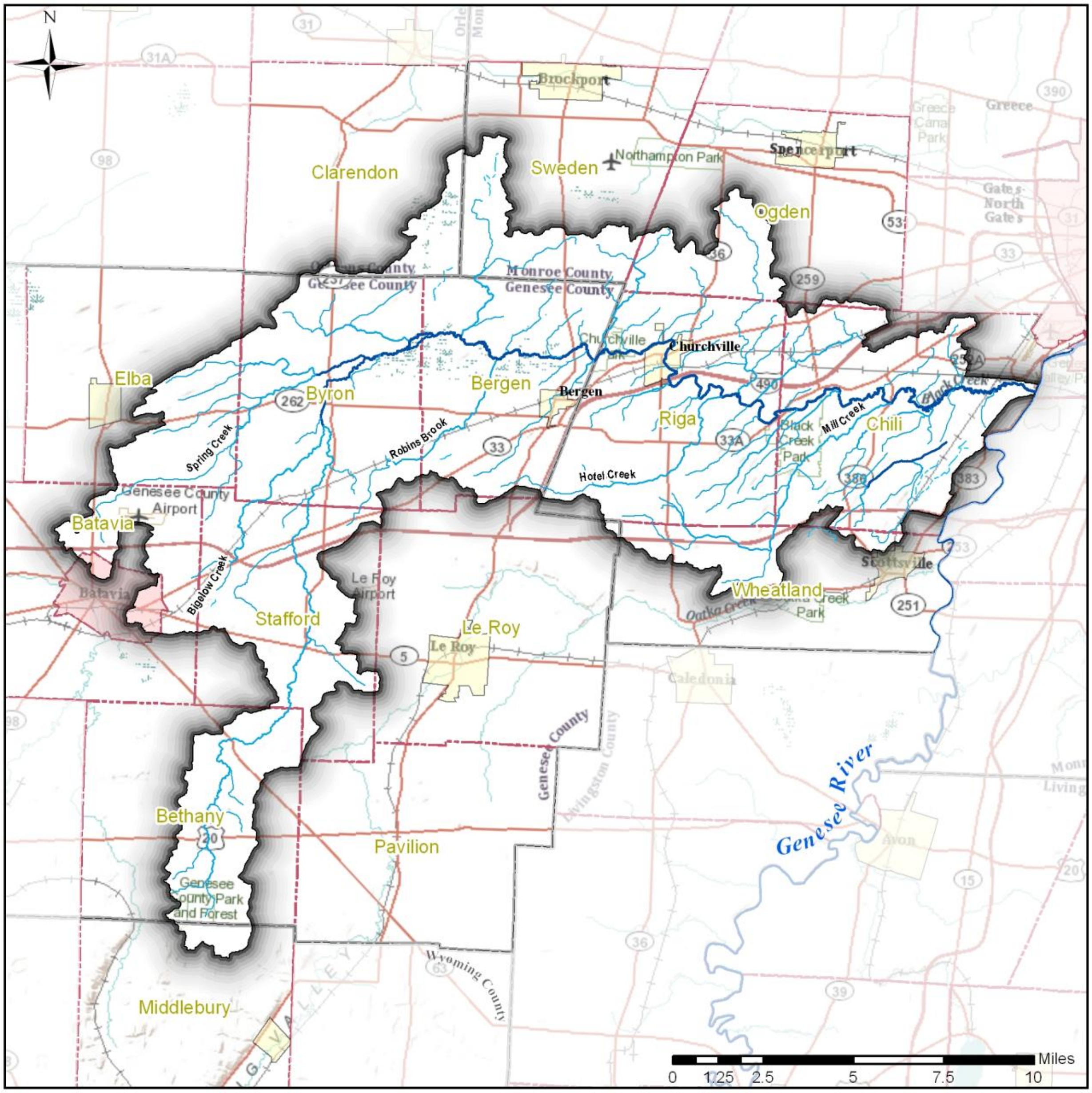


Table 2.3: Spatial Distribution of the Black Creek Watershed by County

	Percentage of the Black Creek Watershed in the County	Percentage of the County Within the Black Creek Watershed
Genesee County	53.7%	32.2%
Monroe County	43.7%	19.5%
Orleans County	2.0%	1.5%
Wyoming County	0.7%	0.3%

2.3 Ecoregions[4]

"Ecoregions" denote areas of general similarity in ecosystems and in the type, quality, and quantity of environmental resources; they are designed to serve as a spatial framework for research, assessment, management, and monitoring of ecosystems and ecosystem components. By recognizing the spatial differences in the capacities and potentials of ecosystems, ecoregions stratify the environment by its probable response to disturbance. These general purpose ecological regions are critical for structuring and implementing ecosystem management strategies across federal agencies, state agencies, and nongovernmental organizations that are responsible for different types of resources within the same geographical areas. The approach used to compile these maps was based on the premise that ecological regions can be identified through the analysis of the composition and spatial pattern of biotic and abiotic phenomena that affect or reflect differences in ecosystem quality and integrity. These phenomena include geology, physiography, vegetation, climate, soils, land use wildlife, and hydrology.

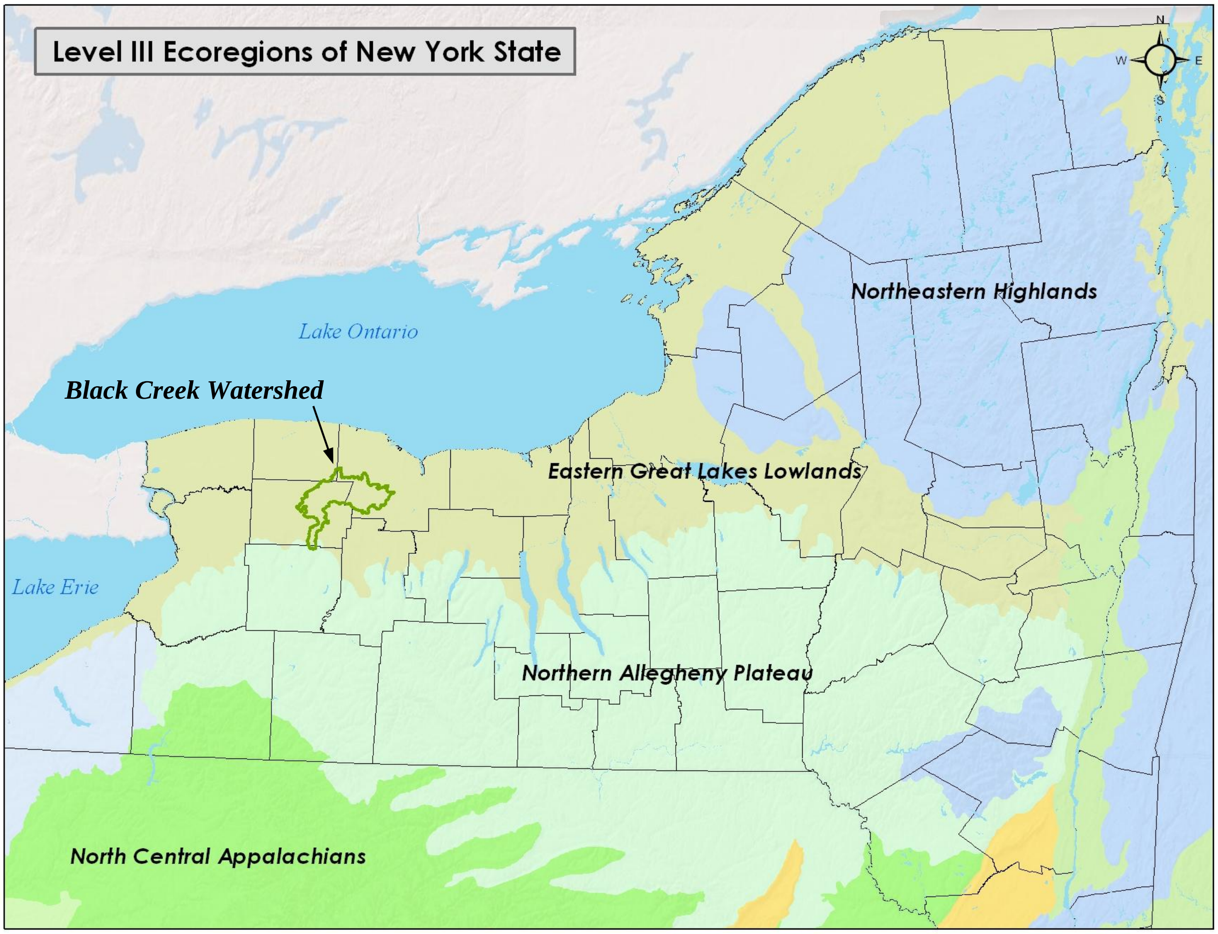
Levels I and II are the coarsest levels of ecoregions and are not illustrated here. Level I divides North America into a total of 15 ecological regions. The *Eastern Temperate Forests* region is the predominant Level I ecoregion of the eastern United States east of the Mississippi River stretching to the Atlantic coast and including the entire Great Lakes region. Level II divides the continent into 50 regions; Black Creek watershed lies in the *Mixed Wood Plains* Level II region, which includes much of the lowland area of upstate New York as well as similar areas throughout portions of the Great Lakes and the North Eastern regions of the United States.

2.3.1 Level III Ecoregion

New York State contains great ecological diversity in its low coastal plains, large river valleys, rolling plateaus, glacial lakes, forested mountains, and alpine peaks. Nine Level III ecoregions and 42 Level IV ecoregions occur in New York and many continue into ecologically similar parts of adjacent states or provinces. As illustrated in Figure 2.5, Black Creek watershed lies primarily in the "Eastern Great Lakes Lowlands" Level III ecoregion with a small portion of its southern tip reaching into the "Northern Alleghany Plateau" Level III ecoregion.

The *Eastern Great Lakes Lowlands* ecoregion surrounds the highland ecoregions of northern New York State. Valleys and lowlands are underlain by interbedded limestone, shale, and sandstone rocks that are more erodible than the more resistant rocks composing the adjacent mountainous areas. The topography and soils of the lowlands have also been shaped by glacial lakes and episodic glacial flooding. Limestone-derived soils are fine-textured, deep, and productive. As a result, much of the region was cleared for agriculture or urban development and less native forest remains than in surrounding ecoregions like the Northeastern Highlands or the Northern Allegheny Plateau. Most agricultural activity is devoted to dairy operations, although orchards, vineyards, and vegetable farming are important locally, particularly near the Great Lakes.

Figure 2.5: Level III Ecoregions of New York State



2.3.2 Level IV Ecoregion

The Black Creek watershed lies primarily in the Level IV ecoregion known as the *Ontario Lowlands*. The Ontario Lowlands are defined by the extent of glacial Lake Iroquois. The relative proximity of the Ontario Lowlands ecoregion to Lake Ontario tempers its climate, meaning that summer heat and winter cold are reduced. Although the influence is strongest within a few miles of the lake shore in the Erie/Ontario Lake Plain, the lake effect penetrates inland enough to make a noticeable winter temperature difference between the Ontario Lowlands and the north shore of Lake Ontario. The lake effect contributes to clouds in November and December, frequent fog in winter, and high snow amounts. Historically, the forest was dominated by beech and sugar maple with smaller amounts of white oak, basswood, elm, and white ash as well as forested wetlands that are seasonally wet and not typically used for agriculture (unless drained). Although forests once entirely covered the Ontario Lowlands, only scattered woodlots and forested wetlands remain today because of the region's high agricultural capability. The loamy soils of the Ontario Lowlands are derived from limestone and calcareous shale (Alfisols); they are generally deep and finely textured. Although dairy and livestock farming are common, the soils and climate of the Ontario Lowlands are also suitable for growing fruit, vegetables, and other specialty crops.

Very small areas of the southern-most portion of the Black Creek watershed is located in the *Cattaraugus Hills* Level IV ecoregion, which is a subset of the Northern Allegheny Plateau Level III ecoregion.

Figure 2.6: Level IV Ecoregions of the Black Creek Watershed

2.4 Climate[5]

The climate in and around the Black Creek watershed is generally defined as *humid-continental*. Atmospheric flow and weather systems come predominantly from continental sources. Warm, occasionally humid, weather results when the airflow is from the south or southwest; cold, dry weather results when the flow is from the northwest or north. From time to time, well-developed weather systems off the mid- or north-Atlantic coast bring airflow from maritime sources into the region. Cool, cloudy, and often damp weather conditions prevail in this flow coming from the easterly quadrant.

Lake Erie and Lake Ontario have an important influence on the climate of the region. For example, they have a moderating effect on temperature. Summertime heating is less than in areas farther away from these large bodies of water. Consequently, thunderstorms are reduced in number and frequency, and there is less damage from hail and strong winds. The moderating effect of the lakes also reduces cooling at night and thus provides a growing season that is longer than that in areas at a greater distance from the lakes. Also influencing the climate are differences in relief and elevation, but these are secondary to the effect of the Great Lakes.

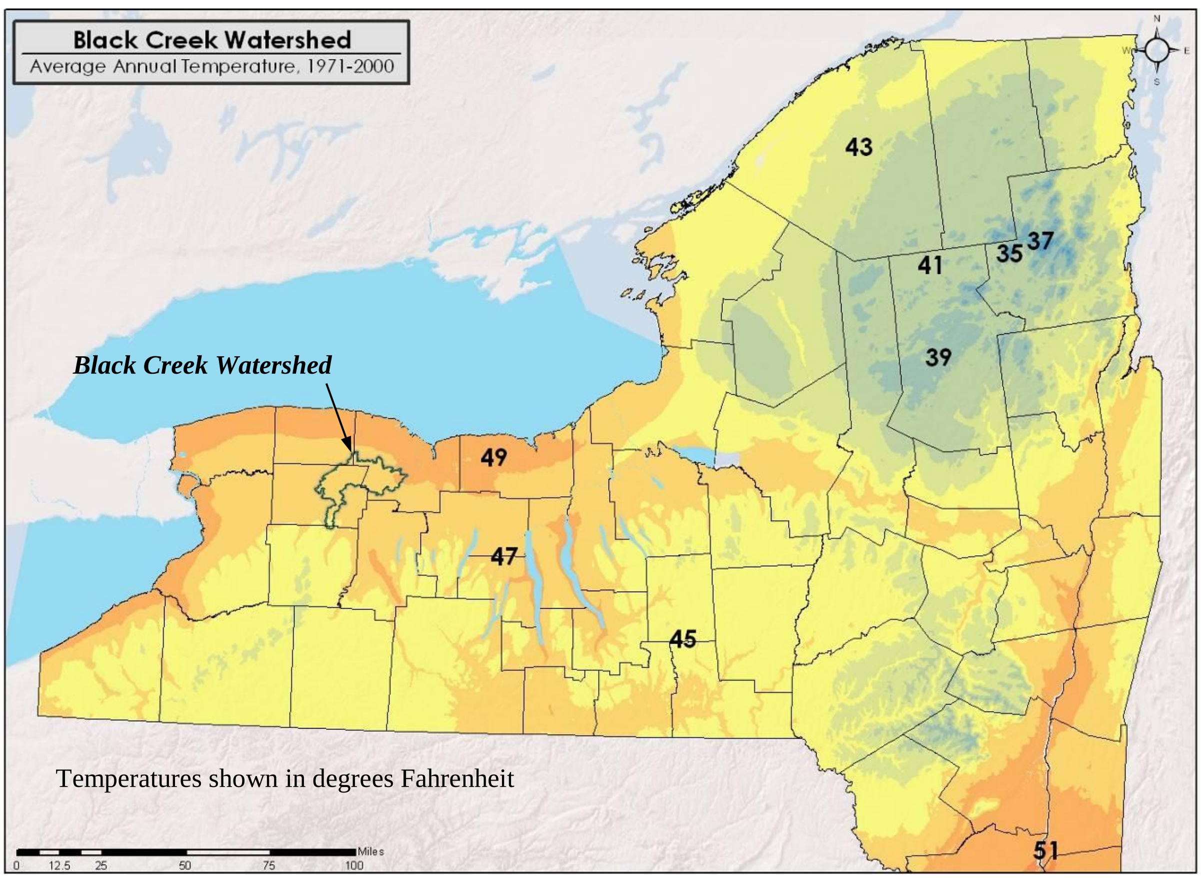
2.4.1 Temperature

Temperature in the Black Creek watershed usually varies noticeably, both in extremes and in averages, from day to day and from week to week. Summers are pleasantly warm in the Black Creek watershed while winters are generally long and cold and have frequent periods of stormy, unsettled weather. Although climate in the Black Cree watershed is chiefly continental, the ranges in temperature are smaller than those in the more centrally located areas of North America.

As Figure 2.7 shows, average monthly temperature range from 45 degrees Fahrenheit in the upper reaches of the watershed to 49 degrees near the lower reaches. The temperature reaches 90 degrees Fahrenheit or higher on an average of 7 days per year, almost entirely in June, July, and August. Temperatures of 0 degrees or below can be expected on 5 to 10 days in most winters.

Temperature tends to be slightly lower in the higher elevations of the watershed. There is a corresponding influence on the length of the frost-free growing season, the duration of snow cover, and other factors of climate affected by temperature. Depending on the seasonal conditions, the freeze-free growing season can vary between 120 to 180 days in length.

Figure 2.7: Average Annual Temperatures for New York State

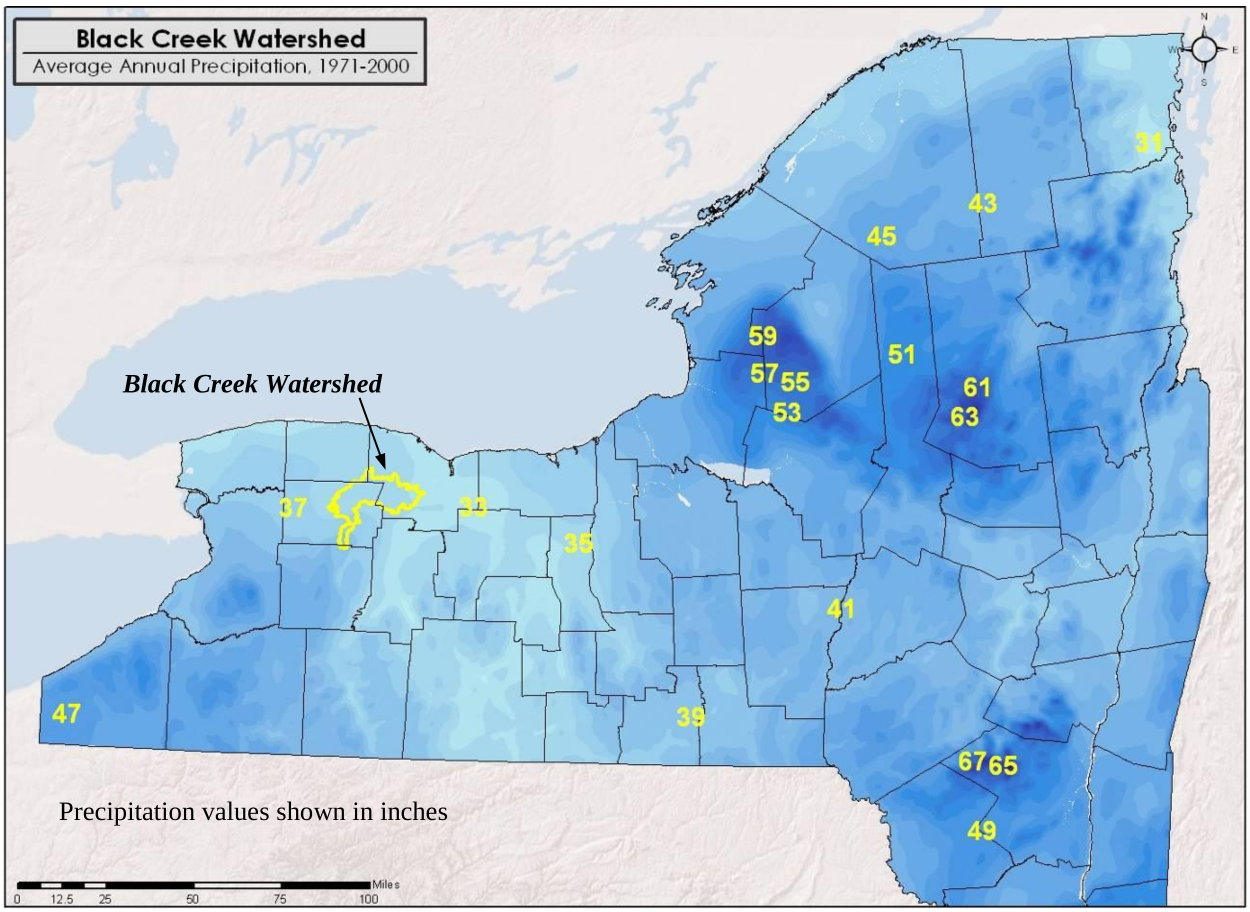


2.4.2 Precipitation

As Figure 2.8 illustrates, average annual precipitation in the Black Creek watershed ranges between 33 and 39 inches per year, depending on the location within the watershed.

Monthly precipitation is at a minimum during winter whereas maximum amounts occur late in spring and in summer. The variation of seasonal precipitation is relatively small, even in comparison with other parts of New York State. During the May-September portion of the growing season, the average total precipitation is approximately 14 to 16 inches. These amounts make up to 45 – 50% of the total annual precipitation. Snowfall is frequently heavy, both in terms of individual storms and monthly amounts. The snowfall season usually begins in early or mid-November and continues through the early half of April. The average winter snowfall is 90 to 100 inches and there is little variation throughout the watershed. Precipitation on the average is evenly distributed in winter.

Figure 2.8: Average Annual Precipitation for NYS



Section 2 Endnotes

[2] Hydrologic Units. [Online] In *United States Geologic Survey*. Retrieved 6/7/11 from http://water.usgs.gov/nawqa/sparrow/wrr97/geograp/geograp.html

[3] Municipalities that have less than 1% of their total land area within the watershed are listed in italics; these will be excluded from detailed analysis in this report. Municipalities marked with an asterisk '*' also have significant land area within the Oatka Creek watershed and will therefore receive similar focus and analysis in that watershed's respective management plan. 1 acre = 43, 560 sq. ft. = 0.0015625 sq. miles; town acreage calculations exclude area of villages & cities within.

[4] Adapted from *Ecoregions of New York* map. [Online] In *New York State Department of Environmental Conservation*. Last viewed 1/3/11 at http://www.dec.ny.gov/about/66718.html

[5] Adapted from US Department of Agriculture Soil Surveys for Genesee, Livingston, Monroe, Orleans and Wyoming Counties. 1969 – 1973

3.0 Physical Characteristics of the Watershed

"Maintenance of aquatic ecological integrity requires that we understand, not only the biological, chemical, and physical condition of water bodies, but also landscape condition and critical watershed attributes and functions, such as hydrology, geomorphology, and natural disturbance patterns."[6]

– An excerpt from *Identifying and Protecting Healthy Watersheds*, a publication of the U.S. Environmental Protection Agency. (Page 2-1)

Section 3.0 includes a selection of existing land cover, hydrologic and other geo-spatial data sources in an effort to provide an accurate description of the primary physical characteristics of the Black Creek watershed. All of this information can be applied in an integrated assessment of watershed health and function at various scales. Opportunities for identifying or developing new data sources and data applications and integrating them with other monitoring and assessment approaches should be sought out as the watershed planning process evolves.

The assessment evaluates the Black Creek watershed and its physical components in an effort to provide a more complete understanding of the watershed's landscape and hydrologic conditions. By doing so, planners can begin to establish local protection and restoration priorities that will continue to be refined through the overall watershed management planning process. Specifically, *Task 13: Subwatershed Prioritization*, will continue to utilize and refine this information in an effort to evaluate and rank subwatersheds and identify priority subwatersheds and focused management actions for those watersheds.

3.1 Geology

A brief overview of significant geologic features within the Black Creek watershed is provided below. Where deemed applicable, the comprehensive overview of geology that was conducted for the *Black Creek Watershed State of the Basin Report* has been included here for general information.

3.1.1 Bedrock Geology

Bedrock geology in the Black Creek watershed was described as follows by SUNY Brockport in the *Black Creek Watershed State of the Basin Report*:

> Approximately 360 to 440 million years ago during the Devonian and Silurian periods of the Paleozoic Era, unconsolidated sediments were deposited when the region now containing the Black Creek Watershed was part of a continental sea (Isachsen and others, 1991). At this time the Appalachian Mountains were uplifting to the east, and the Michigan Basin to the northwest was subsiding. Paleozoic sediments, including clay, fine sand, limestone, rock salt and gypsum, were eventually compacted into rock formations.
>
> The bedrock of the Black Creek Watershed originated from this sediment deposition and compaction. Silurian to middle Devonian age bedrock is primarily limestone and dolostone while late Devonian age bedrock consists mostly of shales with some interbedded siltstone and limestone. Rock salt and gypsum beds are restricted to the subsurface but have had an important impact on both natural surface processes and mineral resources extraction.

> Paleozoic strata dip to the south at approximately one degree resulting in the exposure of younger bedrock to the south and older bedrock to the north. After deposition, lithification, uplift and erosion, the bedrock was then subjected to a long period of erosion prior to the glaciations that affected the landscape of western New York. Permeable bedrock formations serve as groundwater aquifers and participate in both recharge and discharge between deeper bedrock aquifers and the surface water flow of Black Creek and its tributaries.
>
> The Clarendon-Linden fault zone is a regional compressive fault system that crosses western New York in general north-south direction. This fault zone crosses the western side of the Black Creek Watershed. Three prominent fault segments, known as splinter faults, are identified across the watershed. The Clarendon-Linden fault zone makes a rather prominent topographic escarpment that can be viewed on the campus of Genesee Community College. The northerly flowing segment of Black Creek parallels the fault zone. This fault zone is seismically active and has generated low to moderate scale historic earthquakes with a sporadic and poorly known recurrence level.[7]

Maps of bedrock geology including many of features described above can be found on Map 16 in Appendix A.

3.1.2 Surficial Geology

Surficial geology in the Black Creek watershed was described as follows by SUNY Brockport in the *Black Creek Watershed State of the Basin* report:

> Glaciation over the last two million years had a dramatic influence in shaping surface topographic features in the Black Creek Watershed. An ice sheet of greater than one mile in thickness advanced and retreated several times across western New York during the Pleistocene Epoch (Isachsen and others, 1991). Repeated advances and retreats of glaciers were the primary influence on landscape processes in the Black Creek Watershed, however, most landscape features owe their origins to the last glaciation from about 30,000 to 10,000 years ago.
>
> Ice advance scoured bedrock with resistant rock formations persisting as higher areas and less resistant bedrock being carved into landscape lows. A thin blanket of glacial till was spread across most areas and distinct elliptical drumlins pointing to the southwest mark the local ice advance flow direction. Brief pauses in ice retreat resulted in deposition of moraine ridges, the Batavia moraine being the most notable in the Black Creek Watershed. Ice stagnation created broad areas of hummocky topography to the north of the moraine ridges. The ice stagnation areas are locally interrupted by kames, eskers and outwash deposits formed by melt water within the glacier or flowing beyond the glacial margin. After glacial ice retreated from the Black Creek Watershed, lake deposits, mucklands and stream alluvium partly infilled the lowest topographic areas. Modern streams flow in these low floodplain areas and continue to nourish wetland swamps and deposit alluvial sediments.
>
> Surficial sediments provide the geologic parent material for soil formation, contribute significantly to the infiltration and storage of precipitation, are a source of sediment load to surface waters, comprise a sizable groundwater aquifer system and provide recharge to deeper bedrock aquifers.[8]

Illustrations of these features, including confined and unconfined aquifers, can be found on Maps 9, 14 and 15 in Appendix A of this report.

3.1.3 Karst Features and Shallow Soils

In 2010 the U.S. Geological Survey published the scientific investigative paper titled *Hydrogeologic and Geospatial Data for the Assessment of Focused Recharge to the Carbonate-Rock Aquifer in Genesee County, New York*.[9] This study stemmed from concern expressed by local officials regarding chemical and bacteriological contamination in carbonate-rock aquifers present across Genesee County, commonly referred to as the "karst area." The report describes the general characteristics of the carbonate-bedrock aquifer and overlying soils and unconsolidated deposits and presents geospatial information on factors that affect where focused recharge and surface contaminants have the highest potential to enter the carbonate-rock aquifer. Genesee County SWCD is presently using this information to guide its AEM planning activities. In addition, they are coordinating with other agencies and local offices such as the Genesee County Department of Health to assist farmers and land owners in the karst area with problems that have occurred related to fertilizer application and groundwater contamination. A direct result of these efforts is the document *Manure Management Guidelines for Limestone Bedrock/Karst Areas of Genesee County, New York: Practices for Risk Reduction*.[10] The document outlines recommended manure management practices for the karst area of Genesee County, New York. The paper notes that the risk reduction practices may also be effective in karst and other sensitive areas throughout New York State.

GIS data related to the karst area of the Black Creek watershed prepared by the USGS is provided in Map 20 in Appendix A of this report.

3.1.4 Mines

Table 3.1. NYS DEC Mined Land Reclamation Program Database Records for the Black Creek Watershed[11]

Mine Name	Town	Status	Commodity	Total acres affected by mining since 1975	Life of mine acres
A D Call & Sons Excavating & Trucking Inc.	Bethany	Active	Sand and Gravel	8	10
Hanson Aggregates New York LLC	Stafford	Active	Limestone	196	259
Keeler Construction Co Inc.	Stafford	Active	Sand and Gravel	6	6
Seven Springs Gravel Products LLC	Stafford	Active	Sand and Gravel	30	30
Syracuse Sand & Gravel LLC	Wheatland	Active	Sand and Gravel	19	19
Jack W Miller Excavating	Wheatland	Reclaimed	Sand and Gravel	10	10
Elam Sand & Gravel Corp.	Wheatland	Reclaimed	Sand and Gravel	5	45
V.J. Enterprises	Wheatland	Reclaimed	Sand and Gravel	120	175
Moore Excavating	Stafford	Active	Sand and Gravel	8	17
Bergen, Town of	Bergen	Reclaimed	Clay	3	3
Nory Construction Company Inc.	Chili	Reclaimed	Sand and Gravel	11	0
Nory Construction Company Inc.	Chili	Reclaimed	Sand and Gravel	0	0
Alexander, Wohlers & Grastorf	Bergen	Reclaimed	Sand and Gravel	6	6

Map 17 in Appendix A illustrates a total of 13 active and inactive mines in the Black Creek watershed that are identified in the NYSDEC Mined Land Reclamation Program database maintained by the NYS DEC. A summary of information on those facilities is provided in Table 3.1; unabridged information on those facilities can be found online at the source provided.

Natural gas has been commercially drilled in New York State since 1821. It has been piped to towns for light, heat, and energy since the 1870s. The first storage facilities were developed in 1916. Hydraulic fracturing of vertical wells was first used in New York to develop low permeability reservoirs in the Medina Group around the 1970s-80s. Six new Trenton-Black River plays (underground reservoir rocks with fossil fuels) were discovered in 2005. There are dozens of plays across the country. Soon New York State may witness its first Marcellus Shale ‘play’.

Recent advances in horizontal drilling and hydraulic fracturing have allowed extraction of natural gas from deep gas shale reserves, such as the Marcellus shale, to be economically feasible. The Utica Shale is a deeper and more expansive formation that may also have economic viability for the state. The shale must be below approximately 3,000 ft. of overlying rock before it is a successfully play.

The increased demand for cleaner energy and the proximity of these reserves to the Northeast’s population hubs makes these particular ‘plays’ significant. There are certain financial benefits landowners may receive for leasing their land and certain economic gains a community could reap, but there will be challenges and costs that are associated to these benefits.

The New York State Department of Environmental Conservation is developing the generic environmental impact statement to permit high volume hydraulic fracturing natural gas by horizontal well extraction. Many wells that are not considered high volume hydraulic fracturing wells have already been permitted. The developing horizontal well regulations are designed to ensure that all natural gas extraction is safe, does not significantly disrupt the natural flow of surface (or ground) water to make the hydrofracking fluids, and hydrofracking fluids will be disposed of safely as to not pollute our local water sources. This is vital as the surface and ground water is the source for Class AA drinking water for residents in the watershed.

3.2 Soils[12]

Soil conditions in the Black Creek watershed were described as follows by SUNY Brockport in the *Black Creek Watershed State of the Basin* report:

> The Black Creek Watershed contains a large variety of soils and most of the soil types identified in the survey of Genesee, Monroe, Orleans and Wyoming Counties are located within the watershed boundaries.
>
> Black Creek Watershed contains soil types which can be classified in the following groupings. 1) Areas of deep calcareous, high lime soils and developed in glacial till that overlie limestone and dolostone bedrock that occur mostly north of the Onondaga escarpment. 2) Areas of deep calcareous, high lime soils developed in glacial till that overlie limestone and dolostone bedrock. Soil distribution is discontinuous and includes soil areas occasionally shallow to limestone bedrock that occur mostly south of the Onondaga escarpment. 3) Areas of medium lime soils developed in glacial till that overlie mostly Devonian shales. Soil areas include medium to fine textured subsoils developed in shaley tills that occur mostly south of the Onondaga escarpment in

areas of the upper watershed near the southern drainage divide. 4) Areas of soils developed in glacial outwash terraces and kames occur in an outwash plain near Little Canada and East Bethany. 5) Areas of soils developed in glacial lake sediments occur mostly along the flanks of the Bergen Swamp and areas downstream. 6) Areas of deep organic soils occur mostly in the Bergen Swamp and smaller scattered wetlands areas.

Limestone and dolostone bedrock is thought to be the source of much of the lime in the soils. The USDA Soil Survey identifies a majority of the soils in the watershed as being suited for agriculture. Only 15 percent of New York is covered with prime agricultural soils, and the Black Creek Watershed has a relatively high proportion. However, the prime agricultural soils are not evenly distributed throughout the watershed. Most of the areas classed as highly suitable farmland are located in the northern part of the watershed. Soils that are poor for crops but usable for pasture are scattered throughout the watershed. Soils poor for both crops and pasture are recommended for forest development. These soil types include the undifferentiated alluvial soils and steep land greater than 25 percent slope.[13]

Agricultural soils are illustrated in Map 27 in Appendix A of this report; surficial geology is illustrated in Map 15.

3.2.1 Hydrologic Soils

According to the NRCS, a hydrologic group is a group of soils having similar runoff potential under similar storm and cover conditions. Soil properties that influence runoff potential are those that influence the minimum rate of infiltration for a bare soil after prolonged wetting and when not frozen. These properties are depth to a seasonal high water table, saturated hydraulic conductivity after prolonged wetting, and depth to a layer with a very slow water transmission rate. Changes in soil properties caused by land management or climate changes also cause the hydrologic soil group to change. The influence of ground cover should be treated independently.

Hydrologic soil groups are used in equations that estimate runoff from rainfall. These estimates are needed for solving hydrologic problems that arise in planning watershed-protection and flood-prevention projects and for planning or designing structures for the use, control, and disposal of water.

Assignment of soils to hydrologic groups is based on the relationship between soil properties and hydrologic groups. Wetness characteristics, water transmission after prolonged wetting, and depth to very slowly permeable layers are properties used in estimating hydrologic groups.[14]

This report defines four hydrologic soil groups: A, B, C, and D. An analysis of the four soil categories in the Black Creek watershed yielded the following results:

Table 3.2. Hydrologic Soil Groups in the Black Creek Watershed

Hydrologic Soil Groups (HSGs)	Total Acres	% of Watershed Cover
HSG A: Low runoff potential when thoroughly wet; water is transmitted thoroughly through the soil. Group A soils typically have less than 10% clay and more than 90% sand or gravel and have gravel or sand textures.	7,223.96	6%
HSG B: Soils in this group have moderately low runoff potential when thoroughly wet. Water transmission through the soil is unimpeded. Group B	67,005.17	52%

soils typically have between 10% and 20% clay and 50% to 90% sand and have loamy sand or sandy loam textures		
HSG C: Soils in this group have moderately high runoff potential when thoroughly wet. Water transmission through the soil is somewhat restricted. Group C soils typically have between 20% and 40% clay and less than 50% sand and have loam, silt loam, sandy clay loam, and silty clay loam textures	28,843.69	22%
HSG D: Soils in this group have high runoff potential when thoroughly wet. Water movement through the soil is restricted or very restricted. Group D soils typically have greater than 40 percent clay, less than 50 percent sand, and have layer textures. In some areas, they also have high shrink-swell potential.	26,353.24	20%

Map 16 in Appendix A illustrates the locations of these four hydrologic soil groups within the watershed.

3.3 Hydrology

Hydrology is determined by a complex interaction between geology, groundwater, climate, physiography, and land cover. Perhaps the most distinctive trait that characterizes the hydrology of the Black Creek watershed is that it lies within an area of North America that has been largely influenced by prolonged periods of glaciation. The Black Creek watershed lies in the "Eastern Great Lakes Lowlands" (see Section 2.3), which is a series of low relief plains separated by higher relief escarpments. The escarpments and plains trend roughly east-west and slope gently from south to north. The influence of this topography on the hydrology of the Black Creek watershed is clearly visible in maps (shown in Appendix A) as tributaries flow in a general north-easterly direction across the roughly "L-shaped" drainage area of the watershed.

As a general rule, groundwater flow beneath western New York is northward from the Allegheny Plateau through the Eastern Great Lakes Lowlands with ultimate discharge into Lakes Erie and Ontario. Local deviations from this regional northward flow pattern may occur in response to small changes in topography as caused by drumlins, beach ridges, recessional moraines, or bedrock escarpments. In addition, shallow groundwater flow paths may locally be affected by discharges into surface waters or withdrawal from surface waters.

The following sections describe the hydrologic features and properties of the Black Creek watershed and how their function relates to watershed management.

3.3.1 Hydrologic Overview

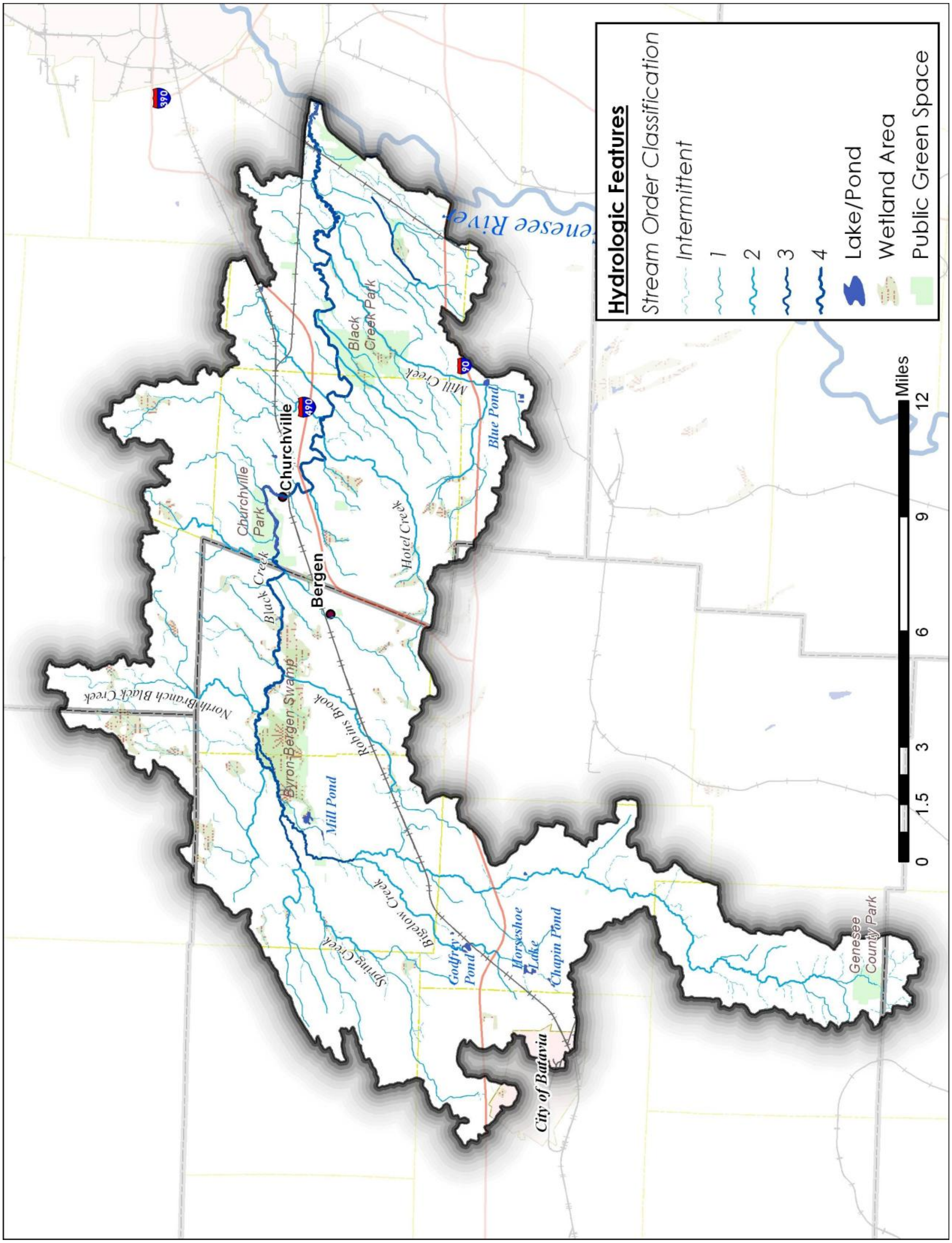
The main stem of the Black Creek flows for 52.6 miles across the counties of Wyoming, Genesee, Orleans and Monroe until it meets the Genesee River in the Town of Chili (Monroe County) where it empties into the Genesee River. The headwaters of the Black Creek originate at approximately 1,150 feet above sea level in the northern portion of the Town of Middlebury in Wyoming County. The Creek begins as several small tributaries flowing north into Genesee County and coalescing at the Genesee County Park and Forest in the Town of Bethany. The Creek becomes a second-order stream shortly thereafter as smaller streams drain the highland areas of the watershed in the Town of Bethany. The Creek meets the Onondaga escarpment in the Town of Stafford (elev. ~850'), establishing Morganville Falls. Here the Black Creek drops approximately 100 feet in elevation over the course of a half-mile. It is after this point that the Black Creek completes its journey out of the northern foothills of the Alleghany Plateau and enters the rolling terrain typical of the Eastern Great Lakes Lowlands. After flowing a distance of approximately 20 miles from its headwaters, the Black Creek converges with Bigelow Creek (elev. ~620') and becomes a third-order stream. The Bigelow Creek subwatershed consists of a series of four ponds created primarily by small, privately-owned dams. Seven Springs Pond lies near the headwaters of Bigelow Creek (elev. 823'), followed downstream by Chapin Pond (elev. 820'), Horseshoe Lake (elev. 778'), and Godfrey Pond (elev. 729').

Downstream of Bigelow Creek, a portion of Black Creek feeds Mill Pond (elev. 608'), located just east of Byron Center. Spring Creek meets Black Creek three miles below the convergence of Bigelow and Black Creek, establishing Black Creek as a fourth-order stream. Spring Creek originates just west of the Batavia Airport and north of the City of Batavia draining the rolling agricultural lands found through the Towns of Elba and Byron. After converging with Spring Creek, Black Creek begins to meander for approximately four miles through Bergen Swamp. Here the Creek is joined by the North Branch of the Black Creek (elev. ~570'), a small, meandering tributary that flows south draining large areas of fields and wetlands across the Towns of Clarendon, Sweden and northern Byron and Bergen.

Robins Brook meets the Black Creek on the eastern edge of Bergen Swamp. Slack water created by the Churchville Dam (elev. 565') begins near the Genesee and Monroe County line as the Black Creek runs through the Village of Churchville. Further downstream, Hotel Creek drains the lands adjacent to Interstates 90 and 490 in the Town of LeRoy and meets the Black Creek at Creek-mile point 38 (elev. ~549'). Mill Creek – the last significant tributary of the Black Creek watershed – meets with the Black Creek at Creek-mile point 45 (elev. ~525'). The Mill Creek watershed drains a portion of northern Wheatland and contains large portions of the active floodplain area within the Town of Chili.

At Creek-mile point 52, the Black Creek meets the Genesee River (elev. ~523') just north of the Ballantyne Bridge at the intersections of State Routes 383 and 252 in the Town of Chili. The Creek is known for having significant slack water and frequent flooding in this area, which is created by a combination of factors, both known and suspected. Large volumes of water from the Genesee River converge with the Black Creek Outlet, creating significant back-flow. This situation is suspected to be exacerbated by numerous man-made and natural obstructions on the Black Creek, but is generally thought to be caused primarily by back-water held by the Court Street Dam approximately 6 miles downstream on the Genesee River in the City of Rochester. The dam helps to maintain the levels of the Erie Canal during navigation season which is often complicated by the high-volumes of water associated with the 2,500 mi^2 Genesee River drainage basin.

Figure 3.1: Overview of Streams and Primary Waterbodies in the Black Creek Watershed



3.3.2 General Flow Statistics

General flow statistics and other fundamental characteristics of the hydrologic network in the Black Creek have been summarized in Table 3.3. These data were derived from two primary sources – GIS analysis of the National Hydrography Dataset (NHD) and through the web-based USGS New York StreamStats GIS application. StreamStats allows users to obtain streamflow statistics, basin characteristics, and descriptive information for USGS data-collection stations and user-selected ungauged sites.[15] The program can estimate streamflow statistics for ungauged sites either on the basis of regional regression equations or on the basis of the known flows for nearby stream-gauging stations. All of the flow statistics provided in Table 3.3 are estimates which were derived through a combination of these approaches.

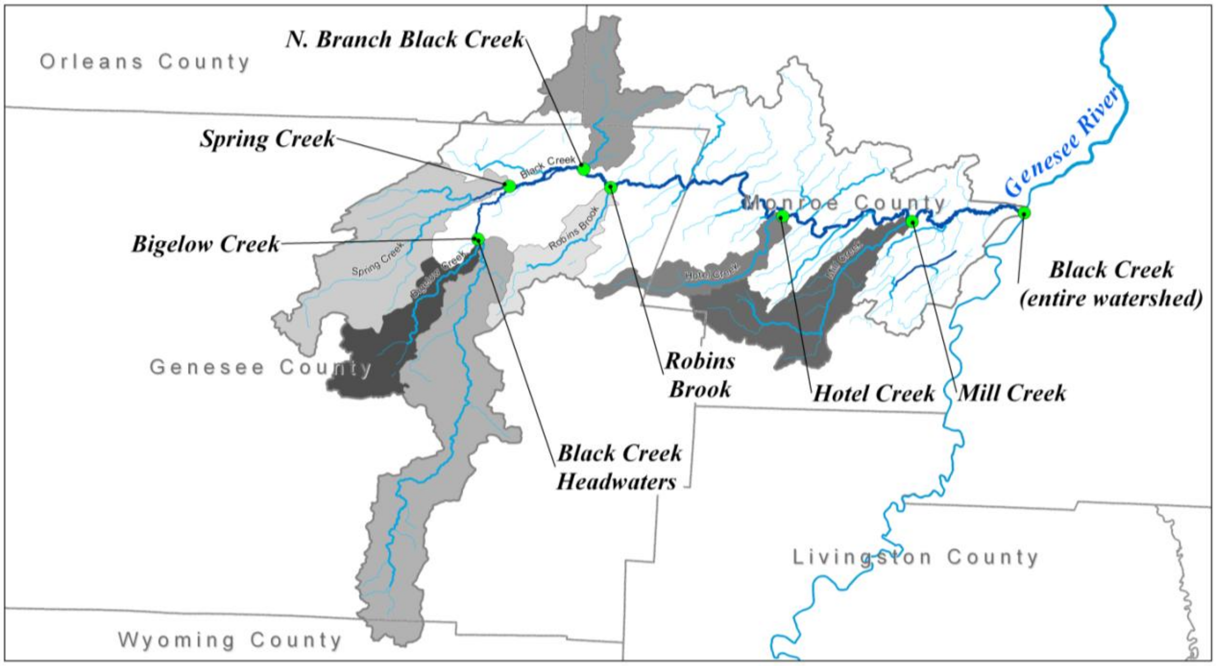
Table 3.3: Characteristics of Streams and Associated Subwatersheds in the Black Creek Watershed

	Black Creek	Mill Creek	Hotel Creek	Robins Brook	Spring Creek	N. Branch Black Creek	Bigelow Creek	Black Creek Headwaters (Upstream of Bigelow Creek)
Drainage Area (Miles^2)	**202**	14.8	6.21	6.9	22.1	11.8	12.9	32.6
Main Channel Stream Length (Miles)	**58.6**	12.9	10	8.19	13.9	9.5	10.7	23.1
Total Stream Network Length (Miles)*	**385.8**	29.3	11.7	10.7	39.9	22.6	12.1	56.8
Mean Annual Precipitation (inches)	**31**	29.9	30	30.6	32.4	29.9	32.8	33.6
Mean Annual Runoff (inches)	**11.1**	9.93	10	10.6	12.4	9.88	12.9	13.7
Basin Lag Factor (hours)	**6.91**	.98	.58	.26	.58	.82	.41	.8
Basin Storage**	**1.73**	2.05	.35	.81	1.02	2.48	1.8	.32
Average basin slope (feet per mi.)	**135**	139	88.2	186	156	41.2	259	224
Minimum daily flow (cfs)	**15**	--	--	--	--	--	--	--
Maximum daily flow (cfs)	**45,700**	--	--	--	--	--	--	--
Average daily stream flow (cfs)	**1,677.7**	--	--	--	--	--	--	--
Mean Annual Flow (cfs)	**1,660**	--	--	--	--	--	--	--

*Stream lengths vary here from those listed in Section 3.3.1 due to variations in calculation method. StreamStats includes braided channels and other intermittent stream reaches, creating greater stream lengths in some cases

**Percentage of total drainage area shown as lakes, ponds and swamps

Figure 3.2: Streams & Corresponding Subwatersheds Listed in Table 3.3



3.3.3 Flood Recurrence Intervals[16]

Flood recurrence refers to the probability that a river will reach flood stage – maximum instantaneous flow – in a given period of time. These estimates are based on regional historical data about rainfall volumes and stream stage. In other words, a 100-year flood has a 1 percent chance of happening in any given year. The USGS StreamStats application was used to generate estimates of peak flows for the Black Creek watershed and subwatersheds; these results are provided in Table 3.4.

Table 3.4: Estimated Peak Flow Statistics for Selected Recurrence Intervals

(all flow levels measured in cubic feet per second)

	Black Creek	Mill Creek	Hotel Creek	Robins Brook	Spring Creek	N. Branch Black Creek	Bigelow Creek	Black Creek Headwaters (Upstream of Bigelow Creek)
2 Year Peak Flood (50% chance)	**2,030**	200	159	151	441	195	196	868
5 Year Peak Flood (20% chance)	**2,920**	285	227	215	627	289	275	1,260
10 Year Peak Flood (10% chance)	**3,550**	341	271	256	750	354	326	1,530
25 Year Peak Flood (4% chance)	**4,370**	411	326	307	905	437	390	1,870
50 Year Peak Flood (2% chance)	**4,980**	462	365	344	1,020	499	436	2,110
100 Year Peak Flood (1% Chance)	**5,590**	511	401	378	1,130	559	480	2,360
200 Year Peak Flood (.5% chance)	**6,260**	563	440	414	1,250	624	527	2,620
500 Year Peak Flood (.2% chance)	**7,110**	626	486	458	1,390	704	583	2,950

3.3.4 Floodplains[17]

The National Flood Insurance Program (NFIP) is a federal program that enables property owners to purchase affordable flood insurance. Before the NFIP, flood insurance was generally unavailable. The program is based on a partnership between communities and the federal government in which the community adopts floodplain management regulations to reduce flood risks and the federal government makes flood insurance available within the community.

The National Flood Insurance Program uses the 100-year flood as the standard on which to base its regulations. This is a national standard used by virtually every Federal and most state agencies, including New York State agencies, in the administration of their programs as they relate to floodplains. The technical and engineering methods involved in determining the magnitude of these floods are well established. Although the 100-year flood is the event estimated to have a one percent chance of being equaled or exceeded each year, there is no guarantee that a flood of this magnitude could not occur in less than 100 years or that one will necessarily occur in each 100 year period at a precise location.

Flood Insurance Rate Maps (FIRM) are produced by the Federal Emergency Management Agency and provide the official record of special flood hazard areas. While paper or flat FIRM maps are generally available online for every community in the Black Creek watershed, corresponding digital GIS data pertaining to the flood boundary are not available for every Black Creek watershed community through state or federal agencies. Furthermore, some portions of watershed communities have never been mapped by FEMA at all, creating significant and sometimes perplexing gaps in the floodplain record. (In order to create efficiencies in the mapping process, FEMA likely elected to skip certain areas which were not prone to frequent flooding or had low population density). Information provided by FEMA has therefore been combined with information created by local offices and agencies in an effort to create a comprehensive picture of the 100-year flood zone across the entire Black Creek watershed.

Map 6 in Appendix A illustrates those areas estimated to be within the 100-year flood zone. While these boundaries are generally very close to the actual boundaries as indicated on official FIRM maps, some variation is evident from place to place. Maps and associated data are therefore for planning purposes only and should not be used to determine the level of flood hazard in any particular area.

Table 3.5: Analysis of 100-Year Flood Zone in the Black Creek Watershed

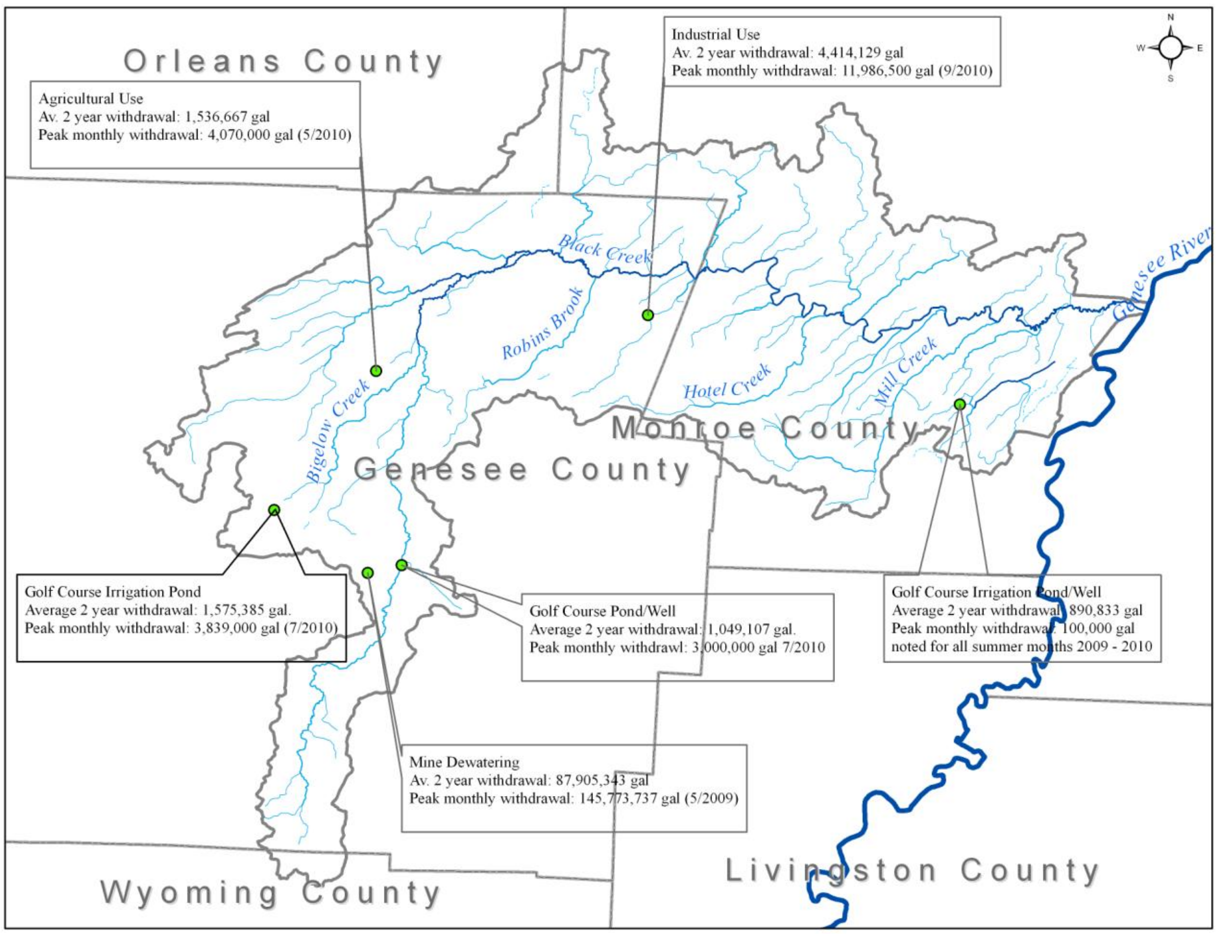
Subwatershed	Acres at or below 100-year flood elevation	% of Subwatershed Area	% of Black Creek Watershed Area
Spring Creek	311.6	2%	0.2%
Black Creek Headwaters	1,263.7	4%	1%
Robins Brook	2,339.0	10%	2%
Hotel Creek	2,819.9	9%	2%
Mill Creek	883.7	4%	1%
Black Creek Outlet	4,032.1	39%	3%
Black Creek Watershed	**11,650.0**	**--**	**9%**

Analysis of the 100-year base flood elevation (1% flood risk) indicated that 9% of the total land area within the Black Creek watershed is within this zone. The Black Creek Outlet subwatershed has the highest concentration of lands in the 100-year floodplain, with 4,032 acres accounting for approximately 39% of total subwatershed area. Full results of this analysis are provided in Table 3.5.

3.3.5 Water Withdrawals

In accordance with ECL Article 15 Title 33 (Water Withdrawal Reporting), NYSDEC maintains records on water withdrawals in excess of 100,000 gallons of water per day.[18] Figures for the Black Creek watershed were requested and provided for the years 2009 and 2010. The results of those figures have been summarized on Figure 3.3:

Figure 3.3: Water Withdrawals Reported to NYSDEC in Excess of 100,000 gal, 2009 – 2010

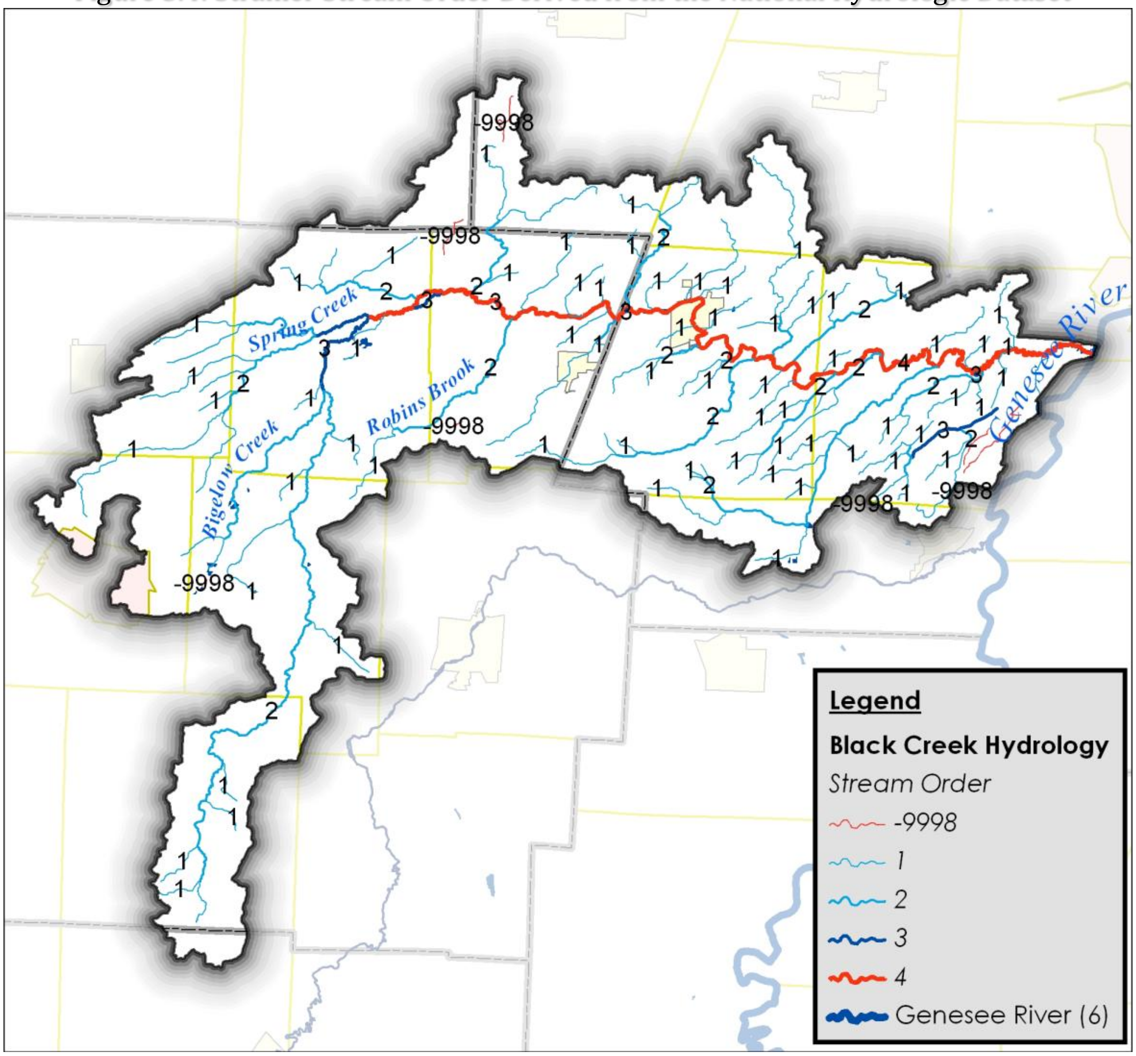


Data provided are only the facilities that voluntarily provided the data to DEC; the Department notes that there may be others that they are not aware of. DEC reports the type of facility (Use Sector) and listed what that facility reported as their water supply source; latitude and longitude coordinates were also provided, which were used to generate points on the map. None of the facilities that provided data indicated that water is diverted out of their basin. It can therefore be assumed that the water is returned to its source.

3.3.6 Stream Order

The Black Creek watershed has streams that range in order from 1 (first order/smallest streams) to 4. As shown in the map below, the Black Creek becomes a third order stream in the Town of Byron and shortly thereafter becomes a fourth order stream in the Town of Bergen and remains so when it meets the Genesee River, which itself is a sixth-order river at this junction.

Figure 3.4: Strahler Stream Order Derived from the National Hydrologic Dataset



The method by which stream order is derived for the NHD does have some minor flaws. One will note, for example, the presence of a number of isolated stream segments found throughout the watershed. The GIS algorithm used to calculate stream order is unable to determine values for disconnected flow lines. These segments are labeled by the GIS as “-9998” which indicates that the stream order value for the flow line is missing or undetermined. Some of these isolated flowlines are indeed mapping errors, while many others are actually streams which are influenced by the karst region of the watershed and effectively disappear underground (see Section 3.1.3 for an explanation of karst geology in this watershed). A number of these streams, however, do in fact connect to the stream network throughout most of the year and require field verification. This does not affect the output of the stream order classification for the major tributaries in the watershed and helps to identify those areas that may be under the influence of unique geologic conditions.

3.3.7 Wetlands

Significant areas of wetlands exist in the Black Creek watershed, particularly in the northern half of the watershed where a post-glacial lake once existed, likely contributing to the wetlands occupying the landscape there today. Wetlands are lands where saturation with water is the dominant factor determining the nature of soil development and the types of plant and animal communities living in the soil and on its surface.[19] Wetlands serve a number of important functions within a watershed, including sediment trapping, chemical detoxification, nutrient removal, flood protection, shoreline stabilization, ground water recharge, stream-flow maintenance, and wildlife and fisheries habitat. Numerous federal and state laws affect the use and protection of wetlands. Because no single one of these laws was specifically designed as a comprehensive policy for wetlands management, understanding how and when the various laws and levels of regulation apply can be somewhat confusing.

The principal federal laws that regulate activities in wetlands are Sections 404 and 401 of the Clean Water Act, and Section 10 of the Rivers and Harbors Act. Wetlands, as defined under the Federal Clean Water Act, are: "…those areas that are inundated or saturated by surface or groundwater at a frequency and duration sufficient to support, and that under normal circumstances do support, a prevalence of vegetation typically adapted for life in saturated soil conditions."[20]

In 1986, the Emergency Wetlands Resources Act mandated that the US Fish and Wildlife Service complete the mapping and digitizing of the Nation's wetlands. The result is the Wetlands Geospatial Data Layer of the National Spatial Data Infrastructure. This digital data provides highly-detailed information on freshwater wetlands and ponds with numerous classifications and sub-classifications. Federal wetlands (referred to as the National Wetlands Inventory (NWI)) in the Black Creek watershed are illustrated on Map 5 in Appendix A. A subwatershed analysis of the NWI geospatial information is provided in Table 3.6:

Table 3.6: US Fish and Wildlife Service National Wetlands Inventory for Black Creek Watershed

Subwatershed	Total Acreage	*Freshwater Emergent Wetland*	*Freshwater Forested/Shrub Wetland*	*Freshwater Pond*	*Lake*	*Other*	*Riverine*
Spring Creek	1,359.1	*147.2*	*1,155.8*	*52.1*	*0*	*4.0*	*0*
Black Creek Headwaters	2,608.1	*407.0*	*1,968.0*	*170.6*	*59.0*	*3.5*	*2,608.1*
Robins Brook	5,864.7	*353.6*	*5,405.1*	*52.7*	*32.9*	*3.6*	*16.8*
Hotel Creek	5,276.1	*612.3*	*4,440.0*	*73.1*	*0*	*0*	*150.6*
Mill Creek	2,754.9	*359.5*	*2,228.0*	*112.7*	*0*	*0*	*54.6*
Black Creek Outlet	2,592.4	*367.4*	*2,097.2*	*41.3*	*0*	*4.3*	*82.1*
Black Creek Watershed	20,455.2	*2,247.0*	*17,294.1*	*502.6*	*91.9*	*15.4*	*304.2*

Table 3.7: NYS Regulated Wetland Acreage by Subwatershed

Subwatershed	NYS Regulated Wetland Acreage
Spring Creek	537.6
Black Creek Headwaters	816.3
Robins Brook	4,756.5
Hotel Creek	3,422.5
Mill Creek	2,230.2
Black Creek Outlet	1,904.5
Black Creek Watershed	**13,667.6**

The principal New York State regulation affecting development activities in and near wetlands in the Black Creek watershed is the Freshwater Wetlands Act, Article 24 and Title 23 of Article 71 of the NYS Environmental Conservation Law. The NYSDEC has mapped the approximate boundaries of all freshwater wetlands of 12.4 acres or more in New York. In some cases, these maps include smaller wetlands of unusual local importance. An adjacent area of 100 feet is also protected to provide a buffer zone to the wetland.

New York State regulated freshwater wetlands in the Black Creek watershed are illustrated on Map 4 in Appendix A. An analysis of these wetland areas by subwatershed is provided in Table 3.7. The largest single contiguous NYS regulated wetland area in the Black Creek watershed is located in and around the vicinity of Bergen Swamp and covers 1,973 total acres. Other regulated wetland areas of considerable size snake throughout the Black Creek watershed and are generally located near stream segments.

3.3.8 Understanding the Active River Area

The Nature Conservancy recently developed an approach to address river health in areas directly adjacent to streams. This "active river area" framework can be used as a tool to inform conservation, restoration and management of riparian areas and entire watersheds. This approach to riparian planning and protection is described in the TNC manual, *The Active River Area: A Conservation Framework for Protecting Rivers and Streams*:

> River health depends on a wide array of processes that require dynamic interaction between the water and land through which it flows. The areas of dynamic connection and interaction provide a frame of reference from which to conserve, restore and manage river systems. We choose the term active river area to define this framework. "Active" indicates the dynamic and disturbance-driven processes that form and maintain river and riparian systems and their associated habitats and habitat conditions. "River area" represents the lands that contain both aquatic and riparian habitats and those that contain processes that interact with and contribute to a stream or river channel. The *active river area* framework offers a more holistic vision of a river than solely considering the river channel as it exists in one place at one particular point in time. Rather, the river becomes those lands within which the river interacts both frequently and occasionally.[21]

The active river area (ARA), therefore, is a critical zone in which watershed restoration and protection efforts should be focused. The ARA is comprised of five components: material contribution areas; the meander belt; floodplains; terraces; and riparian wetlands. The characteristics of the ARA typically evolve from headwaters to outlet and are dependent on a number of variables. In the headwaters of a watershed, which typically have steeper slopes, deep "V"-shaped channels, and fewer meanders, the active river area will be relatively smaller in size compared to downstream locations. As streams converge in these downstream areas, the active river area will tend to widen and become more dynamic, encompassing larger areas of land and generally will be subject to a larger variety of natural processes (erosion, flooding, sediment transport, debris accumulation, etc.) at various levels of intensity.

Map 7 in Appendix A illustrates the active river area throughout the Black Creek watershed; further research into the delineation of and intactness of these lands is recommended.

3.4 Elevation and Steep Slopes

Elevation is the vertical distance from mean sea level to a point on the earth's surface. Elevation influences the genesis of natural soil bodies and soil drainage within a landscape. Elevation in the Black Creek watershed was analyzed using 10 meter resolution Digital Elevation Model (DEMs) raster quads and authenticated against U.S. Geological Survey topographic maps.

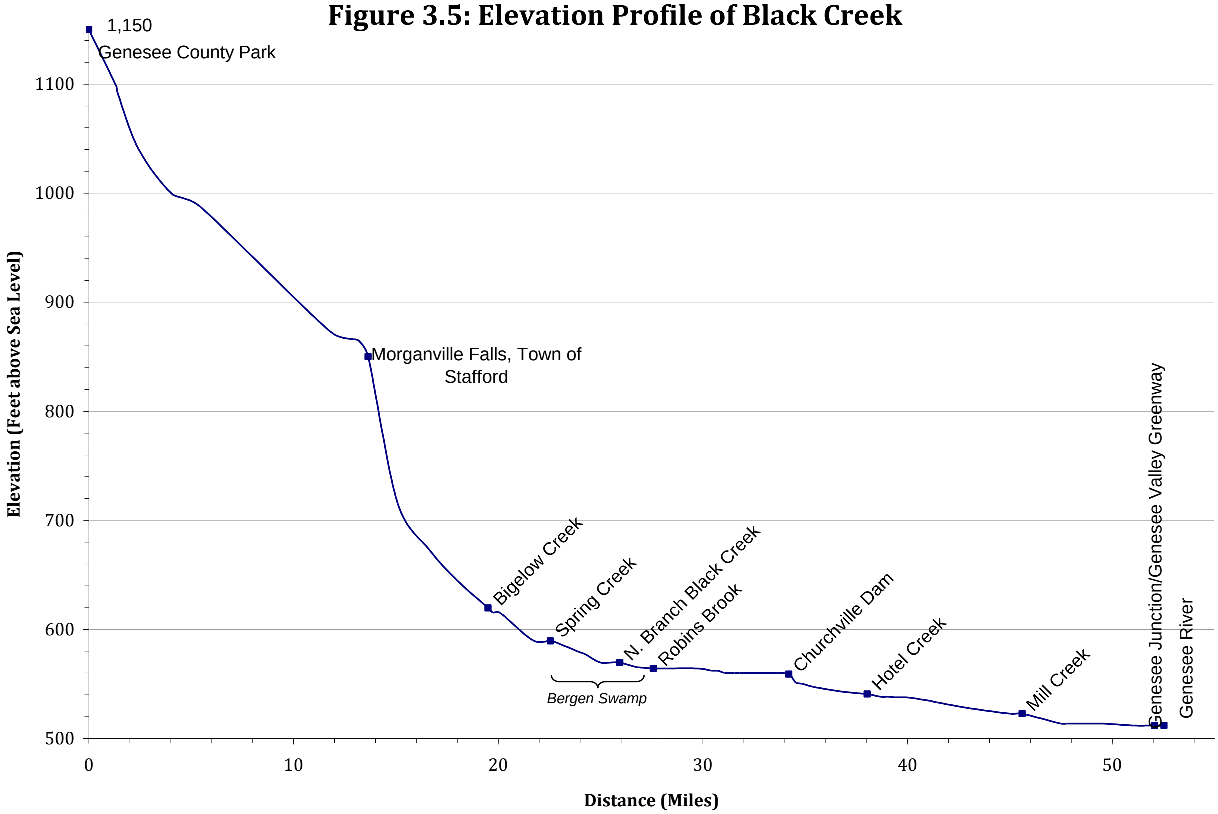
Total relief in the Black Creek watershed is 275.1 meters or 903 feet. The maximum elevation in the watershed was determined to be 431.0 meters or 1,414 feet above sea level (located in the Black Creek Headwaters subwatershed approximately 0.3 miles due east of East Road following the border of the Towns of Middlebury and Town of Bethany). The Black Creek itself begins at an elevation of 1,150 feet above sea level. The lowest point in the watershed is at outlet of Black Creek where it converges with the Genesee River; the elevation at this junction is 155.9 meters or 510 feet above sea level.

The physiography of the Black Creek watershed is relatively flat in character, although the lands have ample evidence of glacial influence. These conditions were well described in the *Black Creek Watershed State of the Basin Report*:

> Within the Black Creek Watershed many hills in the Lake Ontario Lowlands are oriented in a southwesterly direction, indicating a glacial origin as drumlins. Drumlins form as ice advances and deposits glacial till that is streamlined parallel to the ice flow direction. Topography of the Allegheny Plateaus are associated with stream dissection of dendritic patterns into relatively weak Devonian shales. Locally steep slopes occur on the flanks of drumlins and in the upper branches of dendritic tributaries in the upper part of the watershed.[22]

Map 13 in Appendix A illustrates the total relief and slopes greater than 15% in the Black Creek watershed. In addition, data included in the National Hydrography Dataset were used to produce a stream elevation profile of the main stem of the Black Creek, as illustrated in Figure 3.5. Elevations used in this profile are also based on the 10-meter resolution Digital Elevation Models (DEMs) remote-sensing terrain data and represent the estimated stream elevation at the stream bed (as opposed to the mean surface water level).

Figure 3.5: Elevation Profile of Black Creek



3.5 Land Use and Land Cover

Land activities and water quality are inherently linked to one another. The type of activities that take place on the land will directly influence the quality and characteristics of the water that runs off of it. Understanding the characteristics of the land within a watershed area is therefore a central aspect of watershed planning. A variety of GIS data sources can be used to provide a clear understanding of how land within the watershed has been adapted to human uses, such as agriculture, residential, or natural cover. Landscape conditions can further be analyzed in order to assess elements of the watershed such as patterns of natural land cover, land disturbance regimes, and ecological connectivity. This information can be manipulated in a variety of ways (adjusting spatial and temporal scales, for example) to provide users with multiple applications for the management and restoration of land and water resources.

3.5.1 Land Use

Land use refers to the human purposes ascribed to the land, such as “industrial” or “residential” use. Land use can be analyzed utilizing Geographic Information System data derived from county Real Property System (RPS) tax parcel records. As explained on the New York State Department of Taxation and Finance Office of Real Property Tax Services website:

> The Assessment Improvement Law (Laws of 1970, Chapter 957) required local governments to prepare and maintain tax maps in accordance with standards established by the State Board of

> Equalization and Assessment (currently Office of Real Property Services). For the most part, this requirement is a county responsibility…Perhaps the most essential of all assessment tools is an adequate tax map reflecting the size, shape and geographical characteristics of each parcel of land in the assessing unit. The tax map is a graphic display of each assessing unit's land inventory and as such is the major source to the real property assessment roll. The working copy of the tax map used by the assessor can be utilized to record and analyze property transfers, to record other features pertinent to the valuation of land and in the development of a Geographic Information System (GIS). [The GIS] allows us to analyze and map the wealth of parcel level assessment information to solve problems related to: property valuation, local government reassessments, land use, environmental assessment, facility siting and economic development, public health, emergency services and disaster planning.[23]

Tax parcel information is available in GIS format from each county within the study area. Each GIS utilizes the same uniform classification system developed by the New York State Office of Real Property Services that is used in assessment administration in New York State. The system of classification consists of numeric codes in nine categories.

Results listed in Table 3.8 on the following page were tabulated based on an analysis of those properties within the Black Creek watershed.

It is important to note that property classification and tax map maintenance is a responsibility of the county assessor's office (or equivalent). While the classification system standards are intended to create uniform results, human error and subjectivity can sometimes lead to different interpretations of property types from place to place. Some level of variation with the results in Table 3.8 should therefore be assumed. Furthermore, properties are classified primarily for the purposes of taxation and public finance, not environmental analysis. While the information aids environmental assessment, the application of these results to watershed planning has its limitations. The information is therefore presented simply to provide a snapshot of the land use within the Black Creek watershed and subwatersheds and to facilitate rapid assessment of watershed and subwatershed site conditions.

Table 3.8: Land Use within the Black Creek Watershed[24]

Property Classification Category	Acres	% of Black Creek Watershed Area
(1) Agricultural Property used for the production of crops or livestock	60,302.89	48.5%
(2) Residential Property used for human habitation	33,566.89	27.0%
(3) Vacant Land Property that is not in use, is in temporary use, or lacks permanent improvement	14,393.92	11.6%
(4) Commercial Property used for the sale of goods and/or services	1,832.23	1.5%
(5) Recreation and Entertainment Property used by groups for recreation, amusement, or entertainment	1,650.59	1.3%
(6) Community Services Property used for the well being of the community	1,961.95	1.6%
(7) Industrial Property used for the production and fabrication of durable and nondurable man-made goods	833.56	0.7%
(8) Public Services Property used to provide services to the general public	1,125.89	0.9%
(9) Wild, Forested, Conservation Lands & Public Parks Reforested lands, preserves, and private hunting and fishing clubs	5,241.46	4.2%
Unclassified *Property or land that has not been or is unable to be classified*	3,486.92	2.8%

3.5.2 Land Cover

Land cover refers to the type of features present on the surface of the earth. For example, agricultural fields, water, pine forests, and parking lots are all land cover types. Land cover may refer to a biological categorization of the surface, such as grassland or forest, or to a physical or chemical categorization such as concrete.

Land cover was assessed in the Black Creek watershed utilizing imagery associated with the National Land Cover Dataset. This dataset was developed by the Multi-Resolution Land Characteristics (MRLC) Consortium, a group of federal agencies who first joined together in 1993 (MRLC 1992) to purchase satellite imagery for the conterminous U.S. to develop the NLCD. In 1999, a second-generation MRLC consortium was formed to purchase three dates of satellite imagery for the entire United States (MRLC 2001) and to coordinate the production of a comprehensive land cover database for the nation called the National Land Cover Database (NLCD 2001).[25] This database was once again updated utilizing new data from 2006.
GIS analysis of the 2006 NLCD provided the following information:

Table 3.9: 2006 NLCD Land Cover within the Black Creek Watershed		
NLCD Category	**Acres**	**% Cover**
11 - Open Water	275.77	0.2%
21 - Developed, Open Space	8,700.53	6.7%
22 - Developed, Low Intensity	3,311.46	2.6%
23 - Developed, Medium Intensity	720.56	0.6%
24 - Developed, High Intensity	168.35	0.1%
31 - Barren Land	334.26	0.3%
41 - Deciduous Forest	12,619.13	9.8%
42 - Evergreen Forest	255.31	0.2%
43 - Mixed Forest	2,059.38	1.6%
52 - Shrub/Scrub	1,335.26	1.0%
71 - Grassland/Herbaceous	297.34	0.2%
81 - Pasture Hay	39,012.06	30.2%
82 - Cultivated Crops	41,735.51	32.3%
90 - Woody Wetlands	17,633.91	13.6%
95 - Emergent Herbaceous Wetlands	909.37	0.7%
Total	129,368.19	

As Table 3.9 shows, the Black Creek watershed is dominated by agricultural land cover, with 32.3% devoted to "Cultivated Crops" and 30.2% of lands devoted to "Pasture/Hay." This is a significantly larger amount of land area that is indicated by the land use analysis in Table 4.8. This discrepancy is very likely due to the reporting methodology used by local Offices of the Assessor. It is likely that large tracts of lands are being identified as "residential" which may also have some significant amount of pasture or other agricultural use active upon it. Forest cover accounts for approximately 11.6% of total land cover, while "developed" land accounts for a total of 10% of land cover within the Black Creek watershed, with 6.7% of that land area accounting for "developed open space," which generally refers to residential yards, parks, golf courses and other similar types of turf land cover.

Natural land cover – defined here by NLCD categories 41 (Deciduous Forest), 42 (Evergreen Forest), 43 (Mixed Forest), 90 (Woody Wetlands) and 95 (Emergent Herbaceous Wetlands) – are important components of a healthy watershed. As stated in the EPA manual, *Identifying and Protecting Healthy Watersheds:*

> Natural vegetative cover stabilizes soil, regulated watershed hydrology, and provides habitat to terrestrial and riparian species. The type, quantity, and structure of the natural vegetation within a watershed have important influences on aquatic habitats…Conversely, agricultural and urban landscapes serve as net exporters of sediment and nutrients, while increasing surface runoff and decreasing infiltration to ground water stores.[26]

A summary of 2006 NLCD data focusing on natural land cover categories is shown in Table 3.10:

Table 3.10: 2006 NLCD Natural Land Cover within the Black Creek Watershed				
HUC 12 Subwatershed	**Subwatershed Area (Acres)**	***% Forest***	***% Wetland***	**Natural Cover Total**
Spring Creek Subwatershed	14,103.39	*7.6%*	*7.7%*	15.3%
Black Creek Headwaters Subwatershed	29,622.33	*11.1%*	*4.7%*	15.7%
Robins Brook Subwatershed	23,455.09	*8.6%*	*27.4%*	36.1%
Hotel Creek Subwatershed	32,102.70	*14.2%*	*15.6%*	29.8%
Mill Creek Subwatershed	19,826.50	*14.3%*	*12.2%*	26.5%
Black Creek Outlet Subwatershed	10,254.18	*11.5%*	*21.4%*	33.0%
Black Creek Watershed	**129,368.19**	***11.5%***	***14.3%***	**25.9%**

As the figures above indicate, natural cover is relatively low throughout the watershed, with the highest percent natural cover found in the Robins Brook and Black Creek Outlet subwatersheds. The highest percentage of natural cover is found in the Robins Brook subwatershed at 36.1%. Bergen Swamp is located in this watershed which would explain this high degree of natural cover relative to other subwatersheds. Black Creek Outlet subwatershed similarly has a high percentage of natural cover relative to the entire watershed, which is found primarily in the Rural-Agricultural and Agricultural-Conservation zoning districts within the Town of Chili (which also corresponds with the floodplain area). Overall, the average natural cover percentage of 25.9% is again indicative of the watershed's intense agricultural character. A full explanation of 2006 NLCD categories and results by subwatershed is provided in Appendix D of this report.

3.5.3 Land Cover in the Riparian Zone

The land area directly adjacent to streams is considered to be among the most dynamic and sensitive components of a watershed and has a significant influence on water quality. A stream that is surrounded by tree cover and vegetation, for example, will benefit from the cooling effects of shade from the tree canopy above and bank stabilization bank from tree roots and other types of plant cover below. Detritus from surrounding plants will also be contributed to the stream as a source of nutrition and habitat for a variety of animals and organisms. Conversely, streams surrounded by impervious, hard, non-vegetative cover or agricultural cover will likely experience greater soil loss and more impacts from nonpoint source pollution.

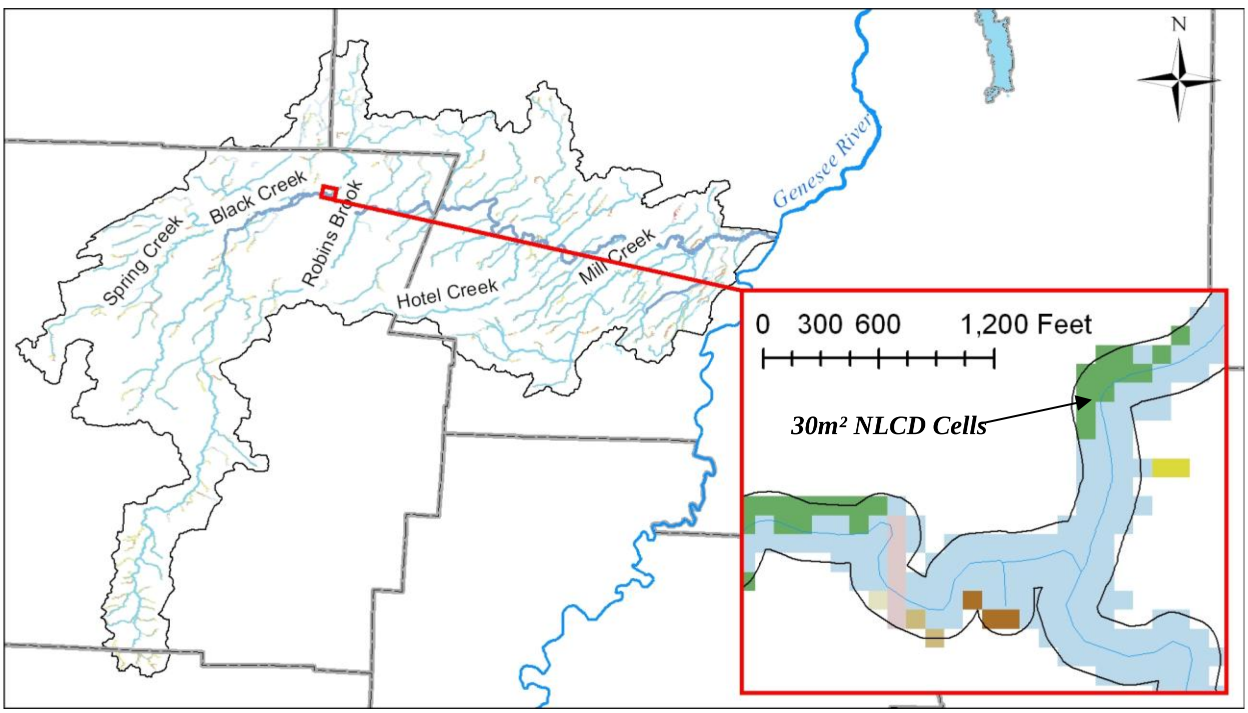
In an effort to ascertain the level of natural cover within areas surrounding streams, a 300' buffer was created around each tributary within the watershed (150' linear distance perpendicular from the stream on both sides of the stream). The riparian buffer linear distance of 150' (45.72m) was selected in an effort to accommodate 30m² cells used by the NLCD raster grid. While correlations exist between various riparian buffer widths and specific ecological, chemical and stream morphological conditions, no such implications are made here with this selection of the 150' distance. Rather, the goal is simply to provide a snapshot of land cover in and around the riparian zone throughout the watershed.[27] Furthermore, the buffer area should not be construed as representative of the active river area described in Section 3.3.8, although they do in fact share much of the same corresponding space.

Land cover analysis using the 2006 NLCD was conducted by subwatershed specifically in this 300' buffer zone. As the chart below indicates, nearly 16,000 acres of land was identified to be within this riparian area. Results of the land cover analysis are as follows:

Table 3.11: Analysis of Natural Land Cover within a 300' Buffer of All Streams, by Subwatershed

HUC 12 Subwatershed	Riparian Buffer Area (Acres)	*% Forest*	*% Wetland*	Natural Cover Total	% Impervious
Spring Creek Subwatershed	1,579	*10.2%*	*26.5%*	**36.8%**	**<1%**
Black Creek Headwaters Subwatershed	3,110	*20.4%*	*19.6%*	**39.9%**	**<1%**
Robins Brook Subwatershed	2,645	*10.4%*	*55.2%*	**65.7%**	**<1%**
Hotel Creek Subwatershed	3,663	*18.1%*	*36.7%*	**54.9%**	**<1%**
Mill Creek Subwatershed	2,749	*17.9%*	*30.9%*	**48.7%**	**1.7%**
Black Creek Outlet Subwatershed	2,216	*11.3%*	*38.2%*	**49.5%**	**1.2%**
Black Creek Watershed	**15,962**	***12.3%***	***34.6%***	**46.9%**	**<1%**

Figure 3.6: Illustration of 300' Riparian Buffer Applied to the Black Creek Watershed



It is again important to emphasize that NLCD land cover classification is generalized on a 30x30 meter scale (.22 acres). Random ground-truthing of NLCD land cover pixels against orthophotos generally reveals a diverse array of actual land cover types within a given NLCD 30x30 meter cell area. Results of this analysis are therefore estimates and should be viewed with a degree of caution.

As Table 3.11 illustrates, the percentage of natural cover in lands adjacent to stream corridors within the Black Creek watershed range between 36.8% in the Spring Creek subwatershed to 65.7% in the Robins Brook subwatershed with an overall total average of 46.9% natural cover. The large proportion of natural cover in the Robins Brook subwatershed is to be expected due to the presence of the forested wetlands in the Bergen Swamp, a major natural feature of this area. Table 3.9 also includes the percentage of impervious cover, which is a good indicator of aquatic system health.[28] This particular measure of impervious cover is a statistical average of the four "development" subcategories. Impervious cover is very low throughout the riparian area across the entire Black Creek watershed, with the highest level of riparian area impervious cover found in the Mill Creek subwatershed at 1.7%. Further information on impervious cover in the Black Creek watershed can be found in Section 3.5.4.

Unabridged riparian area land cover figures are provided in Appendix D of this report and offer further insight regarding the range of land cover in this sensitive area of the Black Creek watershed.
The remainder of land cover in the Black Creek watershed riparian area appears to be predominantly agricultural in nature, including pasture and cultivated crops. This is the predominant land cover in the Spring Creek subwatershed (58% hay and crops combined) and the Black Creek Headwaters subwatershed (51% hay and crops combined), while accounting for smaller, although not insignificant, proportions in the remaining subwatersheds.

3.5.4 Impervious Cover

The Center for Watershed Protection (CWP) defines impervious cover as "any surface in the urban landscape that cannot effectively absorb or infiltrate rainfall."[29] It is the sum of roads, parking lots, sidewalks, rooftops, and other impermeable surfaces of the urban landscape. The impacts of impervious cover on aquatic systems are well-documented.[30] In 1994, CWP published the paper *The Importance of Imperviousness* which outlined the empirical evidence showing the relationship between impervious cover and stream quality. Among the conclusions drawn from that paper include:

- Impervious surfaces reduce infiltration of stormwater and increase stormwater runoff volumes and velocities;
- Impervious surfaces increase stream channel instability which, in turn, triggers a cycle of streambank erosion and habitat degradation;
- Impervious surfaces collect and accumulate pollutants deposited from the atmosphere, leaked from vehicles or derived from other sources and quickly directs those pollutants into receiving waterbodies in a concentrated fashion;
- Impervious surfaces along with other associated factors (such as decreased tree cover) amplify stream warming;
- Increases in impervious surfaces are associated with a decrease in the diversity, richness and composition of the aquatic insect community, such as macroinvertebrates; and
- Levels of subwatershed imperviousness in excess of 10 to 15% can have a negative impact on the abundance and diversity of fish communities as well as the richness of both the wetland plant and amphibian community. (pages 1-8)

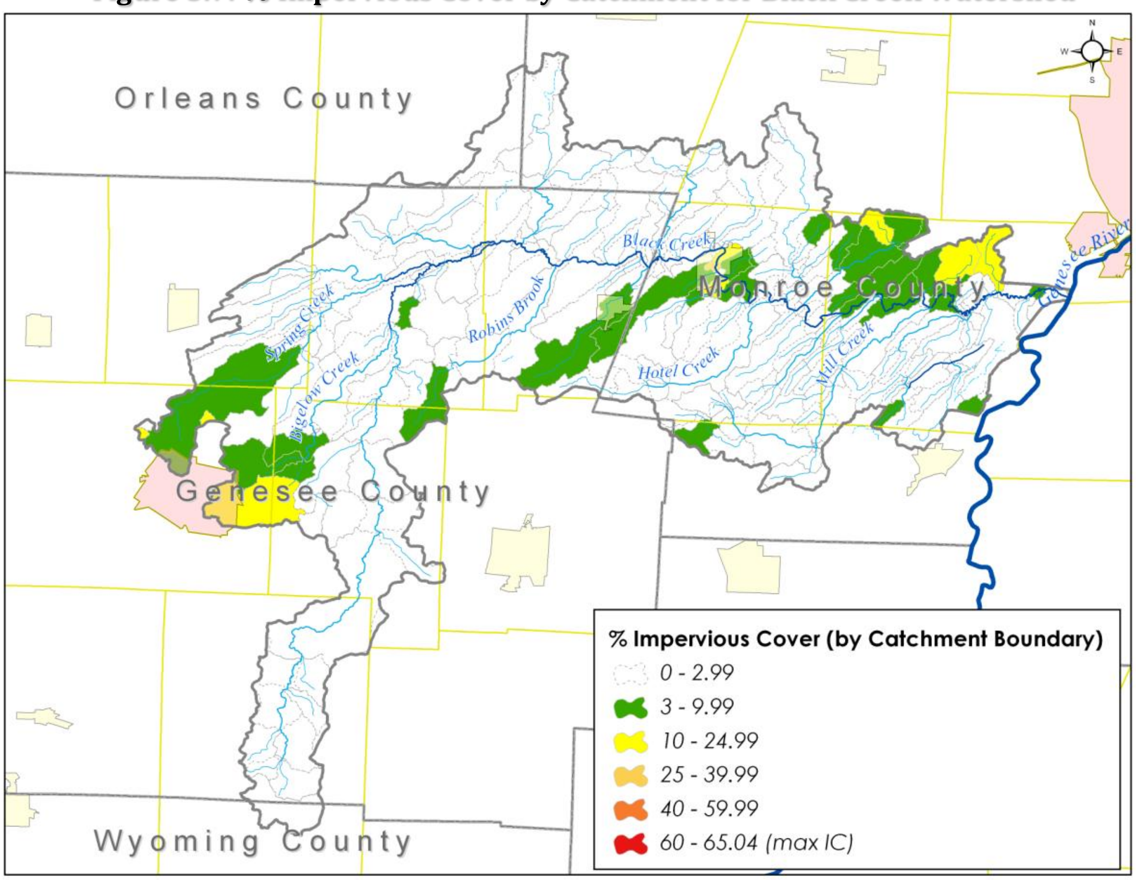
Impervious cover (IC) is therefore a key indicator of stream quality and watershed health. The CWP has integrated these research findings into a general watershed planning model, known as the Impervious Cover Model (ICM). The ICM predicts that most stream quality indicators decline when watershed IC exceeds 10%, with severe degradation expected beyond 25% IC. While the actual stream response to the level of IC will vary based on a variety of conditions (local topography and physiology, other prevailing land cover characteristics, stormwater practices, watershed history), IC has nonetheless been identified as a significant contributor to aquatic system decline and therefore a reliable indicator of urban hydrologic stress.[31]

Table 3.12 illustrates the basic three-tiered threshold classification scheme of urban stream-quality potential based on watershed imperviousness levels.

Table 3.12: Relationship between Urban Stream Quality and Impervious Cover

Urban Stream Quality	Level of Imperviousness
Stressed	*1 – 10% Imperviousness*
Impacted	*11 – 25% Imperviousness*
Degraded	*>26% Imperviousness*

Figure 3.7: % Impervious Cover by Catchment for Black Creek Watershed



Impervious cover is obviously highest in urbanized areas within the watershed, such as the NE of the City of Batavia, Villages of Churchville and Bergen and the suburban are around the Towns of Riga and Chili. The density of buildings and streets creates a high degree of impervious cover in these areas. Overall, the analysis indicates that IC is not a major concern throughout most of the Black Creek watershed when measured by this standard. Several large catchments near the Batavia area are indicating high %IC levels, but these are at the low-end of the 10 – 24.9% range; this is also the case in the area near the Towns of Riga and Chili. The Village of Churchville does have several small catchments with a high %IC with one small catchment measuring IC greater than 25%. The ICM therefore provides a starting point for further research into how these areas affect local aquatic health.

Additional research might include the identification of *effective IC* within these catchments – that is, the specific locations where impervious surfaces are contiguous and directly tied to adjacent waterbodies. These particular areas could then be targeted for stormwater retrofit and mitigation projects in order to eliminate or reduce the negative impacts that they have on local aquatic health.

SECTION 3 ENDNOTES

[6] US EPA. Identifying and Protecting Healthy Watersheds. March 2011. Retrieved 8/11/11 from http://water.epa.gov/polwaste/nps/watershed/hw_techdocument.cfm.
[7] *Black Creek Watershed State of the Basin* (2003), page 25.
[8] *Black Creek Watershed State of the Basin* (2003), pages 25-26.
[9] Reddy, J.E., and Kappel, W.M., 2010, Compilation of existing hydrogeologic and geospatial data for the assessment of focused recharge to the carbonate-rock aquifer in Genesee County, New York: U.S. Geological Survey Scientific Investigations Map 3132, 17 p., 20 sheets, at http://pubs.usgs.gov/sim/3132/.
[10] *Manure Management Guidelines for Limestone Bedrock/Karst Areas of Genesee County, New York: Practices for Risk Reduction. [Online] In Cornell University Nutrient Management Spear Program*. Retrieved 8/8/11 from http://nmsp.cals.cornell.edu/publications/files/Karst_2_15_2011.pdf
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[14] *Soil Properties and Qualities*. [Online] In *Natural Resources Conservation Service*. Retrieved 12/2/10 from http://soils.usda.gov/technical/handbook/contents/part618.html#36
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[20] EPA Regulations listed at 40 CFR 230.3(t)
[21] Smith, Mark P., Roy Schiff, Arlene Olivero, and James MacBroom. T*he Active River Area: A Conservation Framework for Protecting Rivers and Streams*. The Nature Conservancy: April 2008. pp 1
[22] *Black Creek Watershed State of the Basin* (2003), page 29. [Online] In *Black Creek Watershed Coalition*. Retrieved 12/1/10 from http://www.blackcreekwatershed.org/bcstate.htm.
[23] *Tax Mapping in New York State*. [Online] In *New York State Department of Taxation and Finance Office of Real Property Tax Services*. Retrieved 12/01/10 from http://www.orps.state.ny.us/gis/taxmap/index.htm.
[24] Waterbodies, road rights-of-way and other minor boundary irregularities account for a cumulative discrepancy between the actual total area of the watershed and the total property acreage that is classified through the real property system. Refer to GIS Data Sources and Notes in Appendix B for real property source information.
[25] *National Land Cover Database*. [Online] In *Multi-Resolution Land Characteristics Consortium (MRLC)*. Retrieved 12/13/10 from http://www.mrlc.gov/about.php
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4.0 Planning Considerations

"Ecology involves the study of the reciprocal relationships of all organisms to each other and to their biological and physical environments. Landscapes comprise the sum of natural and cultural elements seen in a single view. When we add "planning" to each of these terms, the combined term refers to developing future options for our surroundings, for the interrelationships among biological and physical processes, and for the visual manifestation of those relationships. Because our surroundings contain physical, biological, and built elements, environmental planning involves using knowledge about those elements to provide options for decision making."[32]

> – "Environmental Planning Considerations." An excerpt from *Planning and Urban Design Standards*, a publication of the American Planning Association.

Section 4.0 provides a general overview of the various organizational structures, land uses, and regulatory measures relevant to environmental planning in the Black Creek watershed. Information pertaining to recent planning and organizational history, demographics, development trends, agricultural and other land use activities within the watershed is provided herein.

4.1 Planning History[33]

A wide variety of planning, monitoring and restoration initiatives have been accomplished or are presently underway within the Black Creek watershed. These include activities being undertaken by academic institutions, county Soil and Water Conservation Districts, state and local government agencies, and a variety of other public and nonprofit entities. An overarching goal of the watershed management planning process is the integration of these various initiatives and disciplinary perspectives into a more cohesive and holistic framework for natural resource management.

4.1.1 Black Creek Watershed Coalition

While independent environmental research, planning and assessment has been taking place within the Black Creek watershed for decades, organized intermunicipal watershed planning activities within the watershed did not begin to emerge until the late 1980s and early 1990s. One of the more significant regional watershed planning efforts to take place in and around the Black Creek watershed was the Rochester Embayment Remedial Action Plan (RAP), a response to the 1987 US-Canada Great Lakes Water Quality Agreement that required "Areas of Concern" to prepare RAPs.[34] The Rochester Embayment was named as an "Area of Concern" and its RAP, completed in 1997 (with updates as recent as 2011), was developed by representatives of the six counties that share the Genesee River Basin and the Rochester Embayment drainage. This report recognized the value of using a Basin-wide approach to addressing localized water quality issues that in some cases result from upstream activities, which would include the area of the Black Creek watershed.

In 2001, a local planning group focusing on the North Chili Tributary of Black Creek recommended "preparing a Watershed Plan for the Entire Black Creek Watershed."[35] In addition, at a public symposium held in 2000, participants that live and work in the Black Creek watershed identified several issues of concern that require action. These included environmental concerns, the identification of sensitive resources that merit protection, and the identification of entities that could be involved in the preparation of a watershed plan. In 2002, the Coalition applied for and received a Watershed Assistance Grant from River Network, a national river- and watershed-conservation organization supported by the US EPA.[36] The grant made possible a 6-hour Black Creek Watershed Symposium and the formation of the Black Creek Watershed Coalition, the first meeting of which was held in April of 2002.

The Black Creek Watershed Coalition continues to be very active in watershed planning activities. A number of its notable accomplishments have been listed in the timeline below.

Table 4.1: Timeline of Notable Accomplishments by the Black Creek Watershed Coalition

April 11, 2002	• First meeting of the Black Creek Watershed Coalition (BCWC); efforts to produce are "State of the Basin" report and intermunicipal agreement between counties begins
October 2002	• Establishment of the BCWC website, www.blackcreekwatershed.org/ • Monroe, Genesee and Orleans Counties enter into an Intermunicipal Agreement • The first BCWC Newsletter published
August 2003	• Completion of the Black Creek Watershed State of the Basin Report by SUNY Brockport team
February 2004	• A motion was made, seconded and passed by BCWC members to support collaborative efforts with the Oatka Creek Watershed Coalition
2005 – 2006	• Effort initiated to encourage municipalities to enter into a Call for Cooperation; 9 of 16 targeted municipalities pass resolution to do so
February 2009	• Publication of the Black Creek Watershed Map Guide
July 2009	• NYS Environmental Protection Fund watershed planning grant through NYS Department of State Division of Coastal Resources commences
October 2010	• Black Creek & Oatka Creek Watershed Symposium held to a large audience

In addition, the Black Creek Watershed Coalition website is used as a repository for information related to watershed planning activities taking place in and around the watershed. The website also serves as an important tool for information dissemination on water quality and natural resource protection issues as well as opportunities for public participation. The website address is http://www.blackcreekwatershed.org/.

Table 4.2: Federal and State Agencies Active in the Black Creek Watershed

Agency	Relevant Roles and Responsibilities
United States Army Corps of Engineers (USACE)	The US ACE's stated vision is to "Provide vital public engineering services in peace and war to strengthen our Nation's security, energize the economy, and reduce risks from disasters." In doing so, the USACE plays a significant role in planning and building water resource improvements. The Corps of Engineers regulates construction and other work in navigable waterways under Section 10 of the Rivers and Harbors Act of 1899, and has authority over the discharge of dredged or fill material into the "waters of the United States" (a term which includes wetlands and all other aquatic areas) under Section 404 of the Federal Water Pollution Control Act Amendments of 1972 (PL 92500, the "Clean Water Act"). Under these laws, those who seek to carry out such work must first receive a permit from the Corps. Other significant areas regarding the Corp's role in planning and building water resource improvements include recreation, emergency response and recovery, flood control and floodplain management, navigation, erosion and shore protection, hydrologic modeling, hydropower and water supply management.
United States Geologic Survey (USGS)	A division of the US Department of the Interior, the USGS focuses on research in the natural sciences with emphasis on subjects such as climate and land use change, core science systems, ecosystems, energy, minerals and environmental health, natural hazards, science quality and integrity and water
Federal Emergency Management Agency	A division of the US Dept. of Homeland Security, FEMA's mission is to support citizens and first responders to build, sustain, and improve capability to prepare for, protect against, respond to, recover from, and mitigate all hazards. Responsibilities includes floodplain management, flood hazard mapping and administration of the National Flood Insurance Program.
Environmental Protection Agency	Primary mission is to protect human health and the environment. EPA's FY 2011-2015 Strategic Plan identifies five strategic goals to guide the Agency's work: Goal 1: Taking Action on Climate Change and Improving Air Quality; Goal 2: Protecting America's Waters; Goal 3: Cleaning Up Communities and Advancing Sustainable Development; Goal 4: Ensuring the Safety of Chemicals and Preventing Pollution; and Goal 5: Enforcing Environmental Laws. The EPA enforces the Clean Water Act, the Safe Drinking Water Act, and a number of other important environmental regulations.
Natural Resources Conservation Service	A division of the US Department of Agriculture, the NRCS works with landowners through conservation planning and assistance designed to benefit the soil, water, air, plants, and animals that result in productive lands and healthy ecosystems.
US Fish and Wildlife Service	The U.S. Fish and Wildlife Service is a bureau within the Department of the Interior. Its mission is working with others to conserve, protect and enhance fish, wildlife and plants and their habitats for the continuing benefit of the American people. Among its key functions, the Service enforces Federal wildlife laws, protects endangered species, manages migratory birds, restores nationally significant fisheries, and conserves and restores wildlife habitat such as wetlands.
NYS Dept. of Environmental Conservation	The NYSDEC plays a major role in a diverse array of watershed planning and management issues, including regulatory, chemical and pollution control, dam safety, management of public lands and waters, wetlands protection, mining and reclamation, and the protection and management of animals, plants, aquatic life and associated habitats.
NYS Dept. of Health	NYSDOH tracks environmental health data and trends; oversees the delivery of drinking water in coordination with the EPA, addresses pathogens and other sources of contamination in public sources of drinking water; coordinates emergency preparedness and response for water systems; and provides financing mechanisms such as the NYS Drinking Water State Revolving Fund to help protect and expand public water systems.
NYS Dept. of State	Includes the Division of Coastal Resources, which is involved in a wide variety of programs and initiatives that help revitalize, promote and protect New York's communities and waterfronts. Functions include implementing the State's *Waterfront Revitalization of Coastal Areas and Inland Waterways Act*, planning and technical assistance for redevelopment of brownfields, abandoned buildings and deteriorated urban waterfronts, protecting water quality through

	intermunicipal watershed planning, as well as investing in improvements to waterfront areas through state and federal grant programs.
NYS Dept. of Agriculture and Markets	Relevant Divisions include Soil and Water Conservation and Agriculture Protection and Development which in conjunction with other divisions administer programs such as Agricultural Environmental Management, Agricultural Districts and Farmland Protection.
Great Lakes Commission	The Great Lakes Commission is a public agency established by the Great Lakes Basin Compact in 1955 to help its Member states and provinces speak with a unified voice and collectively fulfill their vision for a healthy, vibrant Great Lakes - St. Lawrence River region. Houses a wide variety of action-oriented programs intended to address specific concerns related to regional coordination and management of natural resources.

4.1.2 Center for Environmental Information Water Quality Restoration Strategy Development[37]

The following text has been summarized from a Lake Ontario Coastal Initiative (LOCI) Fact Sheet on the Water Quality Restoration Strategy for the Black Creek watershed:

> The Lake Ontario Coastal Initiative is a joint project of the nonprofit Center for Environmental Information., Inc. of Rochester, NY; SUNY Brockport; and the Finger Lakes-Lake Ontario Watershed Protection Alliance, an association of county planning departments and soil and water conservation districts. LOCI, in partnership with the Great Lakes Commission, applied for and has been granted Clean Water Act Section 604(b) Project and American Recovery and Reinvestment Act funds in the amount of $254,695 to carry out Total Maximum Daily Load (TMDL) analysis on eight 303(d) listed streams tributary to Lake Ontario. The goal of this project is to carry out the technical assessment, interact with the Black Creek watershed community, and develop a [Water Quality Restoration Strategy] for Black Creek that allows unimpaired use of Black Creek's waters of all classes for fish, shellfish, wildlife and humans. The first draft findings of this effort are due for release in the Spring of 2011 and will be reviewed for incorporation by the Black Creek Watershed Management Plan Project Advisory Committee.

As of April 2012, CEI had completed the Water Quality Restoration Strategy and has made it available for public review. The 2-year investigation modeled sources of phosphorus to the stream and recommends the most cost-effective watershed changes to remove the current impairment and restore water quality. More information on the TMDL process can be found through the New York State Department of Environmental Conservation's and the US Environmental Protection Agency's websites.[38] In addition, further explanation of the specific water quality impairments identified within the Black Creek watershed is included in Section 5.1 of this report.

4.1.3 Federal and State Agencies

Various Federal and State agencies have also been active for several decades in the management of Black Creek watershed resources. These actions have arisen both through cooperative agreements between county and local governments and specific agencies as well as through direct initiative by responsible agencies. These agencies include (but are likely not limited to) the following:

Table 4.3: Description of County Legislatures[39]

County	Chief Administrative Official	Legislative Body	Number of Members*
Genesee County	Manager	Legislature	9
Monroe County	Executive	Legislature	29
Orleans County	Administrator	Legislature	7

Wyoming County	Administrator	Supervisors	16

4.1.4 County and Local Government

A wide variety of local, state and federal offices and agencies are acting both independently and cooperatively in an effort to monitor and manage the natural resources in the Black Creek watershed.

County governments have a large stake in the pragmatic management of watershed resources. Protecting the public's health and safety through flood and hazard management and the maintenance or monitoring of regional water quality are important responsibilities that a number of county departments and divisions share. Flood monitoring and control also has direct implications for the protection of public infrastructure, such as roads, bridges and other forms of public property which may cross or lie within a floodway. Since 2000, stormwater management efforts associated with state and federal stormwater regulations have been administered cooperatively by the Stormwater Coalition of Monroe County. The Coalition consists of 28 regulated municipal entities throughout Monroe County (including three in the Black Creek watershed). The Coalition implements a wide range of projects and programs that reduce stormwater pollution including public education, training for municipal employees, and assistance with stormwater system mapping.

A number of counties in the Black Creek watershed manage a significant amount of public parkland in the watershed. These spaces serve multiple functions, including recreation and habitat protection. A review of existing reports and studies included in Appendix D illustrates some of the efforts undertaken to inventory and maintain those spaces. Similarly, local citizens have over time made their towns, cities and villages responsible for providing similar services to varying extents. Local parks, wastewater treatment plants, and departments of public works are among the important services that local municipalities provide that can play a potential role in maintaining watershed integrity.

4.1.5 Regional Planning

The Finger Lakes/Lake Ontario Watershed Protection Alliance (FL-LOWPA) is comprised of county representatives from multiple disciplines and agencies, including Soil and Water Conservation Districts, Planning and Health Departments, and Water Quality Management Agencies. Governed by a Water Resources Board made up of appointees from its member counties, FL-LOWPA's purpose is to protect and enhance water resources by promoting the sharing of information, data, ideas, and resources pertaining to the management of watersheds in New York's Lake Ontario Basin; fostering dynamic and collaborative watershed management programs and partnerships; and emphasizing a holistic, ecosystem-based approach to water quality improvement and protection.[40] Funding provided by FL-LOWPA has supported the Black Creek Watershed Coalition in maintaining its website, funding past watershed symposiums, and printing educational and outreach publications, such as the *Black Creek Watershed Map Guide*.

A major tenet of FL-LOWPA is grassroots programming. Water quality problems are defined and solutions are developed and implemented at the local level. Through participation in the Alliance, member counties develop a more regional perspective that informs local programming and encourages cooperation. To date, FL-LOWPA has helped to provide significant funding for Black Creek watershed planning and restoration projects.

Genesee Transportation Council (GTC) is the designated Metropolitan Planning Organization (MPO) responsible for transportation policy, planning, and investment decision making in the Genesee-Finger Lakes Region. The U.S. Department of Transportation (USDOT) requires every metropolitan area with a population of over 50,000 to have a designated MPO to qualify for the receipt of federal highway and transit funds. These highway funds can be a significant share of funding for transportation improvement projects in the Black Creek watershed, such as road and bridge maintenance or construction. All GTC activities are responsive to mandates and guidelines including, but not limited to, the Americans with Disabilities Act, Clean Air Act Amendments of 1990, Title VI of the Civil Rights Act of 1964, and environmental justice considerations

Genesee/Finger Lakes Regional Planning Council (G/FLRPC) supports watershed planning in the Black Creek watershed directly through the acquisition of funding sources for specific projects as well as indirectly through its ongoing land use and water resources planning projects that are active across its nine-county region. These programs encompass a variety of services that advance the overall goal of protecting and improving water quality and quantity. As a regional agency, G/FLRPC is able to effectively examine and coordinate water resource issues at a watershed scale.

4.1.6 County Soil and Water Conservation Districts (SWCDs)

Soil and Water Conservation Districts (SWCDs) within each watershed county play a critical role in the management of natural resources and agricultural activities in the watershed. SWCD activities are guided through the leadership of the New York State Soil and Water Conservation Committee which works closely with the New York State Department of Agriculture and Markets. The mission of the New York State Soil and Water Conservation Committee is to develop and oversee implementation of an effective soil and water conservation and agricultural nonpoint source water quality program for the State of New York that is implemented primarily through county Soil and Water Conservation Districts.[41] Through this leadership, local county SWCDs are able to provide efficient implementation of local conservation and agricultural nonpoint source pollution control programs. SWCDs in the Black Creek watershed have played an instrumental role in the implementation of agricultural Best Management Practices (BMPs) on local farms, as well as applying for funding and implementation projects that address erosion and sediment reduction, streambank remediation, and nonpoint source pollution control.

4.1.7 Academic Institutions

Regional academic institutions have played an important role in watershed planning and management in the Black Creek watershed. Independent research conducted by environmental science, geology, biology and other similar departments at regional colleges and universities has significantly advanced the knowledge base within the watershed. This is evidenced by the extensive list of research papers cited in Appendix D. SUNY Brockport is very active in the watershed, conducting various water quality and quantity monitoring studies in support of a variety of short- and long-term projects and programs. In addition, an interdisciplinary team helped produce the *Black Creek Watershed State of the Basin Report* in 2003. Other regional academic institutions, including SUNY Geneseo, Genesee Community College, Buffalo State College, the State University at Buffalo, Rochester Institute of Technology, University of Rochester, and Cornell University have each focused research effort and expertise specifically on the Black Creek watershed over time. Academic institutions will continue to be important watershed stakeholders playing a vital role in information gathering and analysis.

4.1.8 Other Not-for-Profit Organizations

The list of not-for-profit organizations that have initiated or assisted watershed planning, protection and restoration efforts in the Black Creek watershed is a long and diverse one. The Rochester Area Community Foundation has provided important financial support for a number of organizational and educational and outreach activities, such as the *Black Creek Watershed Map Guide*. In addition, local and international organizations such as Ducks Unlimited, the Bergen Swamp Preservation Society, Genesee County Fish and Game Protective Association, the Genesee Land Trust, The Nature Conservancy, the Center for Environmental Information are a sample of the organizations that have supported important research, mitigation and preservation actions in the Black Creek watershed.

4.2 Existing Watershed Reports and Studies

An annotated bibliography of existing reports and studies pertaining to water quality and natural resource protection has been compiled and posted online at the project website; a summary bibliography has been included in Appendix G of this report.[42]

4.3 Inventory of Local Regulations

The Constitution of the State of New York specifies that the primary authority for guiding community planning and development is vested in cities, towns and villages. This authority is commonly referred to as "home rule" and is implemented locally through the creation of comprehensive plans, zoning, subdivision, site plan and other regulatory mechanisms. From time to time, when devising or administering these documents, local government agencies may voluntarily turn to certain entities for consultation or support, such county or regional planning departments, municipal associations, and state agencies such as the Departments of Transportation, Environmental Conservation, or State. In addition, counties themselves are vested with certain power and capacity to guide development and act as a steward of resources within its borders.

Section 4.3 provides a summary of existing plans and regulations in effect among counties and municipalities in the Black Creek watershed. A comprehensive analysis of these documents will follow in subsequent tasks associated with the development of the watershed management plan for the Black Creek watershed.[43]

Table 4.4: Summary of Selected County Plans and Regulations				
	Farmland and Agricultural Protection Plan	Dept. of Health Onsite Wastewater Treatment System Inspection		Hazard Mitigation Plan
		Inspection for new construction	*Inspection at time of refinance or property transfer*	
Genesee County	2002	Yes	Yes*	Yes
Monroe County	1999	Yes	Recommended	Yes
Orleans County	none	Yes	Upon Request*	Yes
Wyoming County	2005	Yes	Yes	Yes

**For refinancing, inspections are typically performed upon request from the lending institution.*

4.3.1: County Plans and Regulations

According to the *New York State Local Government Handbook*, counties in New York State function as a municipal corporation with geographical jurisdiction, home rule powers and the fiscal capacity to provide a wide range of services to its residents.[44] To some extent, counties have evolved into a form of "regional" government that performs specified functions and which encompasses, but does not necessarily supersede, the jurisdiction of the cities, towns and villages within its borders. Counties therefore have the authority to implement a [wide] range of environmental and public health plans, studies and initiatives.

As summarized in Table 4.4, Genesee, Wyoming and Monroe Counties each has its own farmland and agricultural protection plan in place. Farmland and agricultural protection plans are created pursuant to 1NYCRR Part 372 of the New York State Agriculture and Markets Law.[45] Such plans are required to include a statement of the county's goals with respect to agricultural and farmland protection, identification of any lands or areas that are proposed to be protected, and a description of the strategies intended to be used by the county to promote the maintenance of lands in active agricultural use.

Table 4.4 also provides a brief overview of the role of county health departments in monitoring of onsite wastewater treatment systems (septic systems). Sections 347 and 308 of NYS Public Health Law give county boards of health the authority to enact regulations for protection of public health. Each county within the study area has a department of health which performs or requires new onsite wastewater treatment system inspections at the time of new construction; Genesee, Orleans and Wyoming Counties require inspections at the time of property transfer as well. It is important to note, however, that the specific requirements associated with individual inspection of on-site septic systems vary significantly from county to county. Sewage disposal system failures can manifest in a number of ways over time and those failures can be very difficult to detect because the system is buried. Standard inspections, which are typically non-invasive, are not necessarily thorough enough to ensure that the system is functioning properly. A full review and comparison of county inspection procedures will be included in the subsequent *Evaluation of the Regulatory and Programmatic Environment* associated with this project.

Each county has developed a multi-jurisdictional "all-hazard" mitigation plan which operates under a five-year mandatory review cycle.[46] These plans typically include a detailed characterization of natural and man-made hazards in the county (such as flooding risk or hazard materials risk); a risk assessment that describes potential losses associated with the hazards; a set of goals, objectives, strategies and actions that will guide the county's hazard mitigation activities; and a detailed plan for implementing and monitoring the plan.

Table 4.5: Summary of Hazards Rated as "High" or "Moderately High" within County Hazard Mitigation Plans[47]

County	Genesee County	Monroe County	Orleans	Wyoming County
Blight			MH	
Civil Unrest		MH		
Dam Failure		MH	MH	
Earthquake			MH	
Energy Crisis		MH		
Explosion		MH		
Extreme Temperatures			MH	
Flood	MH	MH		MH
Fire	MH	MH	MH	MH
Hazardous Materials (Fixed Site)	MH	MH	MH	
Hazardous Materials (in transit)	MH	MH	MH	MH
Ice Storm	MH	MH	MH	MH
Infestation			MH	
Landslide		MH		
Oil Spill			MH	
Radiological (Fixed Site)		MH		
Severe Storm		MH		MH
Structural Collapse		MH		
Terrorism		MH	**H**	MH
Tornado		MH		
Transportation Accident	MH	MH		
Utility Failure		MH	MH	
Water Supply Contamination	MH	MH	MH	MH
Winter Storm (Severe)		MH	MH	MH

"H" – High Hazard; "MH" – Moderately High Hazard

In addition to the plans listed above, Genesee County has developed an innovative regional planning tool called the Genesee County Smart Growth Plan. Implemented in 2001, the Plan is described as "a mitigating action of potential significant environmental impacts of the Genesee County Water Supply Project upon the viability of agriculture in Genesee County."[48] The Plan is intended to encourage the revitalization of villages and hamlet areas and protect valuable agricultural resources by focusing new industrial, commercial, and residential development opportunities in those areas presently served by public water.

A more in-depth review and analysis of the county and regional regulatory environment will take place under subsequent tasks associated with this watershed planning project.

4.3.2: Municipal Plans and Regulations

As illustrated on Table 4.6, an inventory of the local regulatory environment indicated that each municipality within the watershed has zoning and some form of comprehensive plan in place. The majority of municipalities have a host of additional supplemental regulations in place that are intended to lessen the impacts of land development on the natural environment or to decrease risks to the health and safety of residents.

As with county plans and regulations, a more in-depth review and analysis of the local regulatory environment will take place under subsequent tasks associated with this watershed planning project in an effort to identify and elucidate the effectiveness of these local laws with respect to water quality and natural resource protection.

Table 4.6: Summary of Local Land Use Regulations Among Primary Municipalities in the Black Creek Watershed[49]

	Comprehensive Plan	Zoning Ordinance	Site Plan Review	Subdivision Law	Provisions for Planned Unit or Cluster Dev't	Erosion/ Sediment Control Law	Flood Damage Prevention
Town of Batavia	2007	1997 (e-code)	Yes	Yes	Yes	Yes (see Site Plan Review)	Yes
Town of Bergen*	1996	1983 (e-code)	Yes	Yes	Yes	Yes	Yes
Bergen Village	1996	2000	Yes	Yes	Yes	Yes	Yes
Town of Bethany*	2007	2008	Yes	Yes	Yes	Yes	Yes
Town of Byron*	1993 (under revision)	1997 (under revision)	Yes	Yes	Yes	Yes (see General Provisions)	Yes
Town of Chili	2002	1981 (e-code)	Yes	Yes	Yes	Regulated MS4	Yes
Churchville Village	2008	1955 (e-code)	Yes	Yes	Yes	Yes	Yes
Town of Clarendon	1998 (under revision)	2008 (code online - under revision)	Yes	Yes	Yes (Incentive Zoning)	Yes (see Subdivision regulations	Yes
Town of Elba	2007	2001 (code online)	Yes	2002	Yes	unk	Yes
Town of Middlebury*	2009 (within zoning)	2009	Yes	No	Yes	No	Yes
Town of Ogden	2003	1995 (e-code)	Yes (see §210-11)	Yes	No	Regulated MS4	Yes
Town of Riga	2008	2008 (e-code)	Yes	Yes	Yes	Yes	Yes
Town of Stafford*	2009	2009 (e-code)	Yes	Yes	Yes	No	Yes
Town of Sweden	2005	2009	Yes	Yes	Yes	Regulated MS4	Yes
Town of Wheatland*	2004	1980 (e-code)	Yes	Yes	Yes	Yes	Yes

4.4 Population

Population and the environment are inherently connected. Local economic prosperity is closely tied to residential and commercial growth and development, which in turn are influenced by population growth. Population growth – rapid population growth in particular – can sometimes occur at the expense of the natural environment, putting strains on the carrying capacity of terrestrial and aquatic ecological communities. It is therefore important that we understand where population growth is occurring and at what rate.

In the simplest of terms, local population is determined by net mortality and fertility rates along with net migration either into or out of the geographic unit of observation (in this case a watershed, or a community within a watershed). Our understanding of population figures and trends is largely based on information provided through the decennial census of population conducted by the US Census Bureau. During years between decennial censuses, measuring migration in areas of interest can be challenging and is typically based on estimates and extrapolation. The following sections provide a brief overview of our understanding of current population statistics and trends in the Black Creek watershed.

4.4.1 Census Block Analysis

The smallest geographic unit of observation (or land area) that the US Census Bureau reports population figures for is called the *census block*. Census blocks generally conform to municipal or neighborhood boundaries, not natural boundaries, such as a watershed. Therefore, it is not possible to ascertain specific population figures for a watershed boundary utilizing decennial data from the US Census. Furthermore, the geographic units of observation often change between decennial census years, making 10-year trend analysis at the block level a difficult endeavor. A number of methods do exist, however, that can be used to provide insight and estimations for population figures within a watershed area.

Typical towns and villages within the Black Creek watershed consist of multiple census blocks; by identifying those blocks completely within the watershed boundary and those that overlap the watershed boundary, we are provided with a reliable population range. An analysis of census block figures within the Black Creek watershed from Census 2000 showed a population range between 28,747 and 49,911 persons, a difference of over 21,000 persons.[50] While this range is significant, it can be assumed that the actual population of the Black Creek watershed is closer to the high end and is likely just under 49,911 persons. This assumption is based on close observation of population density maps in combination with the census block boundaries themselves.

A similar method was used to identify census blocks that intersect subwatersheds. This process yields very rough figures; in some cases census blocks are counted more than once because they overlap subwatershed boundaries. These figures can nonetheless provide a general estimate as to the concentration of population in the general vicinity of the subwatershed. Furthermore, the estimate also provides a basic figure of the population that is most likely have a direct influence on the watershed.

Table 4.7: Population Estimates for Subwatersheds

Subwatershed Name	Estimated Subwatershed Population (Census 2000)
Black Creek Headwaters	<8,346
Spring Creek	<3,412
Robins Brook-	<4,192
Hotel Creek-	<11,548
Mill Creek-	<20,840
Black Creek Outlet	<8,611

4.4.2 Population Density

Population density maps in Appendix A provide insight to the locations with the highest concentrations of population in the watershed. The greatest population density appears to be in the Town of Chili, primarily north of Black Creek. Other locations with high population density include all of the villages and hamlets in the watershed, as well as areas in the Towns of Ogden, Riga, Batavia and Stafford.

Table 4.8: Population Change of Towns in the Black Creek Watershed, 1980 – 2010

(total town population; figures include population of villages and cities within)

Municipality	Population 1980[51]	Population 1990[52]	Population 2000[53]	Population 2010[54]	*Percent Change*			
					1980-1990	*1990-2000*	*2000-2010*	***1980-2010***
Town of Batavia	5,565	6,055	5,915	6,809	*9%*	*-2%*	*15%*	**22%**
Town of Bergen	2,568	2,794	3,182	3,120	*9%*	*14%*	*-2%*	**21%**
Town of Bethany	1,876	1,808	1,760	1,765	*-4%*	*-3%*	*0.3%*	**-6%**
Town of Byron	2,242	2,345	2,493	2,369	*5%*	*6%*	*-5%*	**6%**
Town of Chili	23,676	25,178	27,638	28,625	*6%*	*10%*	*4%*	**21%**
Town of Clarendon	2,148	2,705	3,392	3,648	*26%*	*25%*	*8%*	**70%**
Town of Elba	2,487	2,407	2,439	2,370	*-3%*	*1%*	*-3%*	**-5%**
Town of Middlebury	1,561	1,532	1,508	1,441	*-2%*	*-2%*	*-4%*	**-8%**
Town of Ogden	14,693	16,912	18,492	19,856	*15%*	*9%*	*7%*	**35%**
Town of Riga	4,309	5,114	5,437	5,590	*19%*	*6%*	*3%*	**30%**
Town of Stafford	2,508	2,593	2,409	2,459	*3%*	*-7%*	*2%*	**-2%**
Town of Sweden	14,859	14,181	13,716	14,175	*-5%*	*-3%*	*3%*	**-5%**
Town of Wheatland	4,897	5,093	5,149	4,775	*4%*	*1%*	*-7%*	**-2%**

4.4.3 Population Change[55]

Overall, population has been relatively stable in most municipalities in the Black Creek watershed since 1980; population trends are generally in line with those across Upstate New York and throughout the Great Lakes region of the United States during this period of time. Of the 24 towns that have some portion of land area within the Black Creek watershed, four have experienced continual increases in population since 1980 – those of Chili, Clarendon, Ogden, and Riga. The most significant population increases are concentrated in the municipalities near the outlet of the watershed, which happen to also be the most suburbanized towns in the watershed. The Town of Clarendon had the highest population increase between the period of 1980 and 2010 at 70%, although it is important to note that the majority of this growth occurred outside of the Black Creek watershed. The Town of Ogden had the next-highest population increase (35%), followed by the Town of Riga (30%), and the Town of Batavia (22%), while the Towns of Chili and Bergen both experienced a population increase of 21% during this same time period. The figures for Ogden, Riga, Chili and Bergen are perhaps most relevant in that a significant proportion of this growth has likely occurred within the Black Creek watershed.

Six municipalities had a decline in population during this same period of time. The Town of Middlebury in the headwaters of the Black Creek watershed experienced an 8% decline in population between 1980 and 2010 while the Town of Bethany experienced a 6% decline. The Towns of Elba and Sweden both experienced 5% declines and the Towns of Stafford and Wheatland both experienced 2% declines in population.

4.4.4 Population Projections

Population projections to the year 2040 were prepared by G/FLRPC in 2003. While these projections do not incorporate actual figures from the 2010 Census, the relatively minor variances between actual and projected population figures for 2010 does not result in significant changes in the numbers. Results of these projections for the towns in the Black Creek watershed are as follows:

Table 4.9: Population Projections for Towns in the Black Creek Watershed (total population of town)[56]

Municipality	2000 (actual)	*2010 (projected)*	*2020*	*2030*	*2040*	% Change 2000 – 2040
Town of Batavia	5,915	*6,019*	*6,105*	*6,177*	*6,240*	**5.5%**
Town of Bergen	3,182	*3,272*	*3,296*	*3,324*	*3,345*	**5.1%**
Town of Bethany	1,760	*1,772*	*1,782*	*1,791*	*1,798*	**2.2%**
Town of Byron	2,493	*2,547*	*2,591*	*2,629*	*2,661*	**6.7%**
Town of Chili	27,638	*28,632*	*29,447*	*30,138*	*30,738*	**11.2%**
Town of Clarendon	3,392	*3,479*	*3,549*	*3,609*	*3,661*	**7.9%**
Town of Elba	2,439	*2,426*	*2,402*	*2,378*	*2,355*	**-3.4%**
Town of Le Roy	7,790	*7,792*	*7,767*	*7,743*	*7,716*	**.9%**
Town of Middlebury	1,508	*1,525*	*1,505*	*1,481*	*1,458*	**-3.3%**
Town of Ogden	18,492	*19,417*	*19,798*	*20,283*	*20,678*	**11.8%**
Town of Riga	5,437	*5,549*	*5,636*	*5,710*	*5,767*	**6.1%**
Town of Stafford	2,409	*2,441*	*2,466*	*2,488*	*2,507*	**4.1%**
Town of Sweden	13,716	*13,701*	*13,791*	*13,861*	*13,938*	**1.6%**

Town of Wheatland	5,149	*5,240*	*5,311*	*5,369*	*5,414*	**5.1%**

4.5 Development

In many ways, a community's present economic, social, and environmental standing is a reflection of how it has responded to evolving economic and environmental conditions over time. The villages, cities, neighborhoods, and hamlets within the Black Creek Watershed are themselves components part of the natural environment that constitutes Western New York. In the context of today's most pressing environmental problems – population growth, urban sprawl, landscape fragmentation, water degradation, habitat loss, etc. – Western New York has managed to maintain the integrity of appreciable portions of its natural landscape. As a result many of the communities across the region continue to enjoy a good standard of living and quality of life. This is due in part to the efforts of local communities to balance environmental protection and restoration with those of community development.

Communities in the Black Creek watershed continue to evolve and respond to both internal and external demands – demands for housing, public services, and a variety of amenities that maintain a high quality of life (including good schools, aesthetics, effective and efficient governance, etc.). In doing so, community leaders are challenged to maintain a decent standard of living and affordability. Communities often look to new development as a means of broadening the local tax base to alleviate the costs of public services. New development – if left unchecked – can have a cumulative, detrimental effect on a community's ability to provide cost-effective public services while protecting an important local asset, the landscapes that constitute its natural environment. This is supported by numerous "Cost of Community Services" studies and other research that demonstrates that green fields and farmland often provide net property tax benefits to a community. [57]

Growth outside of traditional population centers continues across the region. The result is "sprawl without growth," a phrase coined by Rolf Pendall of Cornell University to describe the disproportionate rate of new green-field land development in the face of slow population growth or population decline. [58] As part of this process, natural habitat and open space continues to become more fragmented, thereby decreasing its functionality over time and thus its ability to provide the important economic and environmental functions it has in the past.

Most indicators suggest that sprawl is not presently a major concern in the Black Creek watershed. New home construction has been relatively flat across Western New York and for most municipalities within the watershed for several decades. Regional growth rates are largely a product of external forces such as global and regional economic trends, state finance and taxation policies, and national migration patterns. Black Creek watershed communities are capable of accommodating additional residential and commercial development with their available land, and infrastructure to support it. If those external forces of growth shift and begin to favor new development in Western New York, how prepared are the Black Creek watershed communities to address the increased environmental and fiscal pressures associated with residential and commercial development? The *Black Creek Watershed Management Plan* will provide tools to balance the conflict between development and preserving the watershed with its inherent environmental and economic functions. These tools, when implemented as part of developmental review and approval processes, may help to sustain this natural landscape and its associated qualities and benefits.

In order for communities to become "sustainable" – to meet the needs of the present without compromising future generations' ability to meet their own needs – they will need to preserve, enhance, and restore the natural landscapes that shaped and strengthened these communities in the past while better integrating future economic development *via* its polices and decisions.

One approach that begins to address the integration of sustainable policies with proposed development is the concept of Better Site Design (BSD). Better site design incorporates non-structural and natural approaches to future development projects to minimize effects on watersheds by conserving natural areas, reducing impervious cover and improve application of stormwater treatment. Some current tools for watershed protection are being revised for community use such as the NYS State Pollutant Discharge Elimination System (SPDES) and General Permit for Stormwater.

Another approach for achieving sustainability is the application of the principles of Green Infrastructure. Green Infrastructure emphasizes the importance of open and green space areas as parts of interconnected systems that are protected and managed for the ecological benefits they provide. It can be achieved locally through a comprehensive strategic planning process that inventory's and evaluates the natural features of the landscape to identify those locations that are important to preserve and protect. The process similarly identifies those locations that have fewer of these qualities and may therefore be more appropriate for development. The process has the potential to mute conflicts between those wanting to preserve green spaces and those proposing development, serving as the framework for conservation and preservation as well as development. The benefits of a Green Infrastructure approach to planning and development are many, including the realization and enjoyment of lower costs of community services, enhanced quality of life, and a more functional and stable natural environment which together make communities more attractive places to live.[59]

These varied approaches, when integrated into community comprehensive plans, watershed management plans, and local open space protection plans, comprise the tools necessary for maintaining the role the Black Creek and its watershed can play in contributing to the quality of life desired by its communities, their citizens and businesses.

4.5.1 Roads and Bridges

Roads and highways can generate and contribute substantial amounts of eroded material and other pollutants into local waterbodies. Specific contaminants associated with road runoff include sediment, oils and grease, heavy metals, garbage/debris, and road salts, as well as fertilizers, pesticides and herbicides applied to roadside facilities or spilled on or near roads. Hydrologically-connected roads – roads that are designed to contribute surface flow directly to a drainage channel – have the greatest potential to deliver road-derived contaminants to streams. New roads can also be a vector to human encroachment on the natural landscape and, in combination with other public services, can induce new development outside of traditional population centers.

As shown in Table 4.10, there are over 564 center-line miles of roads and 53 major bridges which cross a hydrologic feature in the Black Creek watershed (a major bridge is considered any road/stream crossing structure other than a culvert).

Table 4.10: Center Line Road Miles and Associated Bridges in the Black Creek Watershed[60]

	Federal	State	County	Local (Town/City/Village)	Private	Total
Road Miles	57.98	96.32	152.00	232.04	26.62	564.96
Bridges	6	16	16	15	--	53

Bridges present a number of additional risks to hydrologic function. In some cases, the bridge itself creates a direct connection between the roadway and stream if the bridge drain is not diverted to an on-land treatment facility (generally ground infiltration or retention). Bridges and culverts, if built too small, can restrict and concentrate stream flow, thereby creating or accelerating stream bank erosion and stream incision. When not properly maintained or designed, bridges and culverts will cause debris accumulation and contribute to upstream flooding and possible property damage. Bridges and culverts also have the potential to restrict wildlife passage and fish movement if not properly designed and maintained. Conversely, bridge crossings also offer excellent opportunities for recreational access to rivers and streams, a possibility that should be considered during any necessary construction or repair of such facilities.

Table 4.11: Major Bridge Crossings by Waterbody

Waterbody	Federal	State	County	Local
Black Creek	5	14	10	12
Spring Creek		2	1	2
Bigelow Creek			1	1
North Branch Black Creek			2	
Mill Creek	1			
Unnamed Tributary			2	

Maps in Appendix A illustrate the various categories of roads as described above and provide locations of each of the 53 bridges identified. In addition, a discussion of the impacts of impervious surfaces on waterbodies is provided under Section 3.5.4.

4.5.2 Water and Sewer Infrastructure

A basic indicator of residential and commercial growth and development is the presence of infrastructure – in particular, public water and sewer supply. Maps in Appendix A illustrate the location of water lines and sewer lines in the Black Creek watershed as of December 2008. As the maps illustrate, centralized sewer systems are located in most of the villages in the watershed, excluding the Village of Wyoming. Centralized water systems snake throughout many parts of the Black Creek watershed, but become less prevalent in areas around southern Genesee County and Wyoming County. Public water is widely available in the Monroe County towns of Riga, Chili, and Ogden. Significant portions of Byron, LeRoy, Stafford and Batavia also have public water available, generally running along major highways.

4.5.3 Land Use Monitoring Report[61]

The Genesee Transportation Council (GTC) provides funding annually to G/FLRPC in order to conduct the Regional Land Use Monitoring Report (LUMR). This report provides information on the issuance of building permits within each municipality dating back to 1999. The primary purpose for collecting these data is to identify areas of growth within the region that might require transportation planning and service modifications. These data can also help to draw very general conclusions pertaining to threats to watershed integrity that may be posed by high rates of growth and development.

LUMR figures for municipalities that issued an average of 5 or more residential building permits per year between the years 2005 through 2010 are summarized in Table 4.12:

Table 4.12: Municipalities Averaging 5 or More Residential Building Permits per Year (entire town)

	2005	2006	2007	2008	2009	2010	*6 Year Average*
Town of Chili	102	108	73	77	74	28	**77.0**
Town of Ogden	56	56	38	25	21	19	**35.8**
Town of Batavia	12	DNA	15	13	7	12	**11.8**
Town of Riga	13	7	5	3	5	3	**6.0**
Town of Sweden	7	7	5	3	7	5	**5.7**
Town of Clarendon	5	DNA	9	6	2	5	**5.4**
Churchville Village	5	6	7	3	3	8	**5.3**

As stated above, these figures are for residential building permits only; they include only permits issued for the construction of buildings; permit issuance does not imply actual construction. Results for all municipalities are available in Appendix C.

4.5.4 Projected Build Out

"Build out" refers to a hypothetical point in time when a municipality (or, more specifically, a zoning district within a municipality) cannot accommodate any more development due to the lack of additional space as dictated by local land use regulations. Build out scenarios are typically mathematical exercises that attempt to calculate the point in time when build out is likely to occur given a projected rate of growth and development. In order to calculate build out, a number of basic assumptions need to be made. First, the model assumes that zoning laws regarding allowable lot densities will remain the same over time. Second, the model requires a projected rate of growth to be assumed over time; these are typically based on standard population projections. Finally, the model should attempt to calculate or predict standardized "restraints" to development within a given area. Restraints comprise an estimation of gross land that would not be open to new home construction due to environmental restrictions or other physical constraints. Restraints might include areas of standing water, regulated floodplains, regulated/protected wetlands, steep slopes, or simply the area of land required for roads, parks, and other public services.

Even in situations where land use, zoning, and population information is accurate and readily available, build out scenarios have limited application when generalized across a large land area or multiple zoning districts. Furthermore, given that the scenarios are based on population projections, any projected decreases in population will render the build out model null. In light of these challenges, a focused approach to build out was conducted in the Black Creek watershed, one that limited the scope strictly to those municipalities known to have relatively high rates of growth occurring in them.

The build out analysis was based on the following criteria:

- Exclude villages (most villages are at or near buildable capacity or have strict limits to growth governed by their municipal boundaries)
- Focus only on towns with high rates of growth relative to other towns in the watershed by reviewing:
  - Rate of residential building permit issuance over a 5-year period
  - Rate of population change between the years 2000 and 2010, recognizing only those towns with an increase in population during that time period
  - Any municipalities that show tepid growth rates or population decline will be excluded from analysis
- Within selected towns, analyze only those zoning districts presently zoned ‘residential’ or ‘agricultural’
  - While many agricultural areas in the watershed are deliberately zoned as such in order to protect and maintain agricultural uses, the model assumes that those protections may be waived by the land owner or municipality in lieu of residential development
- Zoning districts must have adequate vacant land within them to accommodate new lots or subdivisions
- Focus only on those zoning districts that have public water available in or very near to them
  - Public water has the potential to induce residential growth and development

Table 4.13: Estimated Build Out for Selected Zoning Districts in High-Growth Municipalities

Municipality/ Zoning District	Net acres available for development within watershed portion of district (adjusted for all constraints)	Minimum lot size (sq. feet) as stipulated by code	Estimated number of units that could be built in the zone**	Annual residential building permits – 5 year average	Years until “Build-out” occurs (# of units/av. # of permits per year)
Town of Batavia					
R	32.7	16,000	88	11.8	7.4
AGR	1,598.8	16,000	81		6.9
Town of Ogden				35.8	
R	2,281.8	30,000	3,286		> 50 years
Town of Chili	0.0				
Res 1-12	23.9	13,307*	77		1 year
Res 1-15	408.2	16,307*	1,087		14.1
Res 1-20	436.7	21,307*	889	77	11.5
Rural Ag – 1	36.3	44,867*	35		< 1 year
Rur. Ag Ovrly	1.3	7,307*	7		< 1 year
Ag Cons.	3,280.2	219,107*	619		8
Town of Riga				6	

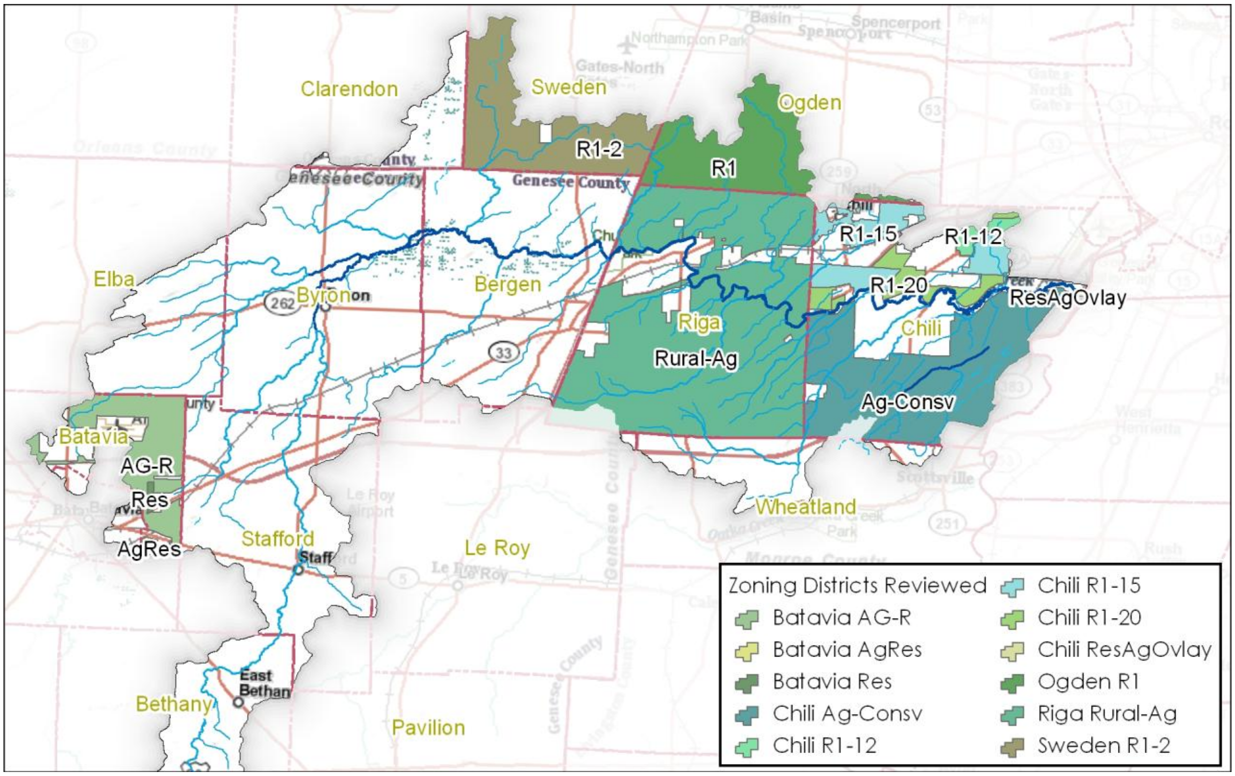
RA	8,868.2	31,307*	12,215		> 50 years
Town of Sweden				5.7	
R1-2	2,428.9	80,000	1,249		> 50 years

1 acre = 43,560 square feet ; * Adjusted for open space requirements
** For most zoning districts, the # of units was adjusted down to account for existing homes on large lots 10 acres or greater in size

Results of the analysis are provided in Table 4.13. Full methodology of the build out analysis can be found in *Appendix B: Data Sources and Notes*. Some weaknesses are apparent with this model. The final column – *Years Until Build-Out Occurs* – is a very general estimation that applies the town-wide 6 year average permit rate to a specific zoning district. In fact, the building permit rate figure used represents the issuance of permits throughout the entire town, not the number of permits issued for a specific zoning district. Furthermore, if an increase in building permit issuance were to occur, this could significantly alter the figures in the *Years until Build-out Occurs* column.

Furthermore, build out models operate under the presumption that residential and commercial development are the primary forces behind market-based land use. In fact, many other market demands influence local land use development patterns. Large portions of Genesee and Wyoming Counties, for example, consist of some of the most productive and profitable agricultural lands in New York State. Demand for land in these areas of the watershed is largely driven by the desire to farm and the need to acquire more arable land, not for the construction of residential subdivisions. These market trends can certainly change, but an analysis of county agricultural statistics indicate a continual increase in farm acreage in each of these counties since 1997 (refer to Figure 4.2).

Figure 4.1: Location of Zoning Districts in which Build Out was conducted



Nonetheless, the model provides several useful insights. The first is the result of the calculation of "net acres available for development." These are reliable figures that can provide local officials with a very rapid assessment of a zoning district's potential for further development. The other is the "estimated number of units" figure, which similarly provides local officials with a rough idea of what the district might look like in the future if growth were to occur. Municipalities should use these figures and apply serious consideration regarding the type of future growth and development that should take place in their communities, regardless of whether they have "a lot" or "a little" land left for future development.

Establishing better site planning and design standards and creating incentives for developers to conserve natural areas can help to meet a community's demand for future growth without sacrificing environmental quality. Decreasing minimum lot sizes and increasing density, mandating cluster subdivisions, conserving sensitive lands, and buffering water resources are among the tools and practices that can be incorporated directly into local law. By doing so, communities can make strides toward creating economically viable, yet environmentally sensitive development decisions. Such principles – often referred to as Better Site Design standards – will be addressed under Task 13 – *Evaluation of the Regulatory and Programmatic Environment*. As explained in the NYSDEC publication *Better Site Design* (2008), "The aim of better site design is to reduce the environmental impact "footprint" of the site while retaining and enhancing the owner/developer's purpose and vision for the site. Many of the better site design concepts employ non-structural on-site treatment that can reduce the cost of infrastructure while maintaining or even increasing the value of the property relative to conventional designed developments."[62]

4.6 Public Lands and Trails

Public lands can be classified into a number of different categories. The variety of public lands that exist in the Black Creek watershed vary tremendously in terms of size, ownership, operation and maintenance, and designated and permitted uses. Public land uses include local municipal ball fields and cemeteries, multi-use county parks, and significant holdings of conservation lands by not-for-profit conservation organizations and land trusts, such as The Nature Conservancy, Genesee Land Trust and the Bergen Swamp Preservation Society.

A brief overview of these lands follows; refer to Appendix A for an illustration of the location and extent of public lands and trail corridors.

4.6.1 Public Lands

Table 4.14: Identified Public Park, Recreation and Conservation Lands in the Black Creek Watershed

Public Land Category	Acreage
NYSDEC Lands	103.7
Other State Park/Recreation Lands	35.85
Land Trust or Easement	2,315.92
County Parkland	2,660.24
Municipal Parkland	437.72
Cemetery	71.97
Total	*5,625.4*

Table 4.14 illustrates the results of an analysis of public lands derived from county real property data and other GIS sources. A selection of those lands within the Black Creek that have contiguous acreage greater than 50 acres are listed in Table 4.15:

Table 4.15: Parks and Preserves >50 Acres within the Black Creek Watershed

Park Name	Administrator	Park Location	Acreage within BC watershed
Bergen Swamp	Bergen Swamp Preservation Society, The Nature Conservancy	Towns of Byron and Bergen	1,939 acres[63]
Black Creek Park	Monroe County	Town of Chili,	1,495
Churchville Park	Monroe County	Town of Riga/Village of Churchville	737
Genesee County Park	Genesee County	Town of Bethany	429
Brookdale Preserve	Genesee Land Trust	Town of Chili	275
Reed Road Preserve	Genesee Land Trust	Town of Chili	131
Union Station Park	Town of Chili	Town of Chili	63
Davis Park	Town of Chili	Town of Chili	53

4.6.2 New York State Open Space Conservation Plan

The *2009 New York State Open Space Conservation Plan* includes lists of regional priority conservation projects that have been identified by Regional Advisory Committees and through public comments received through the Plan's review process. Priority projects included on this list are eligible for funding from the State's Environmental Protection Fund, and other State, federal and local funding sources. The Plan states that, "For most of the project areas identified, a combination of State and local acquisition, land use regulation, smart development decisions, land owner incentives and other conservation tools used in various combinations, will be needed to succeed in conserving these open space resources for the long term."[64] In addition to the Priority Projects listed in the body of the report, the Region 8 Advisory Committee also identified "Additional Priority Projects" warranting attention and focus for preservation and enhancement if resources allow.

Priority Projects

> Genesee River Corridor- This project will protect the variety of habitats and landscapes found along the Genesee River as it flows north from Pennsylvania to Lake Ontario… (page 108)
>
> Genesee Greenway Recreationway - The Genesee Valley Greenway (GVG) is a 90 mile long corridor that extends from the city of Rochester in Monroe County through to the Village of Hinsdale in Cattaraugus County. It passes through woodlands, wetlands, river and stream valleys and rolling farmlands providing connections to Letchworth State Park, local parks, major trail systems and historic villages and towns in Monroe, Livingston, Wyoming, Allegany and Cattaraugus Counties… (page 110)

In addition, *Ecological Corridors*, *Exceptional Forest Communities*, *Grassland Preservation and Restoration* (specifically in the Towns of Covington and Middlebury in Wyoming County), *Trails and Trailways*, and *Significant Wetlands* are identified as general Priority Project areas (pages 112 – 113).

Additional Priority Projects

> *Bergen Swamp - Located just twenty miles from Rochester in Genesee County, Bergen Swamp is a 2300-acre system of wetlands that harbors an incredible diversity of plants and animals, including 40 species of rare, threatened, or endangered plants and the endangered Massasauga Rattlesnake. Although more than 1600 acres of the swamp is owned by the Bergen Swamp Preservation Society, there is a need to complete protection of core areas and to acquire upland buffer that can protect the swamp from residential development. (page A-122)*

Unabridged versions of the reports containing the regional priority project narratives and information on the identification process can be found in the Plan's appendices.[65]

4.6.3 Trails

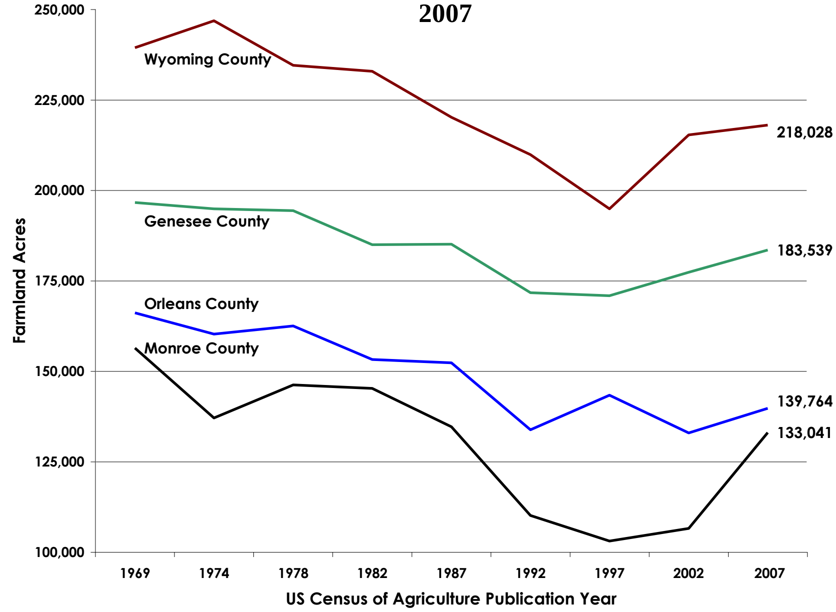
Regional recreational trails that cross through the Black Creek watershed include the Genesee Valley Greenway, which follows abandoned rail road rights of way and portions of the Genesee River, as well as numerous state-funded snowmobile trails. The New York State Office of Parks, Recreation and Historic Preservation identifies over 74 miles of officially-designated snowmobile trails within the watershed.[66]

4.6.4 Public Fishing Access

Black Creek and its tributaries have abundant opportunities for sport fishing. The only NYS DEC Public Fishing access location identified within the Black Creek watershed is the State Boat Launch located at the outlet of the Black Creek near the Ballantyne Bridge, near the intersection of Scottsville Road (State Rt 383) and Jefferson Road in the Town of Chili. This location is accessible to both car-top boats as well as small motorized boats. The *Black Creek Watershed Map Guide* – a publication of the Black Creek Watershed Coalition – identifies 11 additional sites that offer public fishing access.[67] These sites vary and include locations both on-shore opportunities and car-top boat launch facilities.

4.7 Agriculture

Figure 4.2: Change in County Farmland Acreage, 1969 – 2007



As noted in Section 3.5.1, real property records indicate that land use within the Black Creek watershed is devoted principally to agriculture, with 48% of properties classified as "agricultural" under the NYS real property classification system. This is nearly twice the land area of the next highest land use type ("residential" property accounts for 27% of total properties in the watershed). There is therefore no doubt that agriculture is a significant factor when considering land use activities in the Black Creek watershed. Furthermore, as illustrated in Figure 4.2, agricultural land acreage is beginning to increase within each Black Creek watershed county after experiencing years of steady decline.

Public agencies such as the New York State Department of Agriculture and Markets, county Soil and Water Conservation Districts and the National Resources Conservation Service (a division of the USDA) provide a number of beneficial services to regional agribusinesses. Outreach services provided by these agencies include crop and nutrient management, flood and erosion control, and agricultural environmental Best Management Practice implementation. In the provision of these services, these agencies compile information on a variety of agriculture- and environment-related subjects that in turn are intended to help measure the effectiveness of and scope of their work. This information can provide us with important insight regarding the state of agricultural activities within the watershed, how those activities impact the natural environment, and how they are changing over time.

As with population statistics, data on agricultural operations can be difficult to ascertain at the watershed level. The lands that belong to a single agribusiness in some cases will cross more than one watershed boundary. Considering that the uses of a farmer's land will often change over time due to necessary crop rotation schedules or changes in a farm's business plan or operational focus, identifying specific land uses or production statistics over time can by challenging. Nonetheless, a selection of basic agricultural indicators has been included herein in an effort to begin describing the state of agriculture in the Black Creek watershed. As the watershed management planning process continues, developing a more accurate and complete assessment of the activities occurring on the land will be a critical component of watershed planning and water quality restoration. Furthermore, this will require close coordination with relevant farm service agencies and land owners.

4.7.1 Local Agricultural Districts

Local agricultural districts are described in detail on the New York State Department of Agriculture and Markets website:

> Article 25-AA of the Agriculture and Markets Law authorizes the creation of local agricultural districts pursuant to landowner initiative, preliminary county review, state certification, and county adoption…The purpose of agricultural districting is to encourage the continued use of farmland for agricultural production. The Program is based on a combination of landowner incentives and protections, all of which are designed to forestall the conversion of farmland to non-agricultural uses. Included in these benefits are… protections against overly restrictive local laws, government funded acquisition or construction projects, and private nuisance suits involving agricultural practices.
>
> The [Division of Agricultural Protection & Development] manages the certification of new districts and the review and recertification of existing districts. State certification confirms that a district meets the purposes and intent of the Agricultural Districts Law and all eligibility criteria described therein…The Division administers the Land Classification System, including maintenance of the statewide master list of agricultural soils.[68]

Map 26 in Appendix A illustrates those lands that are presently enrolled in a local agricultural district within the counties of Orleans, Genesee, Monroe and Wyoming Counties. Within the Black Creek watershed, 82,050 acres of land fall within a local agricultural district, which accounts for 63% of the total land area within the watershed.

Table 4.16: Lands within the Black Creek Watershed Enrolled in a Local Agricultural District

	Acreage within the Black Creek Watershed	County Watershed Share within an Ag. District	Percent of Watershed Share within an Ag. District
Genesee County	69,460	48,741	70%
Monroe County	56,519	31,747	56%
Orleans County	2,582	732	28%
Wyoming County	862	830	96%
Total	**129,422**	**82,050**	**63%**

4.7.2 Agricultural Environmental Management (AEM)

As stated on the program's website: "AEM is a voluntary, incentive-based program that helps farmers make common-sense, cost-effective and science-based decisions to help meet business objectives while protecting and conserving the State's natural resources. Farmers work with local AEM resource professionals to develop comprehensive farm plans using a tiered process…"[69] The result is a coordinated approach to implementing agricultural conservation practices that make a meaningful improvement to the health and stability of the natural environment.

AEM is coordinated by county Soil and Water Conservation Districts in each of the four Black Creek watershed counties. AEM priorities are detailed in county AEM strategic plans which are updated on a five-year cycle. The plans prioritize actions by specific watersheds within the county based on local water quality concerns and input from a local advisory committee.

Table 4.17: Summary of County AEM Statistics – Black Creek Watershed[70]

	Approx. Acres of Ag. Land Reported in AEM Surveys	AEM Farms	CAFOs	Types of Farms							
				Crop	*Equine*	*Dairy*	*Beef*	*Veg.*	*Deer*	*Sheep*	*Orchard/ Tree*
Genesee County	29,218	56	8	29	1	14	5	7	--	--	--
Monroe County	31,563	24	2	9	6	4	2	--	1	1	1

No significant AEM statistics available for portions of Orleans and Wyoming Counties within the watershed

It is important to note that, as stated above, CAFOs and their operations cross watershed boundaries. In many cases, manure spreading and/or the location of other farm-related facilities might be spread across one of more watersheds. The statistics above reflect statistics of the general principal location of the farm operation.

In addition, SWCDs have provided estimates of the percentage of AEM farms ***in both*** the Black Creek and Oatka Creek watersheds using the following Best Management Practices:

Table 4.18: Estimates of Percentage of Black Creek and Oatka Creek Watershed AEM Farms Using the Following BMPs[71]

BMPs	Genesee	Monroe
Conservation Tillage	30%	70%
Stripcropping	15%	45%
Ag-to-Forest Land Conversion	1%	10%
Ag-to-Wetland Conversion	5%	10%
Nutrient Management	45%	65%
Grazing Land Management	10%	35%
Terraces/Diversions	5%	55%
Streambank Protection	48%	40%
Barnyard Management	43%	50%
Cropland Management*	50%	75%

**Includes one or more of the following practices: residue management, buffers, rotations, and cover crops.*

4.7.3 Concentrated Animal Feeding Operations (CAFOs)

The general trend occurring in United States agriculture over the past half century has been a reduction in small, family-operated farms and consolidation into larger, more centralized operations. The Concentrated Animal Feeding Operation (CAFO) is a direct reflection of that trend and represents an economy of scale in agricultural commodity production. CAFOs are defined as lots or facilities where animals are stabled or confined and fed or maintained for a total of 45 days or more in any 12-month period; they are categorized as either "large" or "medium" based on the number of animals confined.[72] CAFOs that discharge to waters of New York State are regulated by the NYS DEC under the authority of the Clean Water Act through the New York State Pollution Discharge Elimination System (SPDES) (refer to Section 4.8 for more information on the NYS SPDES program).[73]

A total of 8 Concentrated Animal Feeding Operations (CAFOs) were found to be located directly within the boundary of the Black Creek watershed – five medium size and 3 large sized. In addition, 11 CAFOs (seven medium and four large) were found to be within 2 miles of the Black Creek watershed boundary. Identification of CAFOs near the watershed border is an important consideration, as manure spreading often takes place across large areas that are associated with the farm operation. Information on each of these facilities is summarized in Table 4.19; Map 28 in Appendix A includes the corresponding location of farms listed therein.

Table 4.19: NYSDEC Medium and Large CAFOs Located In or Near the Black Creek Watershed

Facility Name	County	CAFO Size	CAFO Type			
			Mature Dairy	Heifers	Other	CAFO Area
Barniak Farms	Genesee	Medium	498	0		6 Acres
Lor-Rob Dairy Farm	Genesee	Large	1700	0	2000 Heifers/Calves	25 Acres
Hy Hope Farms, Inc.	Genesee	Medium	491	0	216 (Unreadable), 97 Heifers, 122 Steers	6 Acres
Offhaus Farms Inc.	Genesee	Large	950	300	200 Calves	4 Acres
Kohlman Farms, Inc.	Monroe	Medium	0	475	75 Feeders	2 Acres
Daniel Bridge	Genesee	Medium	350	0		15,200 SF
Zuber Farms	Genesee	Large	940	760		9 Acres
Leibeck Farm	Monroe	Medium	176	85		28,865 SF
CAFOs Outside Black Creek Watershed -- 2mi Buffer						
Craig T. Harkins	Wyoming	Medium	183	100		28,755 SF
Pagen Farms, Inc.	Genesee	Medium	657	640		2 Acres
Post Dairy Farms LLC	Genesee	Medium	230		170 heifers/calves	27,000 SF
CY Heifer Farms, LLC	Genesee	Large		4000		
Batavia Downs Gaming	Genesee	Medium			405 horses	6 Acres
Stein Farms LLC	Genesee	Large	630		550 young stock	66,793 SF
Oak Orchard Dairy, LLC	Genesee	Large	1400			75,000 Sq. ft.
Udderly Better Acres	Genesee	Medium	330			0
John/Mark/Maureen J. Torrey	Genesee	Large	1050			2 Acres
Colby Homestead Farms	Monroe	Medium	280			1 Acre
D & D Dairy	Monroe	Medium	375			1 Acre

4.7.4 NRCS Crop Cover

The USDA National Agricultural Statistics Service (NASS) Cropland Data Layer (CDL) is a raster, geo-referenced, crop-specific land cover data layer with a ground resolution of 30 meters. The data layer is aggregated to a possible 85 standardized categories for display purposes, with the emphasis being agricultural land cover (a total of 50 are identified in the Black Creek watershed). The purpose of the Cropland Data Layer (CDL) Program is to use satellite imagery to (1) provide acreage estimates to the Agricultural Statistics Board for the state's major commodities and (2) produce digital, crop-specific, categorized geo-referenced output products. Classification accuracy is generally 85% to 95% correct for the major crop-specific land cover categories, which is a relatively high degree of accuracy. These outputs are supported and managed with ground-truth field data.

GIS analysis of the 2010 data layer yielded the following results:

Table 4.20: 2010 Cropland Data Layer Analysis for the Black Creek Watershed

Crop/Land Cover	Acres	% Share of Watershed
Corn	24,414.3	18.45%
Forest Categories Combined*	24,194.8	18.28%
Wetland Categories Combined*	16,644.9	12.58%
Developed Space Categories Combined*	13,115.3	9.91%
Other Hay	12,716.8	9.61%
Alfalfa	12,080.0	9.13%
Soybeans	8,197.5	6.19%
Other Various Cash Crops Combined*	7,147.3	5.40%
Winter Wheat	6,482.8	4.90%
Pasture/Grass	4,167.2	3.15%
Shrub/Barren/Fallow/Idle Lands	3,173.1	2.40%

*Tabular results for all land cover categories provided in Appendix D.

The strength and emphasis of the CDL is crop-specific land cover categories. The accuracy of the CDL non-agricultural land cover classes is entirely dependent upon the USGS, National Land Cover Dataset (NLCD 2001). Thus, the USDA, NASS recommends that users consider the NLCD for studies involving non-agricultural land cover (refer to Section 3.5 for NLCD land cover values). Forest cover, for example, is found to be nearly twice the value than that noted under the 2006 National Land Cover Dataset product. Reasons for such a significant discrepancy are not fully understood.[74]

4.8 Pollution Control

The US EPA divides water pollution sources into two categories: point and non-point. Point sources of water pollution are stationary locations such as sewage treatment plants, factories and ships. Under the Clean Water Act, the National Pollutant Discharge Elimination System (NPDES) permit program controls water pollution by regulating point sources that discharge pollutants into waters of the United States. In New York State this program is administered by the NYSDEC and is referred to as the State Pollutant Discharge Elimination System (SPDES).

Water pollution and potential adverse environmental and public health effects associated therein can result from sources other than traditional point-sources; these are referred to as non-point sources of pollution. Non-point sources are more diffuse and include sources such as agricultural runoff, construction site runoff, and pollutants collecting and running off of impervious surfaces.

Understanding the sources of pollution in the Black Creek watershed and the degree to which they are monitored and managed is an important element of watershed management. The US EPA, in conjunction with state and local authorities, monitors pollution levels in the nation's water and provide status and trend information on compliance and other issues. A selection of pollution control metrics are provided here under Section 4.8.

4.8.1 State Pollution Discharge Elimination System (SPDES)[75]

As stated above, New York State has a state program that has been approved by the United States Environmental Protection Agency for the control of wastewater and stormwater discharges in accordance with the Clean Water Act. Under New York State law the program is known as the State Pollutant Discharge Elimination System (SPDES) and is broader in scope than that required by the Clean Water Act in that it controls point source discharges to groundwater as well as surface waters. A list of permitted SPDES discharge points in the Black Creek watershed is provided in Table 4.21.

Table 4.21: New York State Pollution Discharge Elimination System Permittees within the Black Creek Watershed

Facility Name	SPDES No.	Town	Owner
Batavia Bulk Plant	NY0228877	Batavia	Suburban Heating Oil Partners LLC
Allens, Inc. – Bergen Facility	NY0078794	Bergen	Allens, Inc.
Byron SD STP	NY0160971	Byron	Town of Byron
Village of Bergen Sewage Treatment Plan	NY0110434	Bergen	Village of Bergen
Union Processing Corp.	NY0098817	Chili	Union Processing Corp

A review of Enforcement and Compliance History records through the USEPA Enforcement & Compliance History Online (ECHO) database yielded the following information for each facility:

Table 4.22: USEPA Enforcement & Compliance History Online (ECHO) of Black Creek SPDES Permittees

Facility Name/Desc.	Discharge Point/Waterbody	Effluent Exceedances (9/08 – 9/11)	Description	Notices of Violation (NOV) or Informal Enforcement (9/06 – 9/11)
Batavia Bulk Plant (Heating Oil Dealer)	Bigelow Creek/Horseshoe Lake Tributary	1	Oil and Grease limit exceeded by 253% Oct-Dec 08	2 Clean Water Act NOVs 05/15/2009 12/16/2009
Allens, Inc. – Bergen Facility (Frozen Fruit, Juice, and Vegetable Manf.)	Black Creek, Bergen	n/a	Chloride (as Cl) exceeded by 42% Oct-Dec 10 Nitrite plus Nitrate exceeded between 9 and 90% on four quarters between 2009 & 2011	No Data
Byron SD STP (Public Sewage Treatment Fac.)	Black Creek	45	Combination of non-compliance factors were recorded over the five year period including: pH; Flow; Nitrogen/ammonia/; & Sus. Solids	No Data
Village of Bergen Sewage Treatment Plant (Public Sewage Treatment Fac.)	Minny Creek	54	Combination of non-compliance factors were recorded over the five year period including: pH; BOD; Flow; Nitrogen/ammonia/; D.O.; & Sus. Solids	No Data
Union Processing Corp. (Petroleum Bulk/Metal Processing)	Black Creek	Incomplete	--	2 Clean Water Act NOVs 09/18/2009 10/15/2009 1 Clean Water Act Notice of Noncompliance 04/16/2010

Effluent Violations (labeled as "exceedances" above) refer to the number of times a monitored value at a facility exceeds the effluent limit set in the facility's permit. Effluent violations at every pipe and parameter may be counted once over each reporting period. For example, if a facility had one pipe with two parameters reported every month, the maximum number of effluent violations would be 1(pipe)x2(parameters)x12(months)x3(years)=72 effluent violations.

Notices of Violation (NOV) are activities taken by EPA or the state that often precede a formal administrative or civil/judicial enforcement action. Not all notices of violation are escalated to formal enforcement action for a variety of reasons, including the following: the facility quickly corrects the problem(s) indicated in the notice, the violation is determined to be less severe than originally thought, or consultation between the facility and EPA or the state indicates that a violation has not occurred.

USEPA Enforcement & Compliance History Online (ECHO) database can be accessed online at http://www.epa-echo.gov/echo/index.html.

Descriptive data obtained from the NYSDEC on municipally-owned waste water treatment plants (WWTPs) is provided in the table below.

Table 4.23: Descriptive Data of Municipal WWTPs in the Black Creek Watershed[76]

Facility Name	SPDES No.	Discharge Waterbody/Stream Classification	Year Built	Last Update	Plant Class	Collection	Additional Treatment
Village of Bergen Sewage Treatment Plant	NY0110434	Black Creek C	1986	--	1	Separated System	--
Byron SD STP	NY0160971	Minny Creek C	1985	--	2A	Separated System	Filtration and Post aeration

Plant Class explanation:
Plant Class - Refers to the certification required for the chief operator based on scoring of the plant's treatment train: Activated Sludge Treatment, with a definition of a biological treatment process in which a mixture of wastewater and activated sludge is agitated and aerated. The activated sludge is subsequently separated from the treated wastewater by sedimentation and wasted or returned to the process as needed.

- 4A plant score greater than 75 points
- 3A plant score between 56 and 75 points
- 2A plant score between 31 and 55 points
- 1A plant score or less than 30 points

Any biological oxidation process other than activated sludge.

- 4 plant score greater than 75 points
- 3 plant score between 56 and 75 points
- 2 plant score between 31 and 55 points
- 1 plant score or less than 30 points

In general, the higher the "plant class" the more sophisticated the system and hence a higher level of technical training is required.

4.8.2 SPDES General Construction Permit

The NYS General Permit for Construction Activities (Permit No. GP-0-10-001) is required for any construction activity that will disturb more than 1 acre of land.[77] Before commencing construction activity, the owner or operator of a construction project that will involve soil disturbance of one or more acres must obtain coverage under the Permit for Stormwater Discharges from Construction Activity. The permit is intended to reduce impacts to area waterbodies from sediment runoff. This is achieved in part through the development of a Stormwater Pollution Prevention Plan (SWPPP) as well as strict compliance and enforcement standards.

Table 4.24 provides the results of a review of General Permit issuances in the Black Creek watershed during the period 2003 and 2010. As the chart indicates, while permitted construction activities are disbursed throughout the entire watershed, the majority of permits were issued in the Towns of Chili (46) and Batavia (21) during this time period.

Table 4.24: NYS General Permit for Construction Activities – Permits Issues in the Black Creek Watershed, 2003 – 2010 (Source: NYSDEC)

Year	2003	2004	2005	2006	2007	2008	2009	2010
No. of Permits Issued	17	15	17	10	17	11	15	16
Av. Disturbed Area (Acres)	13.6	20.3	5.6	7.2	6.2	5.0	10.2	6.8

4.8.3 EPA Regulated Facilities

To improve public health and the environment, the EPA collects information about facilities or sites subject to environmental regulation. A query of this database identified 15 faciltiies to be present in the Black Creek watershed, as listed in Table 4.25 and illustrated on Figure 4.3.

The public is able to conduct research on facilities within their neighborhoods or areas of interest through the US EPA *Envirofacts* database, an online database and retrieval system for regulated facilities in the United States. Information on the facilities listed in Table 4.25 as well as other facilities can be found therein by visiting http://www.epa.gov/enviro/index.html.

The regulatory programs and authorities covered through this database and reported for the Black Creek watershed are as follows:

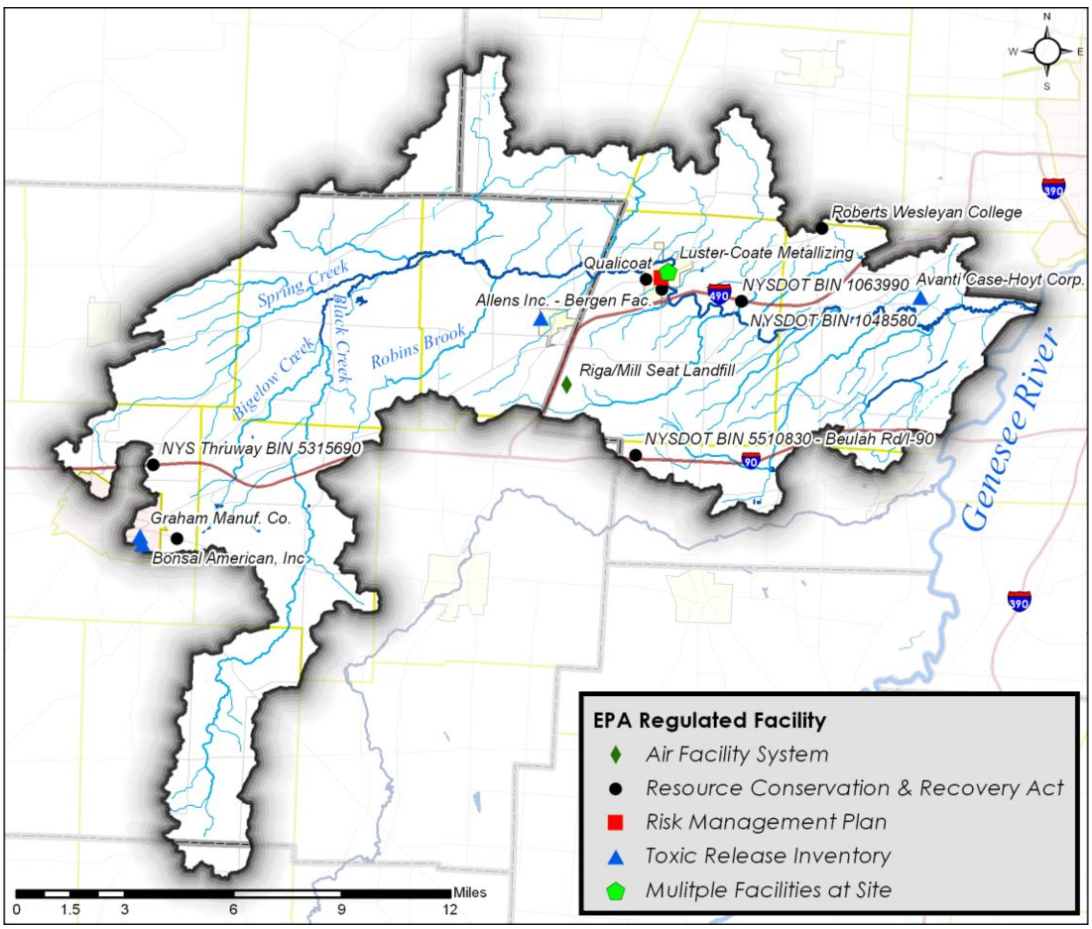
- **Toxic Release Inventory**: EPCRA Section 313 requires EPA and the States to collect data annually on releases and transfers of certain toxic chemicals from industrial facilities and make the data available to the public through the Toxics Release Inventory (TRI).
- **Resource Conservation & Recovery Act (RCRA):** Through RCRA, Congress directed EPA to regulate all aspects of hazardous waste. As a result, EPA developed strict regulations for the treatment, storage, and disposal of hazardous waste. States may implement stricter requirements than the Federal regulations as needed. Facilities listed here may be assumed to be required to perform one or more of the following procedures: treatment and disposal of hazardous materials; storage of hazardous materials, record keeping and reporting of activities associated with hazardous materials; and other requirements as stipulated by Federal law.
- **Risk Management Plan**: Under the authority of section 112(r) of the Clean Air Act, the Chemical Accident Prevention Provisions require facilities that produce, handle, process, distribute, or store certain chemicals to develop a Risk Management Program, prepare a Risk Management Plan (RMP), and submit the RMP to EPA.
- **Air Facility System**: Required by Title V of the Clean Air Act, the System consists of legally-enforceable documents designed to improve compliance by clarifying what facilities (i.e. air pollution sources) must do to control air pollution. Issued to all large sources (“major” sources) and a limited number of smaller sources (called “area” sources, “minor” sources, or “non-major” sources).

USEPA Regulated Facilities also include municipal wastewater treatment plants which are covered under Section 4.8.1 of this report.

Table 4.25: Black Creek EPA Regulated Facilities

Facility Name	Location	Facility Type
Bonsal American, Inc.	Batavia	Toxic Release Inventory
Batavia Service Center	Batavia	RCRA
Graham Manufacturing Company, Inc.	Batavia	Toxic Release Inventory
NYS Thruway Auth. BIN5315690	Batavia	RCRA
NYSDOT BIN5510830 – Beulah Rd. Over I-90	Churchville	RCRA
Riga/Mill Seat Landfill	Bergen	Air Facility System
Allens Inc., – Bergen Facility	Bergen	Toxic Release Inventory
NYSDOTBIN 1048580	Riga	RCRA
NYSDOTBIN 1063990	Riga	RCRA
Churchville Water Storage Tank	Riga	RCRA
Avanti Case Hoyt Corp.	Churchville	Toxic Release Inventory
Qualicoat	Churchville	RCRA
Star of the West Milling Co.	Churchville	Risk Management Plan
Luster Coate Metallizing Corp.	Churchville	Multiple Facilities
Roberts Wesleyan College	Rochester	RCRA

Figure 4.3: USEPA Regulated Facilities in the Black Creek Watershed



4.8.4 Hazardous Waste Sites

The NYS DEC Division of Environmental Remediation maintains a database of sites being addressed under one of the Division's remedial programs – *State Superfund*, *Brownfield Cleanup*, *Environmental Restoration* and *Voluntary Cleanup*. This database also includes the Registry of Inactive Hazardous Waste Disposal Sites and information on Institutional and Engineering Controls in New York State. A query of this database identified four facilities present in the Black Creek watershed. The locations of those facilities are shown in the map below; a description of the facility and facility status is provided in Table 4.26.

Figure 4.4: NYSDEC Hazardous Waste Sites

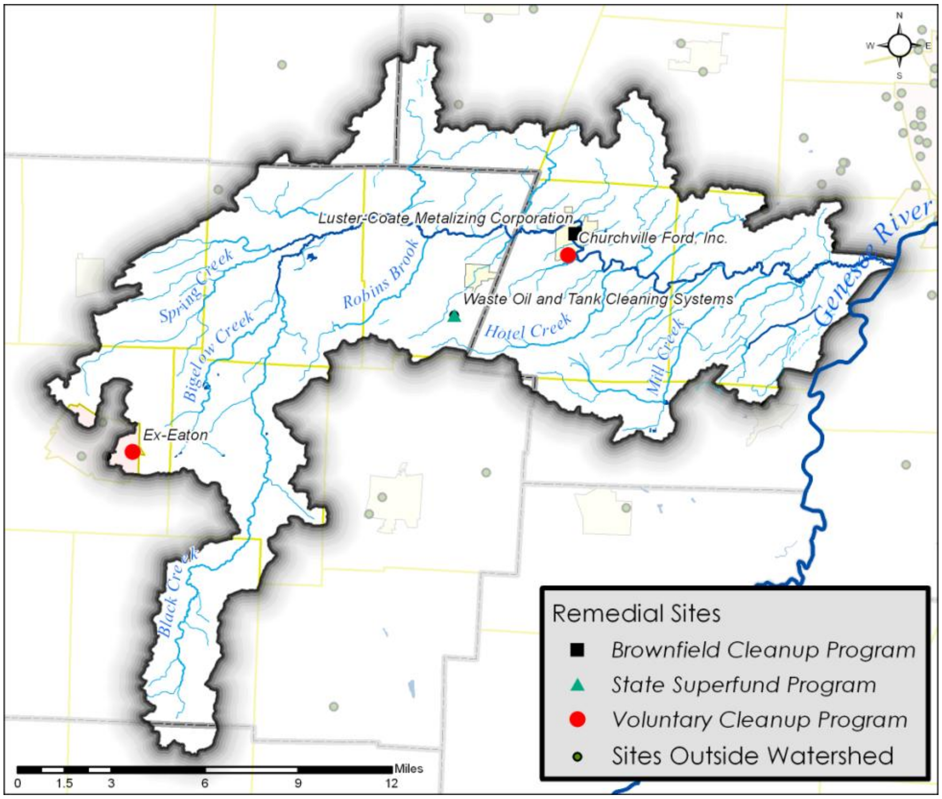


Table 4.26: Black Creek DEC Hazardous Waste Sites[78]

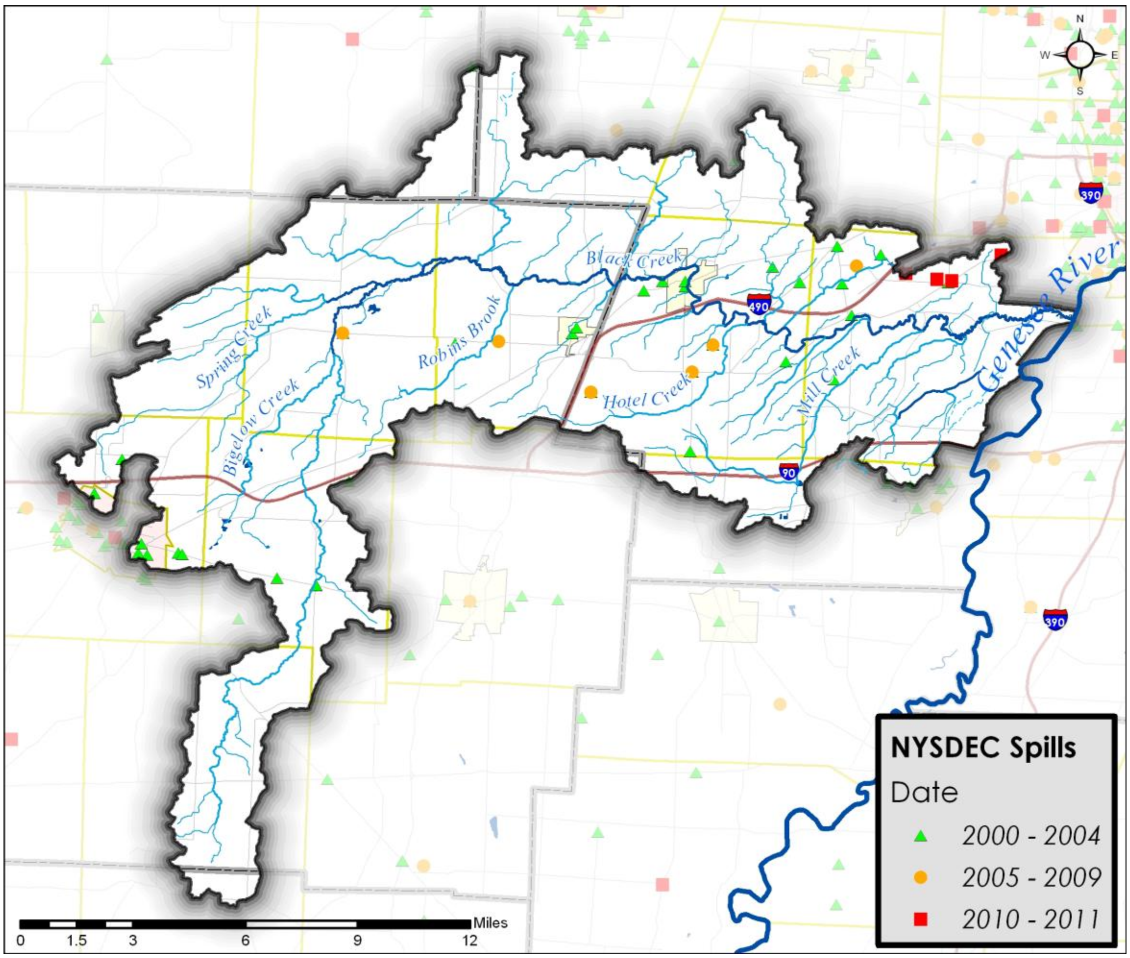
Site Name	Site Location	Site Program	Site Priority Classifications
Waste Oil and Tank Cleaning Systems	Lake Road, Bergen	State Superfund Program	C
Ex-Eaton	22-40 Clinton Street, Batavia	Voluntary Cleanup Program	A
Luster-Coate Metalizing Corporation	32 East Buffalo Street, Churchville	Brownfield Cleanup Program	A
Churchville Ford, Inc.	111 South Main Street, Churchville	Voluntary Cleanup Program	A

Classification Code A: The classification assigned to a non-registry site in any remedial program where work is underway and not yet completed (i.e., Brownfield Cleanup Program, Environmental Restoration Program, and Voluntary Cleanup Program sites). **Classification Code C:** The classification used for sites where the Department has determined that remediation has been satisfactorily completed under a remedial program (i.e., State Superfund, Brownfield Cleanup Program, Environmental Restoration Program, Voluntary Cleanup Program).

4.8.5 Spills

The NYSDEC maintains a database of chemical and petroleum spills reported to the Department since 1978. GIS analysis of the information was performed in order to begin to illustrate the degree to which spills have occurred in and around the Black Creek watershed over time. An initial query of spills data identified over 10,000 spill incidences across NYSDEC Region's 8 and 9 dating back to 1978. These data were sorted to include only spills dating back to January 1, 2000, in order to narrow down the number of records and to allow a limited GIS analysis. The records were then geo-coded, a process in which an x-y point location is generated based on address data provided in the database, allowing the user to assign a point location on a map for each reported incident. In some cases, these locations are generalized due to limited information on the actual location.

Figure 4.5: NYSDEC Spills, 2000 – 2011



A total of 49 spills were identified within the Black Creek watershed during the period 2000 to 2011. Those incidences were classified as follows:

- Commercial/Industrial (15)
- Commercial Vehicle (11)
- Unknown (7)

- Private Residence (5)
- Gas Station (4)
- Institutional (2)
- Passenger Vehicle (2)
- Rail (2)

Specific materials and volumes are not available through this particular query mechanism but can be obtained for specific incidences utilizing the NYSDEC Spill Incidences Database online search tool at http://www.dec.ny.gov/cfmx/extapps/derexternal/index.cfm?pageid=2.

4.8.6 Landfills

Mill Seat Landfill is a mixed solid waste facility located in the Hotel Creek subwatershed of Black Creek and lies on the Bergen/Riga town line in Monroe County. The facility is owned and operated by Monroe County Department of Environmental Services and accepts residential, institutional and commercial solid waste including asbestos. The NYSDEC Department of Chemical and Pollution Control reported as of 2009 that the landfill has a present waste quantity of 497,732 tons of material, an existing annual permit limit of 598,650 tons/year and a remaining existing and entitled capacity under permit of 5,600,000 tons.[79] Leacheate from the facility is collected and discharged into the the Monroe County Pure Waters waste water treatment system where it is treated at the Frank E. Vanlare wastewater treatment facility in Rochester, NY.

The incidental location of the Mill Seat Landfill is illustrated on the map entitled “EPA Regulated Facilities” in Section 4.8.4 (note that the regulated facility mapped here is a methane digester that is operated at the landfill which is listed as an Air Facility System).

SECTION 4 ENDNOTES

[32] American Planning Association. Planning and Urban Design Standards. (Hoboken: John Wiley & Sons, 2006. 99

[33] Portions of this section adapted from USGS & Monroe County DOH article "The Black Creek Watershed Coalition," printed in the Improving Water Quality in Monroe County newsletter. Fall 2002, Issue 8.

[34] *Rochester Embayment Area of Concern*. [Online] In *USEPA*. Retrieved 12/2/10 from http://epa.gov/greatlakes/aoc/rochester.html#Background.

[35] See page 53 of the report Watershed Plan for the North Chili Tributary of Black Creek (2001). Available online through the Black Creek Watershed Coalition website, http://www.blackcreekwatershed.org/bcnchili.htm. Last visited online 12/3/10.

[36] River Network. http://www.rivernetwork.org/. Last visited online 12/3/10.

[37] *LOCI Fact Sheet: TMDL Project*. [Online]. In *Center for Environmental Information*. Retrieved 2/3/11 from http://www.ceinfo.org/loci/tmdl/LOCI_TMDL_BlackCreek.pdf

[38] *Total Maximum Daily Loads*. [Online] In *New York State Department of Environmental Conservation*. Retrieved 2/3/11 from http://www.dec.ny.gov/chemical/23835.html. *Total Maximum Daily Loads (303d).* [Online] In *US Environmental Protection Agency*. Retrieved 2/3/11 from http://water.epa.gov/lawsregs/lawsguidance/cwa/tmdl/index.cfm

[39] Table adapted from the New York State Local Government Handbook. Table 6: New York Counties, pp 40. Online at http://www.dos.state.ny.us/LG/publications/Local_Government_Handbook.pdf. Updated population figures resulting from the 2010 Census may result in redistricting and changes in the number of members in 2011.

[40] *About Us*. [Online] In *Finger Lakes-Lake Ontario Watershed Protection Alliance*. Retrieved 2/3/11 from http://www.fllowpa.org/about.html

[41] *What We Do*. [Online] In *New York State Soil and Water Conservation Committe*e. Retrieved 12/14/10 from http://www.nys-soilandwater.org/about_us/what_we_do.html

[42] *Related Materials*. [Online] In *Intermunicipal Planning for the Black & Oatka Creek Watersheds*. Retrieved 1/2/11from http://gflrpc.org/Publications/BlackOatka/Summary%20of%20Reports.pdf

[43] Refer to Task 15 (as described above).

[44] New York State Department of State Division of Local Government Services. New York State Local Government Handbook. pp 39. Online at http://www.dos.state.ny.us/LG/publications/Local_Government_Handbook.pdf.

[45] *Farmland Protection Program.* [Online] In *New York State Department of Agriculture and Markets*. Retrieved 1/2/11from http://www.agmkt.state.ny.us/AP/agservices/farmprotect.html#county .

[46] Federal authorization to prepare a countywide all-hazard mitigation plan comes from the Disaster Mitigation Act of 2000 and 44 CFR (Code of Federal Regulations, Title 44). These regulations provide a mandate directing local governments to assess the potential dangers posed by natural hazards to their communities and propose cost effective means of reducing/eliminating the threats posed by those hazards. Hazard mitigation planning programs are strongly encouraged and supported by the Robert T. Stafford Disaster Relief and Emergency Assistance Act of 1974, known as the Stafford Act (PL 93-288, as amended) and New York State Executive Law Article 2B: State and Local Natural and Man-Made Disaster Preparedness.

[47] Genesee County Multi-Jurisdictional All-Hazard Mitigation Plan (2007); Monroe County Pre-Disaster Mitigation Plan (2005); Orleans County Multi-Jurisdictional All-Hazard Mitigation Plan (2008); Wyoming County Multi-Jurisdictional All-Hazard Mitigation Plan (2008).

[48] *Genesee County Smart Growth Plan*. [Online] In *Genesee County New York State*. Retrieved 1/2/11 from http://www.co.genesee.ny.us/dpt/planning/smartgrowth.html.

[49] Year indicates the year that the law was originally adopted; amendments have often been made since this date. "ecodes" are those made available online through the General Code website. General Code is an independent for-profit service; it is assumed that the municipality provides the company with appropriate updates to their code on a regular basis. An entry of 'unk' indicates that the municipality's code was not available in its entirety at the time of review; it is therefore unknown whether the component exists. Municipalities listed as a "Regulated MS4" are required to have an erosion and sediment control law in place as per State and Federal law.

[50] Note that as of August 2011, 2010figures were not available at the census block level.

[51] US Census Bureau. 1980 Census of Population, Detailed Population Characteristics of New York

[52] US Census Bureau. American FactfFinder. Data Set: 1990 Summary Tape File 1 - 100% data, Total Population.

[53] US Census Bureau. American FactfFinder. Data Set: 2000 Summary File 1100% data, Total Population.

[54] US Census Bureau. Census 2010, Summary File 1 General Profile 1: Persons by Race, Age, and Sex, Urban and Rural

[55] Due to difficulties associated with analyzing population change at the census block level, analysis in this section relies on total population figures for the entire municipality.

[56] *Regional Population Forecasts*. [Online] In *Genesee/Finger Lakes Regional Planning Council*. Retrieved 1/2/11 from http://gflrpc.org/Publications/PopulationForecasts.htm

[57] American Farmland Trust. *Guide to Local Planning for Agriculture in New York*. Page 9. www.farmland.org

[58] *Sprawl Without Growth: The Upstate Paradox*. [Online] In *The Brookings Institution*. Retrieved 1/2/11 from http://www.brookings.edu/reports/2003/10demographics_pendall.aspx

[59] For a comprehensive discussion on Green Infrastructure, refer to: Benedict, Mark A. and Edward T. McMahon. *Green Infrastructure: Linking Landscapes and Communities*. Washington: Island Press. 2006.

[60] Table 3.10. "Federal" includes all undivided Federal routes, 2 to 4 lane routes, interstate routes and associated ramps; center line miles are accounted for in both directions for divided highways. "Local" includes all town, city, and village roads named or unnamed on official county base maps. Only bridges which cross a hydrologic feature, such as a stream, lake or wetland, are considered. Bridges are categorized according to the road/highway they are located on; column does not assume ownership or maintenance responsibilities. Bridge features counted exclude culverts and rail road bridges.

[61] *Regional Land Use Monitoring*. [Online] In *Genesee/Finger Lakes Regional Planning Council*. Retrieved 1/2/11 from http://gflrpc.org/Publications/LandUseMonitoring.htm

[62] *Better Site Design*. [Online] In *New York State Department of Environmental Conservation*. Retrieved 8/3/11 from http://www.dec.ny.gov/docs/water_pdf/bsdcomplete.pdf.

[63] RPS analysis identified 1,939 acres of land under the ownership of the Bergen Swamp Preservation Society (BSPS) and the Nature Conservancy in and around the area commonly known as Bergen Swamp; the BWPS website notes that it has acquired "nearly 3,000" acres of land to date, however, portions of those lands are in areas outside of the vicinity of Bergen Swamp.

[64] *2009 New York State Open Space Conservation Plan*, page 56. [Online] In *New York State Department of Environmental Conservation*. Retrieved 8/3/11 from http://www.dec.ny.gov/lands/47990.html

[65] *2009 New York State Open Space Conservation Plan*.

[66] Includes trails which are funded through the NYS Snowmobile Trail Fund. This fund, using snowmobile registration fees, provides grants to local governments, park regions, and the DEC to improve snowmobile trail systems.

[67] *Black Creek Watershed Map Guide*. [Online]. In *Black Creek Watershed Coalition*. Retrieved 8/3/11 from http://www.blackcreekwatershed.org/docs/BlackCreekWatershedMapGuide_Map.pdf

[68] *Agricultural Districts*. [Online] In *New York State Department of Agriculture and Markets*. Retrieved 1/2/11from http://www.agmkt.state.ny.us/AP/agservices/agdistricts.html

[69] *Agriculture Environmental Management*. [Online] In *New York State Soil and Water Conservation Committee*. Retrieved 1/2/11 from http://www.agmkt.state.ny.us/soilwater/aem/.

[70] Statistics provided by Monroe and Genesee Soil and Water Conservation Districts.

[71] Statistics provided by Monroe and Genesee Soil and Water Conservation Districts.

[72] See *§ 122.23.b* under *Part 122—EPA Administered Permit Programs*. [Online] In *US EPA*. Retrieved 8/3/11 from http://www.epa.gov/npdes/regulations/cafo_final_rule2008_comp.pdf.

[73] *Concentrated Animal Feeding Operations (CAFO) - Final Rule.* [Online] In *US EPA*. Retrieved 8/3/11 from http://cfpub.epa.gov/npdes/afo/cafofinalrule.cfm. See also *Permits for Concentrated Animal Feeding Operations (CAFOs)*. [Online] In *New York State Department of Environmental Conservation*. Retrieved 8/3/11 from http://www.dec.ny.gov/permits/6285.html

[74] Full accuracy statistics and data notes for the NYS CRP datalayer can be found at http://www.nass.usda.gov/research/Cropland/metadata/metadata_ny10.htm

[75] State Pollution Discharge Elimination System. [Online]. In *New York State Department of Environmental Conservation*. Retrieved 8/3/11 from http://www.dec.ny.gov/permits/6054.html

[76] *Descriptive Data of Municipal Wastewater Treatment Facilities* (Jan 2004). [Online] In *NYSDEC Division of Water*. Retrieved 7/7/11 from http://www.dec.ny.gov/chemical/8721.html

[77] *Stormwater Permit for Construction Activity*. [Online] In *New York State Department of Environmental Conservation*. Retrieved 8/3/11 from http://www.dec.ny.gov/chemical/43133.html

[78] Site Priority Classifications. [Online] In *New York State Department of Environmental Conservation*. Retrieved 8/3/11 from http://www.dec.ny.gov/chemical/8663.html

[79] *2009 Solid Waste Capacity Char*t. [Online] In *NYSDEC*. Retrieved 2/2/11 from http://www.dec.ny.gov/chemical/68335.html

5.0 Surface Water Chemical Characteristics

The chemistry of surface waters, including those in streams, is affected by the nature of the underlying bedrock geology and the soil in the watershed, by the biota, especially the vegetation, and by the nature of the precipitation that falls on the watershed. Limestone bedrock and soils containing other carbonates, for example, buffer the pH of acid precipitation before it reaches the stream. The bedrock and, especially, the soils, add other substances to the water as well—organic debris, inorganic sediment and various dissolved substances. Inasmuch as human activities alter the nature of the watershed's soil and overlying vegetation, they too have important impacts on the chemistry of water in the stream.

Because of their importance to living organisms or because they serve as indicators of human impact, certain chemical attributes of the water are of special interest. Forms of phosphorus and nitrogen are of particular importance because they tend to limit or promote the growth of plants and algae. Where these limiting nutrients are abundant, plant and algal growth flourishes. Such excess growth may be unsightly or otherwise troublesome in its own right, but, as it senesces and decays, it may also consume much of the oxygen dissolved in the water, leading to other chemical and biological problems. This process of excess fertilization of plant and algal growth is frequently referred to as eutrophication. Other chemicals, often those of anthropogenic origin, are essentially toxic to the biota: heavy metals—e.g., mercury and lead—and certain synthetic organic compounds—e.g., some pesticides and PCBs—accumulate in biological tissues ("bioaccumulate") and become concentrated at higher and higher levels of the food chain ("biomagnification). Sediment eroding from the watershed makes the water turbid, blocking sunlight from reaching the algae that coat the bottom of the stream and that, along with organic debris washed in from the riparian area around the stream, serve as the base of the food chain. Reduced photosynthesis by diatoms and other algae that coat the bottom of the stream will also lead to reduction in dissolved oxygen—a product of photosynthesis. Sediment also smothers microhabitats that harbor animals living on the bottom of the stream. Turbidity may also interfere with many human uses of the waterbody.

5.1 Water Quality Criteria and Standards

5.1.1 Ambient Water Quality Standards (AWQS) Screening

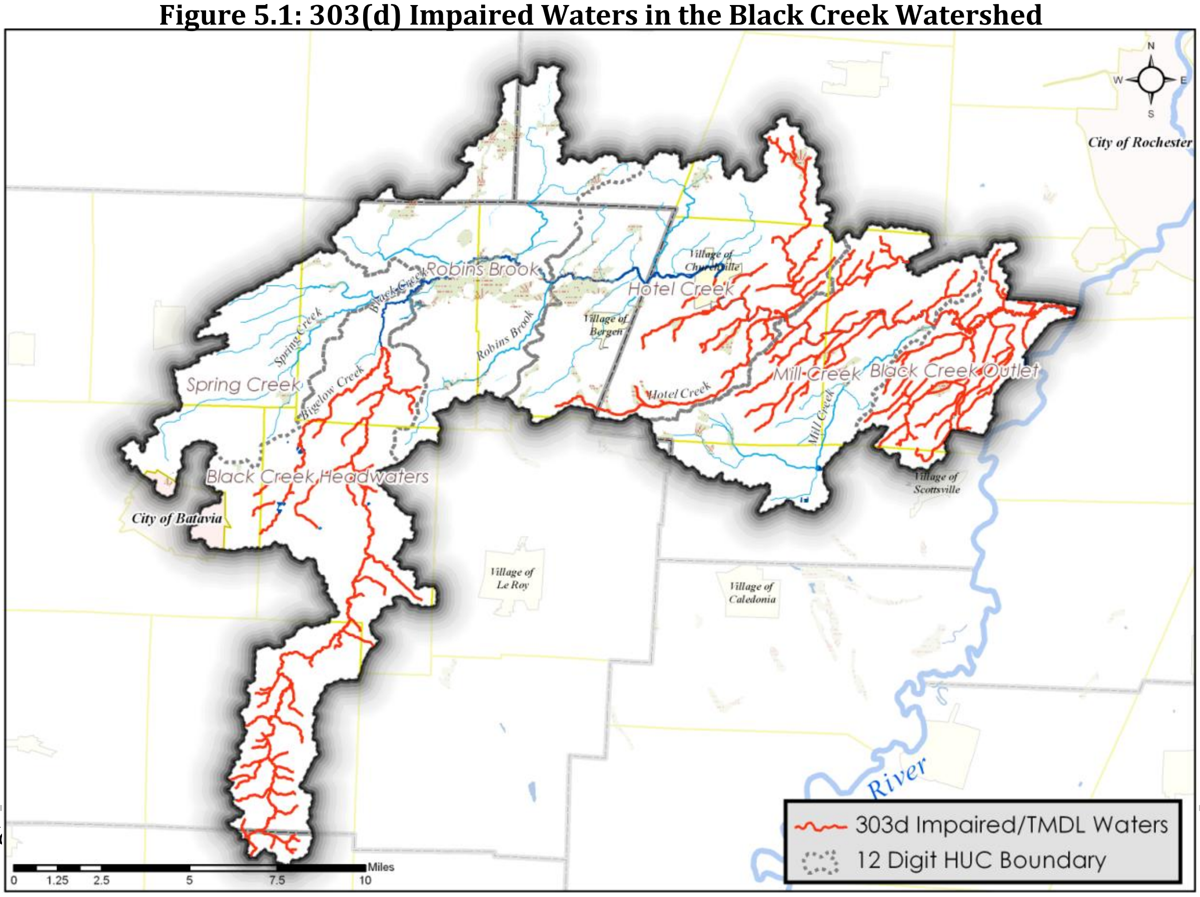
Under authority of the Clean Water Act, the federal Environmental Protection Agency (EPA) requires states to classify waters for a designated use (e.g., water supply, recreation, aquatic life), to promulgate ambient water quality standards, which are enforceable limits on pollutants related to these designated uses, and to periodically evaluate whether the designated uses are, in fact, achieved. To support the states in meeting these responsibilities, EPA scientists develop criteria, defined as the best professional judgment of limits on specific parameters that will support the designated use (e.g., ammonia concentrations that would not harm the aquatic biota). The federal criteria are not legally enforceable limits. States have the option of promulgating the federal criteria as their standards, or developing their own standards.

New York State DEC classifications for surface waters in the state range from A to D depending on the current of expected best use of the water:

> **A:** Source of water supply for drinking, culinary or food processing purposes; primary and secondary contact recreation; and fishing. The waters shall be suitable for fish, shellfish, and wildlife propagation and survival.
>
> **B:** Primary and secondary contact recreation and fishing. These waters shall be suitable for fish, shellfish, and wildlife propagation and survival.
>
> **C:** Fishing. These waters shall be suitable for fish, shellfish, and wildlife propagation and survival. The water quality shall be suitable for primary and secondary contact recreation, although other factors may limit the use for these purposes.
>
> **D:** Fishing. Due to such natural conditions as intermittency of flow, water conditions not conducive to propagation of game fishery, or stream bed conditions, the waters will not support fish propagation. These waters shall be suitable for fish, shellfish, and wildlife survival. The water quality shall be suitable for primary and secondary contact recreation, although other factors may limit the use for these purposes.

In addition, classification of B or C waters may be designated "T", supporting a trout population, or "TS" supporting trout spawning. Currently, most of Black Creek and its tributaries are classified "C". A segment of the creek and lower sections of some of its tributaries in the Towns of Bergen and Riga downstream from Bergen Swamp and near the Village of Churchville are classified "B" (Figure 5-1). The swamp may act as a buffer, filtering the water and improving its quality. Segments of tributaries are classified C(T). A segment of a tributary downstream from Churchville is further classified "TS".

Figure 5.1: 303(d) Impaired Waters in the Black Creek Watershed



In an effort to identify areas of potential concern, a survey of recent available data was conducted to assess Black Creek's compliance with NYSDEC ambient water quality standards (AWQS). Comparison of water quality from place to place within the watershed is inhibited by important data gaps. It is important to note when and where these water-quality parameters were measured, by whom, and by what procedures, as data gathered at different times, by different researchers using different techniques, may not be comparable.

The data selected were the most recent sample dates within the past 10 years from three datasets:

- USGS 04231000 BLACK CREEK AT CHURCHVILLE, NY – Data available from this station range from 1954 to 2009. For the purposes of this screening, data from 2005 through 2009 were used.
- RIBS BLACK CREEK IN BYRON @ STATE ROUTE 237 – Rotating Intensive Basin Study, conducted in 2000 by the New York State DEC
- SUNY Brockport – Data collected by for the Genesee River Project by Dr. Joseph C. Makarewicz (SUNY Brockport) during 2010 on Black Creek from a sample location described as "Lower (Black Crk)", which corresponds to the USGS Churchville location.

Analytical results from these datasets meeting the AWQS are shown in Table 5-1, while parameters that exceeded the AWQS are shown in Table 5-2. The parameters listed in Table 5-3 are those with narrative standards; the data available pertaining to these narrative standards do not allow a determination of compliance or non-compliance. The AWQS, referred to in Tables 5-1, 5-2 and 5-3, can be reviewed online at the NYSDEC website.[80]

Table 5-1: Summary of Ambient Water Quality Standards (AWQS) for parameters sampled in recent years that met the standards

Parameter	AWQS for Class B and C Waters	Data Source/Location (year)	Meets Standards?
Ammonia	Varies with pH and temperature. *For this data set, standards range from 0.7 to 1.3 mg/l*	RIBS – Byron @ State Route 237 (2000)	Standards met.
Cadmium	0.85 exp (0.7852 [ln (ppm hardness)] - 2.715) (A[C]) *Varies depending on sample hardness. For this dataset, standards range from 5.11 to 8.32 ug/l.*	RIBS – Byron @ State Route 237 (2000)	Standards met.
Copper	(0.96) exp(0.8545 [ln (ppm hardness)] - 1.702) (A[C]) *Varies depending on sample hardness. For this dataset, standards range from 23.7 to 40.2 ug/l.*	RIBS – Byron @ State Route 237 (2000)	Standards met.
Dissolved Oxygen	For nontrout waters, the minimum daily average shall not be less than 5.0 mg/l, and at no time shall the DO concentration be less than 4.0 mg/l.	RIBS – Byron @ State Route 237 (2000)	Standards met.
Fluoride	(0.02) exp(0.907 [ln (ppm hardness)] + 7.394) (A[C]) *Varies depending on sample hardness. For this dataset, standards range from 5,948 to 10,438 ug/l.*	RIBS – Byron @ State Route 237 (2000)	Standards met.
Lead	(1.46203 - [ln (hardness) 0.145712]) exp (1.273 [ln (hardness)] - 4.297) (A[C]) *Varies depending on sample hardness. For this dataset, standards range from 12.7 to 24 ug/l.*	RIBS – Byron @ State Route 237 (2000)	Standards met.
Nickel	0.997 exp (0.846 [ln (ppm hardness)] + 0.0584) (A[C]) *Varies depending on sample hardness. For this dataset, standards range from 136 to 230 ug/l.*	RIBS – Byron @ State Route 237 (2000)	Standards met.
Nitrite Nitrogen	100 ug/L except 20 ug/L for trout waters (T or TS) (A[C])	RIBS – Byron @ State Route 237 (2000)	Standard met.
pH	Shall not be less than 6.5 nor more than 8.5	RIBS – Byron @ State Route 237 (2000)	Standards met.
Zinc	exp (0.85 [ln (ppm hardness)] + 0.50) (A[C]) *Varies depending on sample hardness. For this dataset, standards range from 217 to 368 ug/l.*	RIBS – Byron @ State Route 237 (2000)	Standards met.

A[C] – Standard for aquatic life, chronic exposure.

Table 5-2: Summary of Ambient Water Quality Standards (AWQS) for parameters sampled in recent years that did not meet the standards

Parameter	AWQS for Class B and C Waters	Data Source/Location (Year)	Meets Standards?
Aluminum	100 ug/l (A[C])	RIBS – Byron @ State Route 237 (2000)	30% of measurements exceeded standard
Coliforms, Total	• The monthly median value of the samples, from a minimum of five examinations, shall not exceed 2,400 cfu/100 ml, and; • more than 20 percent of the samples, from a minimum of five examinations, shall not exceed 5,000 cfu/100ml *Applicable when disinfection is required for SPDES permitted discharges directly into, or affecting the best usage of, the water; or when the department determines it necessary to protect human health.*	SUNY Brockport – Lower (2010)	August and September exceeded the monthly median standard of 2,400 cfu/100ml. August, September and October exceeded the percent standard of 5,000 cfu/100ml.
Mercury	0.0007 µg/l (H[FC])	RIBS – Byron @ State Route 237 (2000)	Measurements exceeded standards; however, the data were reported as less than the method detection limit, and the method detection limit exceeded the standard.
Solids, Total Dissolved	Shall be kept as low as practicable to maintain the best usage of waters but in no case shall it exceed 500 mg/L.	RIBS – Byron @ State Route 237 (2000)	90% of samples exceeded standard.

A[C] – Standard for aquatic life, chronic exposure.
H[FC] – Standard for human exposure via fish consumption

Table 5-3: Summary of Ambient Water Quality Standards (AWQS) for parameters sampled in recent years that have narrative standards difficult to evaluate against numerical data

Parameter	AWQS for Class B and C Waters	Data Sources/Location
Nitrogen, Total	None in amounts that will result in growths of algae, weeds and slimes that will impair the waters for their best usages.	USGS – Churchville (2005-2009) SUNY Brockport – Lower (2010)
Phosphorus, Total	None in amounts that will result in growths of algae, weeds, and slimes that will impair the waters for their best usages.	RIBS – Byron @ State Route 237 (2000) USGS – Churchville (2005-2009) SUNY Brockport – Lower (2010)
Solids, Total Suspended	None from sewage, industrial wastes or other wastes that will cause deposition or impair the waters for their best usages.	RIBS – Byron @ State Route 237 (2000) USGS – Churchville (2005-2009) SUNY Brockport – Lower (2010)
Solids, Total	None from sewage, industrial wastes or other wastes that will cause deposition or impair the waters for their best usages.	RIBS – Byron @ State Route 237 (2000)
Turbidity	No increase that will cause a substantial visible contrast to natural conditions.	RIBS – Byron @ State Route 237 (2000)

More detailed evaluation of the AWQS with respect to these three datasets is presented in Appendix E.

It is worth noting that the data, taken at different times by different agencies, do contain some discrepancies. In particular, the USGS values for all parameters for which there are comparisons (total phosphorus, total nitrogen and total suspended solids) are higher, sometimes by more than an order of magnitude (Table 5-4). It is likely that the higher concentrations evident in the USGS data set are the result of a sampling regime designed to capture high-flow events. As displayed in Figure 5-4, higher concentrations of nutrients and sediment typically occur at higher streamflows. Also evident in this figure is the distribution of streamflow conditions sampled by the research teams.

Table 5-4: Comparison of selected analytical results from three data sets

Parameter (units)	RIBS at Byron Route 237 2000 (N = 10)	USGS at Churchville 2005-2009 (N = 42)	SUNY Brockport 2010 (N = 15)
Phosphorus (mg/l)			
Min	0.021	0.022	0.037
Max	0.107	0.618	0.075
Average	0.058	0.117	0.053
Nitrogen (mg/l)			
Min	na	0.042	0.78
Max	na	694	1.4
Average	na	191	1.1
TSS (mg/l)			
Min	1.0	7.0	2.7
Max	6.0	748	29
Average	3.0	48	10

na – not available

5.1.2 Priority Waterbodies List (PWL)

States must complete periodic assessments of water quality and habitat conditions in order to evaluate whether standards are met, and whether the designated uses are supported. In New York, surface waters exhibiting symptoms of degradation are placed on a Priority Waterbodies List (PWL), and categorized based on the severity of water quality and/or habitat degradation (Table 5-5).

Table 5-5: Categories of water quality, based on the severity of water quality and/or habitat degradation

Severity	Criteria
Precluded	*Frequent/persistent* water quality, or quantity conditions and/or associated habitat degradation *prevents all aspects* of the waterbody use.
Impaired	Occasional water quality, or quantity conditions and/or habitat characteristics *periodically prevent* the use of the waterbody, or; Waterbody uses are not precluded, but some aspects of the use are *limited* or *restricted*, or; Waterbody uses are not precluded, but *frequent/persistent* water quality, or quantity conditions and/or associated habitat degradation *discourage* the use of the waterbody, or; Support of the waterbody use *requires additional/advanced* measures or treatment.
Stressed	Waterbody uses are not significantly limited or restricted, but occasional water quality, or quantity conditions and/or associated habitat degradation *periodically discourage* the use of the waterbody.
Threatened	Water quality currently supports waterbody uses and the ecosystem exhibits no obvious signs of stress, however *existing or changing land use patterns* may result in restricted use or ecosystem disruption, or; Monitoring *data reveal increasing contamination* or the presence of toxics below the level of concern, or; Waterbody uses are not restricted and no water quality problems exist, but the waterbody is a *highly valued resource* deemed worthy of special protection and consideration.

The most recently published Priority Waterbodies List (2003) evaluates 3 segments of Black Creek—upper, middle and lower Black Creek, each with its associated minor tributaries, and Bigelow Creek, a major tributary of the upper segment of the creek (Table 5-6). [81]

Table 5-6: Priority waterbody listings (PWL) for segments of Black Creek and its tributaries (NYSDEC PWL 2003).

Black Creek Segment	Use Impairment	Cause Source	Class	W B Category
Lower Black Ck & Minor Tribs.	Aquatic Life known to be **impaired** Recreation known to be **stressed** Aesthetics known to be **stressed**	nutrients agriculture/municipal	C	Impaired
Middle Black Ck & Minor Tribs.	Aquatic life known to be **stressed** Recreation known to be **stressed** Aesthetics known to be **stressed**	algal/weed growth; nutrients	C	Minor Impacts
Upper Black Ck & Minor Tribs.	Aquatic life known to be **impaired** Recreation known to be **stressed**	nutrients agriculture; municipal	C	Impaired
Bigelow Creek and Tribs. (Trib. of upper Black Ck)	Aquatic life known to be **impaired** Recreation known to be **stressed**	nutrients agriculture	C	Impaired

5.1.3 Section 303(d) Listing

In New York, waterbodies with designated uses considered precluded or impaired are eligible for placement on the 303(d) list. This list is named for the section of the Clean Water Act requiring states, territories, and authorized tribes to assess water-quality conditions within their jurisdictions and compare the data to promulgated standards. The 303(d) list is a product of this assessment; water bodies are placed on the list when additional controls are needed to bring water quality into compliance with standards and criteria.

Based on review of the Final New York State (June 2010) 2010 Section 303(d) List of Impaired Waters Requiring a TMDL/Other Strategy (http://www.dec.ny.gov/docs/water_pdf/303dlistfinal10.pdf), Black Creek was listed in 2004 with impairment requiring Total Maximum Daily Load (TMDL) development for phosphorus from agriculture and municipal sources. The two segments noted are both Class C waters, and are designated as “Black Creek, Lower and minor tribs (0402-0033)” and “Black Creek, Upper and minor tribs (0402-0048)” (Fig 5-2). Currently NYSDEC has no Total Maximum Daily Load (TMDL) standards for flowing waters. As a first step in developing TMDLs for such waterbodies, the Center for Environmental Information (CEI prepared a water quality restoration strategy (WQRS) for the impaired segments of Black Creek. (see http://ceinfo.org/images/loci/tmdl/factsheets/LOCI_TMDL_BlackCreek.pdf). Furthermore, Prof. Joe Makarewicz and his group at SUNY Brockport have collected water-quality data from a number of sites on Black Creek and its tributaries with the goal of identifying particular stream reaches where excessive nutrient enrichment is occurring. When available, this data set and the WQRS from CEI will be useful tools for restoring water quality in the impaired segments of Black Creek and its tributaries.

5.2 Water Quality Data Summary

The water chemistry of Black Creek (and its tributaries) was characterized in the Black Creek Watershed State of the Basin Report (2003) using data from the USGS gauging station at Churchville from 1954 to 2001 as the primary source (Table 5-7). Except for continuing monitoring by the USGS at this station and data from the NYSDEC Rotating Integrated Basin Studies (RIBS) survey conducted in 2005, few more recent data exist.

The State of the Basin Report notes that, for the time period reported for the USGS gauging station, there are gaps in recording—especially from the late 1970s through the mid-1990s—and that the record is further compromised because methodologies for collecting and reporting some of the parameters changed over the years. Nonetheless, the State of the Basin Report characterized the quality of the water in Black Creek as generally good. Although no public water supplies draw water from the creek, the State of the Basin Report (2003) frequently compares water-quality parameters for the creek with standards for drinking water. The State of the Basin Report claims the NYSDEC rates all of Black Creek a “Class A” waterbody, but, as noted above, current classification for most of the creek is “Class C”.

Table 5-7: Chemical Characteristics Reported in the State of the Basin Report (2003)

Parameter	State of the Basin (2003)		SUNY Brockport (2010)
	Range	Mean	
Total Dissolved Solids	197-1040 mg/L	657 mg/L	
Specific Conductivity	339-1650 uS/cm	1002 uS/cm	
Hardness	140-850 mg/L as $CaCO_3$	522 mg/L $CaCO_3$	
Total Nitrogen	2.1-14 mg/L as NO_3^-	7.1 mg/L	
Nitrate (NO_3^-)	0.3-13 mg/L	4.2 mg/L	0.7 mg/L as N
Ammonia (NH_3)	0-1.24 mg/L	0.2 mg/L	
Total Phosphorus	0.06-0.73 mg/L (as PO_4^{-3})	0.2 mg/L	0.065 mg/L
pH	6.7-8.5		
Alkalinity	86-294 mg/L (as $CaCO_3$)	193 mg/L	
Dissolved Oxygen	7.2-14.2 mg/L		

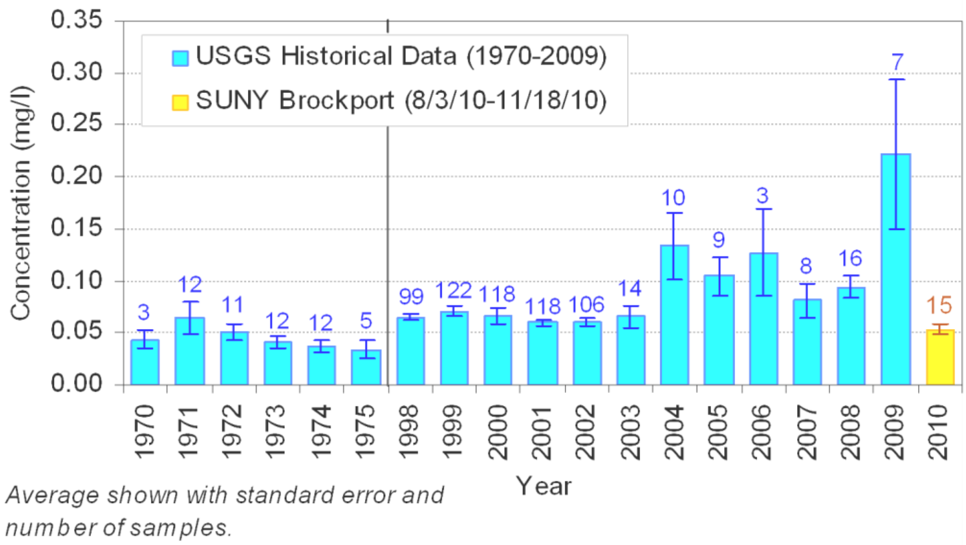
Sources:
1. State of the Basin Report, 2003 - Various water quality data collected by monitoring activities of the USGS, USEPA, NYSDEC and Monroe County Department of Health.
2. SUNY Brockport 2010 (Makarewicz)

Water quality trends over time for selected parameters – phosphorus, nitrogen, chloride and total suspended solids - are discussed in the following sections. In summary, we have not identified temporal trends in water quality conditions in Black Creek. The one exception to this conclusion is a slight increase in the concentration of chloride, which is almost certainly a result of road deicing practices.

5.2.1 Phosphorus

Average annual total phosphorus (TP) concentrations measured in Black Creek at the USGS gauging station at Churchville for the years since the State of the Basin Report (2002-2009) seem to be higher than those from earlier years (Figure 5-3). Before 2004, no average concentrations exceeded 0.10 mg/L, but, in four of the years since then, phosphorus concentrations exceeded 0.10 mg/L, and concentrations in the two years that do not still exceeded all values from the 1970s and 1990s. One must note, however, that the averages for recent years are based on very few measurements (10 or fewer), whereas averages from earlier years, especially during the 1990s, were based on many measurements. Measurements of total phosphorus concentrations measured by the Genesee River Project, led by Dr. Joseph Makarewicz, SUNY College at Brockport, and based on 15 measurements fall back in the range typical of years from the 1970s and 1990s. The data for total phosphorus concentrations at Churchville, therefore, do not provide clear evidence of an increasing trend. Hayhurst et al. (2010), in their report of chemical constituents at nine USGS stream-monitoring stations in Monroe Co., NY, for the years 2002-2008, also detected no statistically significant temporal trend.

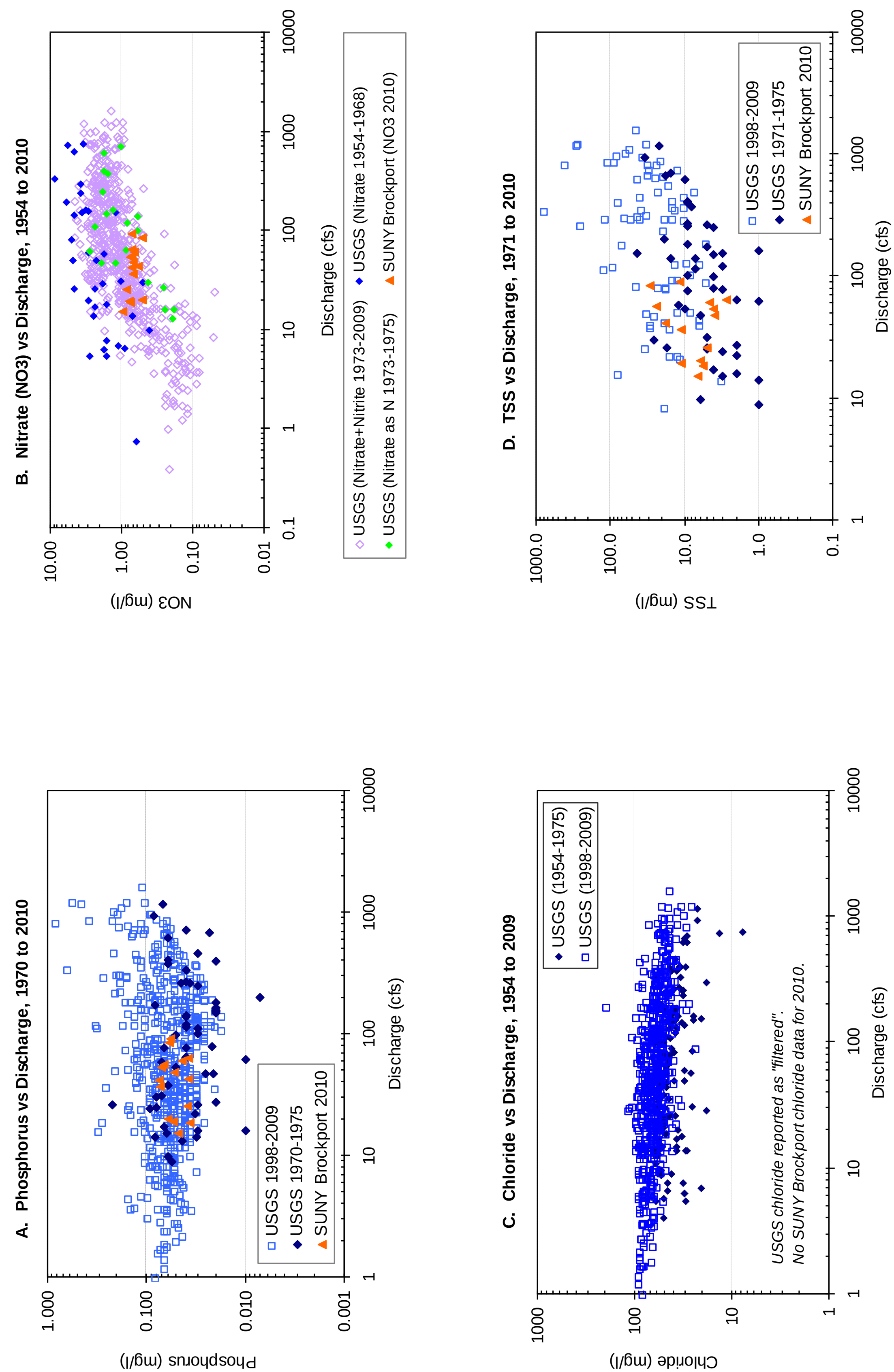
Figure 5-3. Annual statistics for phosphorus concentrations in Black Creek at



It is typical for ambient concentrations of sediment, nutrients and other chemicals to vary with the discharge (flow) rate of the creek: higher concentrations typically occur with higher discharge rates, such that much of the mass of these substances born by the creek during the course of a year may be born during a few storm events when the discharge rate is high. We examined this effect for the chemical parameters we investigated by plotting the concentration against the discharge rate at the time the measurement was taken (Figure 5-4) for USGS data and for 2010 data from the SUNY Brockport group. Interestingly, the results vary from parameter to parameter.

Although the few highest concentrations of total phosphorus did occur during the very highest flow rates overall, for all 3 data sets, there seems to be no clear trend, with some low concentrations occurring during periods of relatively high flow (Figure 5-4A). Nitrate (NO_3) and total suspended solids (TSS) do show the expected relationship, with the highest concentrations occurring during times of high flow (Figures 5-4B and 5-4D), but chloride (Cl^-) presents a slightly decreasing trend, with high flow rates having lower concentrations (Figure 5-4C).

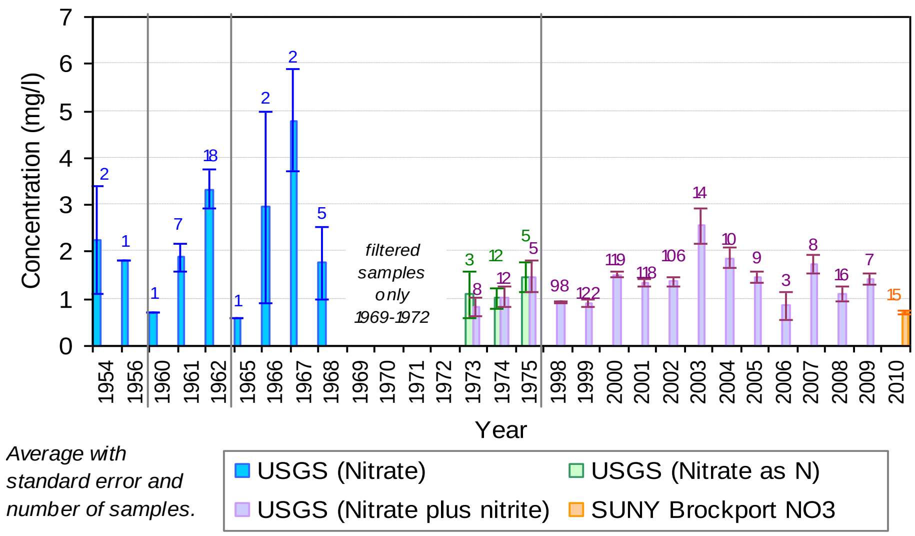
Figure 5-4: Comparison of parameter concentrations with stream discharge, Black Creek at Churchville



5.2.2 Nitrogen

Since 1973, the USGS has reported concentrations of nitrogen-containing compounds as combined nitrate (NO_3^-) and nitrite (NO_2^-). The former is typically by far the more abundant of these two, so the combined data do not differ much from measurements of nitrate alone. A principal source of these inorganic forms of nitrogen in agricultural districts is run-off of manure and other fertilizers from fields, and there is seasonal variation as plants and denitrifying bacteria take up the nitrite and nitrate during the growing season. Hayhurst et al. (2010) also found a statistically significant decreasing trend in nitrate-nitrite concentration of approximately 9%/yr for the years 2002-2008. These authors suggest that this trend reflects a decrease in agricultural acreage as the urban population of Rochester moves outward. The lowest average concentration was recorded recently (2010) by the SUNY Brockport group.

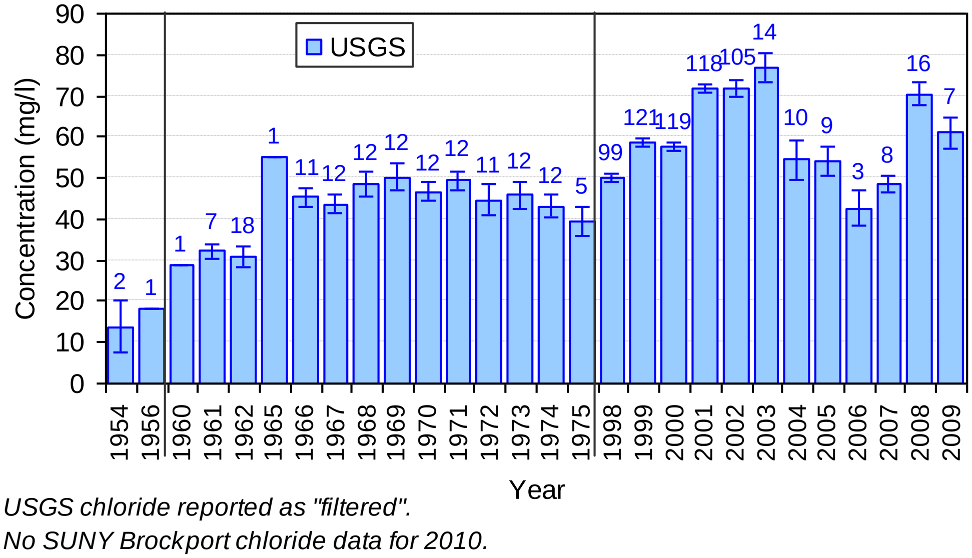
Figure 5-5: Annual statistics (average with standard error) for nitrate in Black Creek at Churchville



5.2.3 Chloride

Annual average chloride concentrations—a major source of which is deicing salt used on roads in the watershed—do seem to have increased (Figure 5-6), although not consistently so. The highest average concentrations all occur after 2000, and the years since then in which average annual chloride concentrations are somewhat lower than these peak values (2005-2007) represent averages based on fewer samples. Such an increasing trend might be expected with increasing population in the watershed and heavier road use, but Hayhurst et al. (2010), found no statistically significant trend in chloride concentrations at Churchville for the six-year period, 2002-2008. The lack of data between 1975 and 1987 diminishes the power of a statistical trend analysis, but it appears that the chloride concentrations increased through the second half of the 20th century, and that recent data indicate that the trend may have stabilized.

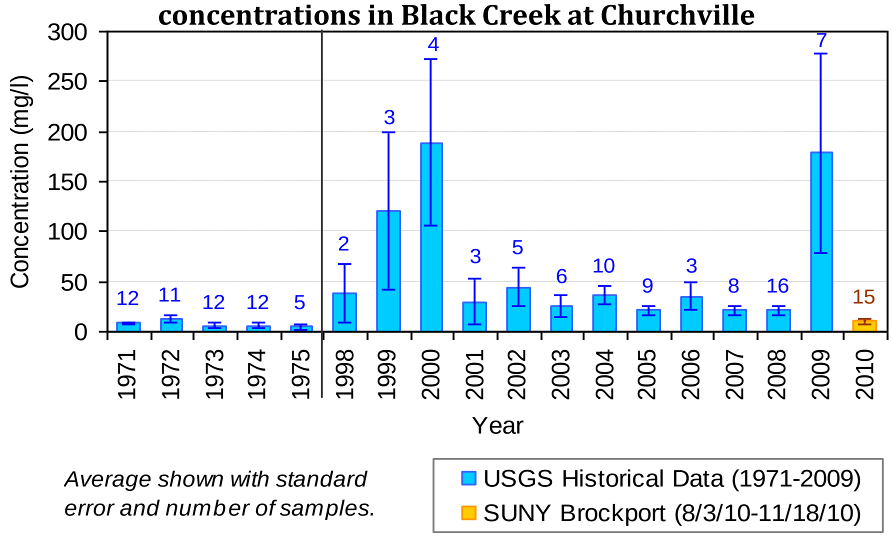
Figure 5-6: Annual statistics (average with standard error) for chloride concentrations in Black Creek at Churchville



5.2.4 TSS

The concentration of suspended solids (TSS) in the stream consists mostly of sediments eroded from the watershed and is very sensitive to the discharge rate of the stream (Figure 5-3D). Annual averages, especially those based on samples taken on only a few days during the year, are likely to be all but meaningless in calculating the sediment load carried by the stream over the course of a year. Annual averages of the USGS data taken since 1998 appear higher than those from years in the early 1970s (Figure 5-7), with a few years—1999, 2000 and 2009—having very high averages. All of the peaks, however, represent years with very few sample days (<7) with very high standard errors. Average TSS for the 15 days sampled in 2010 is low and similar to those from the 1970s, so no increasing or decreasing trend seems likely.

Figure 5-7: Annual statistics (average with standard error) for total suspended solids concentrations in Black Creek at Churchville



5.3 Constituent Loads

As recently as December 2010 Hayhurst et al. (2010) reported calculations of annual loads of chloride, sulfate, ammonia plus organic nitrogen, nitrate plus nitrite nitrogen and phosphorus at 9 USGS gauging stations in Monroe County, NY, including the station on Black Creek in Churchville, for the 6 years 2002-2008. Calculation of load—the mass of a given chemical constituent passing the station over some time period, typically a year—involves integrating the concentration of the constituent with the flow rate of the stream, taking into account the fact that the concentration may vary with the flow rate—typically with the highest concentrations accompanying the highest flow rates or storm events. Furthermore, because streams draining larger areas might be expected to bear higher loads just by virtue of their size, it is informative to express these values as "yields", normalizing the annual loads to the size of the watershed (see series of tables included in Appendix F).

For 3 of the 5 constituents reported in Hayhurst et al., Black Creek's constituent loads were among the lowest of the Monroe Co., NY, sites studied. For sulfate and for nitrate-nitrite nitrogen, however, Black Creek's loads were among the highest, reflecting the high concentrations of these constituents in the stream water. As discussed above, the inorganic nitrogen most likely reflects agricultural run-off. The high concentrations and yields of sulfate result from outcrops of natural gypsum (calcium sulfate) over which the stream flows above the gauging station at Churchville.

Section 5 Endnotes

[80] NYS regulation 6NYCRR Part 703: Surface Water and Groundwater Quality Standards and Groundwater Effluent Standards. Retrieved online 7/7/11 from http://www.dec.ny.gov/regs/4590.html#16130

[81] *Summary Listing of Priority Waters*, NYSDEC, [Online]. Last viewed online 3/1/12 at http://www.dec.ny.gov/docs/water_pdf/pwlgeneslist.pdf. Ont 117-19 and Ont 117-19-30.

6.0 Biological Characteristics

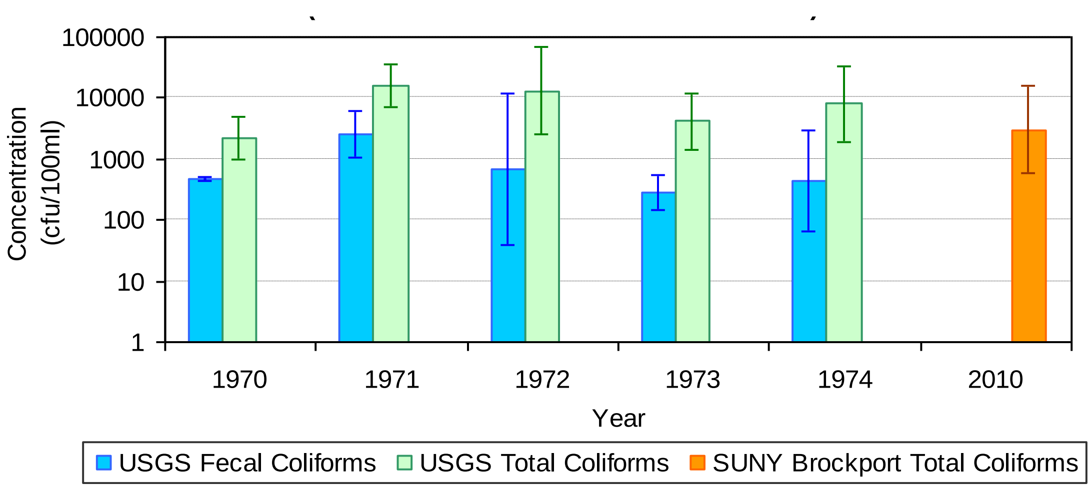
6.1 Coliform Bacteria

Coliform bacteria that originate in the intestinal tracts of birds and mammals, including humans, are reported as "fecal coliforms", and are used to indicate the potential presence of pathogenic (disease-causing) microorganisms in water. Although these bacteria themselves may not be pathogenic, because they are specific to the intestinal tracts of animals, they indicate that animal feces, perhaps containing pathogens, has entered the water. Other coliform bacteria are naturally present in the soil and may reach the waterway through erosion and runoff. Measurements reported as "total coliforms" include these soil organisms as well as the "fecal coliforms". Because erosion and runoff are greater during periods of high-flow storm events, counts of "total coliforms" can vary greatly with stream discharge rates.

Individual on-site wastewater disposal systems (septic systems), wastewater treatment facilities and animal feeding operations, including pastured animals with access to streams, confined animal feeding operations (CAFOs), or run-off from manured fields are likely sources of fecal coliform bacteria in waterways. Waterfowl, including Canada geese, can also contribute fecal coliform bacteria to waterways.

The *Black Creek Watershed State of the Watershed Report* (2003) noted that water samples taken between June 1971 and August 1974 frequently contained large numbers of fecal coliform bacteria—up to 36,000 cfu (colony-forming units)/100 ml; median = 550—but that more recent data were not available.

Figure 6-1. Annual statistics (geometric mean +/- standard deviation) for fecal and total coliforms in Black Creek at Churchville. USGS data from 1970 through 1974; SUNY Brockport data from 2010



Recent water-quality studies by the SUNY Brockport Genesee River Project report similarly high values for total coliform bacteria measured weekly in lower Black Creek at Churchville between 3 August and 9 November 2010. These measurements range from 200-26,100 cfu/100 ml with an arithmetic mean of

7213 cfu/100 ml (SE=2484 cfu/100 ml) and a median of 5100 cfu/100 ml. Coliform counts are higher in the summer (median before 8 Oct. = 7850 cfu/100 ml) than in the fall (median after 8 Oct. = 600 cfu/100 ml). The limited data available do not indicate any trends of increase or decrease.
The SUNY Brockport 2010 total coliform data were evaluated for compliance with the New York State Ambient Water Quality Standard (AWQS) (Table 6-1). The AWQS for total coliforms consists of two standards, based on a minimum of 5 examinations:

1. The monthly median value shall not exceed 2,400 cfu/100ml, and
2. more than 20 percent of the samples shall not exceed 5,000 cfu/100ml

Table 6-1: Evaluation of 2010 SUNY Brockport total coliforms data with AWQS

Month 2010	N samples	The monthly median value shall not exceed 2,400 cfu/100ml		More than 20 percent of the samples shall not exceed 5,000 cfu/100ml	
		Monthly Median	*Exceeds Criterion?*	*% of Samples >5000 cfu/100ml*	*Exceeds Standard?*
August	5	14,800	Yes	80%	Yes
September	4	6,100*	Yes*	75%*	Yes*
October	4	1,300*	No*	25%*	Yes*
November	2	na	--	na	--

* - Number of samples fewer than 5 (4).
na – indicates insufficient number of samples (2) for evaluation with AWQS

For 3 of the months sampled in 2010, the SUNY Brockport data reflect fewer samples than the minimum number water-quality standards require, but, because they are the most recent data available, we report them here for comparison. It appears that coliform bacteria do exceed the Ambient Water Quality Standards at the Churchville site. One should note, however, that these most recent data are for "total coliform", not "fecal coliform". Nonetheless, these data do suggest that human or animal wastes are entering Black Creek. Further monitoring at various sites along the stream could locate the source or sources. The Genesee River Project, under Dr. Joseph Makarewicz at the SUNY College at Brockport, continues to monitor Black Creek and other Genesee River tributaries. As part of this continuing study, Spring Creek, a tributary of Black Creek, was monitored during the summer of 2010 for total coliforms as well as a number of chemical parameters. The results of this study suggest that confined animal feeding operations (CAFOs) in that subwatershed have a significant impact on coliform bacteria as well as nutrients in the creek. A municipal sewage disposal leach field in the subwatershed, however, had no measurable effect (M. Winslow, SUNY Brockport, pers. comm.).

6.2 Fish

The most recent general surveys of fish in the Black Creek Watershed were done by the NYSDEC Regions 8 and 9 between 2000 and 2007. The species lists from those surveys cannot be used reliably to detect changes in the fish community in the watershed; they may serve as baseline data for future surveys.

A total of 30 species of fish were recorded among the surveys.

White sucker	Mimic shiner	Bluegill
Northern hog sucker	Central mudminnow	Blackside darter
Smallmouth bass	Bluntnose minnow	Greenside darter
Largemouth bass	Shorthead redhorse	Fantail darter
Northern pike	Brook silverside	Johnny darter
Alewife	Northern pike	Tessellated darter
Common carp	Banded killifish	Walleye
Stonecat	Rock bass	Yellow perch
Golden shiner	Black crappie	Logperch
Spotfin shiner	Pumpkinseed	Brown trout

Information obtained through personal conversation with NYSDEC Region 8 officials

In 2009, the DEC stocked approximately 410 brown trout at Spring Creek – a tributary of Black Creek - in Byron. Spring Creek is a class C(T) waterbody. Wild brown trout are found in Hotel Creek from the mouth upstream to NY Route 33A. According to Matt Sanderson, NYSDEC Region 8, Wild brown trout and brook trout are found in Blue Pond Inlet.

6.3 Macroinvertebrates

The community of animals living in a waterbody is a good indication of the qualities of the water, especially the qualities important for supporting organisms. In particular, evaluation of the community of invertebrate animals—largely insects—living on the bottom of a stream have been widely used as an indicator of water quality. These bottom-dwelling invertebrate animals, large enough to be seen without the aid of a microscope, are referred to as benthic macroinvertebrates. Some of these animals are sensitive to pollution, and since many of them live in the stream for a year or more, they integrate the condition of the water over time, unlike so-called “grab samples” for chemical analysis that represent only a snapshot of conditions. The NY-DEC, the US-EPA and other environmental regulatory agencies publish standard techniques for using the community of benthic macroinvertebrates to assess water quality.

The benthic macroinvertebrate community of Black Creek and a number of its tributaries were scheduled for assessment in the NY-DEC Rotating Integrated Basin Studies (RIBS) program in 2004 and 2009, but those data have not yet formally been made available by the DEC. Table 6.2 includes a summary of the 2004 study. Table F-2 in Appendix F includes a summary of the ***preliminary data*** from the 2004 study; additional explanation and detail is provided therein.

Table 6.2: Assessment of level of impact on water quality in Black Creek and tributaries from benthic macroinvertebrate data collected as part of the NY-DEC RIBS program, 14 September 2004 (provided by Peter Lent)

	Black Creek North of Byron 200 m Upstream Rt 237 Bridge	Black Creek Below Churchville 80m Downstream Burnt Mill Rd Bridge	Spring Creek North of Byron 20m Downstream RT 237 Bridge	Mill Creek Chili Center Immediately Above Stottle Rd Bridge
Total Number in Sample	100	100	100	100
Number of Species in Sample	21	11	12	14
Biological Assessment Profile (BAP)	5.9	3.8	3.9	4.2
Overall Rating of Impact	SLIGHT	MODERATE	MODERATE	MODERATE

Freshwater mussels also reside in Black Creek and its tributaries. According to NYSDEC Region 8 (Avon) biologists (personal communication), "Black Creek was a hot spot for mussels. We found a total of 11 species, including four species of greatest conservation need. Live mussels were found at all ten survey sites between Stafford and Chili (Rt. 386), although diversity was greatest between Churchville and Chili."

A study conducted in the summer of 2010 recorded 10 species of mussels in the Black Creek Watershed (Table 6.3) (*unpublished data, NYSDEC Bureau of Wildlife)*

Table 6.3: 2010 NYSDEC Mussel Survey – Black Creek Watershed

Scientific Name	Common Name
Black Creek	
Alasmidonta marginata Say	Cylindrical papershell
Fusconaia flava (Rafinesque)	Wabash pigtoe
Lampsilis ovata (Say)	Pocketbook
Lampsilis siliquoidea (Barnes)	Fat mucket
Lasmigona costata (Rafinesque)	Flutedshell
Pyganodon grandis (Say)	Floater / Giant floater
Strophitus undulatus (say)	Squawfoot / Creeper
Villosa iris (Lea)	Rainbow
Bigelow Creek	
Anodontoides ferussacianus (Lea)	Cylindrical papershell
Spring Creek	
Pyganodon grandis (Say)	Floater / Giant floater
Onion Creek (near Churchville)	

Villosa iris (Lea)	Rainbow

6.4 Other Animals

The DEC introduced river otter (Lontra canadensis) to Black Creek in 1998. Quantitative follow-up studies have not been done by the DEC, but DEC Region 8 officials confirm that animals are still present in the area. Rochester Institute of Technology graduate student Darren Doherty's 2010 graduate thesis in Environmental Science titled "Distribution patterns of river otters, Lontra canadensis, within Monroe County, New York" included three tributaries of the Genesee River: Black, Honeoye, and Oatka Creeks. The study in part confirmed the presence of otters in the Black Creek watershed as well as the suitability of the habitat conditions in the watershed to support otters.

The Second Atlas of Breeding Birds in New York State (McGowan, KJ and K Corwin, Eds., 2008, Cornell Univ. Pr.) is available through NY DEC website. The Atlas lists bird species likely or confirmed to be breeding during the 2000-2005 survey period in each of 5,333, 5 km by 5 km, survey blocks statewide. Since the survey blocks do not correspond to watershed boundaries and since many survey blocks lie within the Black Creek Watershed, it would be difficult and time consuming to extract a species list for the entire watershed. If one wished to find if a particular bird had been noted as breeding in some small section of the watershed, however, one could locate the data here.

Finally, trapping records provided by NYSDEC indicate that both beaver and coyote have been taken in the Black Creek Watershed within the past decade.

6.5 Biological elements of special concern

A number of animals, plants and ecological communities rare either nationally or in the state of New York are listed with the New York Natural Heritage Program (Appendix F, Table F-1), and some are listed or are candidates for listing in the US Fish and Wildlife Service's threatened and endangered species program (Table 6-3). Special permitting policies pertain in locations where these elements may occur. The DEC's Statewide Wildlife Conservation Strategy for the Southwest Lake Ontario Basin, which includes the Black Creek Watershed, lists many of these elements as of concern regionally, and specifically lists the Bergen Swamp as an area housing many of these threatened species and habitat types. The Statewide Wildlife Conservation Strategy lists habitat destruction and fragmentation associated with development as a high-order threat in the region in general.

Table 6.4: Rare, Threatened and Endangered Species and Significant Habitats within Black Creek Watershed (NY Natural Heritage Program database)

		NY Protection Status[2]				Conservation Ranking[3]
Common Name[1]	**Scientific Name**	**E**	**T**	**R**	**U**	
Reptiles						
Bog Turtle*	*Glyptemys muhlenbergii*	x				S2; G3
Coal Skink	*Eumeces anthracinus*				N[4]	S2S3; G5
Eastern Massasauga	*Sistrurus catenatus catenatus*	x				S1; G3G4T3T4Q

Queen Snake	*Regina septemvittata*	x			S1; G5
Fish					
Blackchin Shiner*	Notropis heterodon			x	S1; G5
Dragonflies and Damselflies					
Black Meadowhawk*	Sympetrum danae			x	S2S3; G5
Vascular Plants					
Big Shellbark Hickory	*Carya laciniosa*		x		S2; G5
Calypso*	*Calypso bulbosa var. americana*	x			SH; G5T5?
Crawe's Sedge	*Carex crawei*		x		S2; G5
Creeping Juniper	*Juniperus horizontalis*	x			S1; G5
Deer's Hair Sedge	*Trichophorum cespitosum ssp. cespitosum*		x		S2; G5T5
Dragon's Mouth Orchid	*Arethusa bulbosa*		x		S2; G4
Handsome Sedge	*Carex formosa*		x		S2; G4
Houghton's Goldenrod	*Oligoneuron houghtonii*	x			S1; G3
Log Fern*	*Dryopteris celsa*	x			S1; G4
Low Nutrush	*Scleria verticillata*	x			S1; G5
Marsh Arrow-grass	*Triglochin palustre*		x		S2; G5
Marsh Valerian	*Valeriana uliginosa*	x			S1S2; G4Q
Mountain Death Camas	*Anticlea elegans ssp. glaucus*		x		S2; G5T4T5
Northern Bog Sedge	*Carex gynocrates*	x			S1; G5
Northern Bog Violet	*Viola nephrophylla*	x			S1; G5
Ohio Goldenrod	*Oligoneuron ohioense*		x		S2; G4
Ovate Spikerush	*Eleocharis ovata*	x			S1S2; G5
Sheathed Sedge	*Carex vaginata*	x			S1; G5
Small White Ladyslipper	*Cypripedium candidum*	x			S1; G4
Sticky False Asphodel	*Triantha glutinosa*	x			S1; G4G5
Swamp Lousewort	*Pedicularis lanceolata*		x		S2; G5
Whorled Mountain-mint*	*Pycnanthemum verticillatum var. verticillatum*		x		S1S2; G5T5
Wiry Panic Grass	*Panicum flexile*		x		S3; G5
Woodland Agrimony*	*Agrimonia rostellata*		x		S2; G5
Communities					
Marl fen				x	S1; G2G3
Northern white cedar swamp				x	S2S3; G4
Rich graminoid fen				x	S1S2; G3
Silver maple-ash swamp				x	S3; G4

[1]Rare plants, rare animals and significant communities documented in the Oatka Creek watershed since 1980, unless marked with an asterisk (*), which indicates last documented in vicinity of the project site before 1980.

[2]NY Protection Status: E = Endangered; T = Threatened; R = Rare; U = Unlisted.

[3]Conservation rankings:

- State Ranking – Rarity in New York as ranked by NY Natural Heritage Program on a 1 to 5 scale.
  S1 = Critically imperiled S2 = Imperiled S3 = Vulnerable S4 = Apparently secure
  S5 = Abundant and secure SH = Historical records only, no recent information available
- Global Ranking – Global rarity as ranked by Nature Serve on a 1 to 5 scale.
  G1 = Critically imperiled G2 = Imperiled G3 = Vulnerable
  G4 = Apparently secure G5 = Secure GNR = Not ranked;
  - T-ranks (T1-T5) are defined the same as the G-ranks (G1-G5), but T-rank refers only to the rarity of the subspecies or variety.
  - Q = a question exists whether or not the species or variety is a good taxonomic entity.
  - ? = a question exists about the rank.

[4]N = No open season

Table 6.5: Federally Listed Endangered, Threatened and Candidate Species within counties of the Black Creek Watershed (US Fish and Wildlife Service)

Common Name	Scientific Name	NY County[1]	Federal Status[2]				
			E	T	P	C	D
Birds							
Bald eagle[3]	*Haliaeetus leucocephalus*	*GOW*					x
Reptiles							
Bog turtle[4,5]	*Clemmys [=Glyptemys] muhlenbergii*	*GMO*		x			
Eastern massasauga	*Sistrurus catenatus catenatus*	*G*				x	
Vascular Plants							
Eastern prairie fringed orchid[4]	*Platanthera leucophea*	*GO*		x			
Houghton's goldenrod	*Solidago houghtonii*	*G*		x			

[1]Counties in NY: G = Genesee; M = Monroe; O = Orleans; W = Wyoming
[2]Federal Status: E = Endangered; T = Threatened; P = Proposed; C = Candidate; D = Delisted.
[3]"The bald eagle was delisted on August 8, 2007. While there are no ESA requirements for bald eagles after this date, the eagles continue to receive protection under the Bald and Golden Eagle Act (BGEPA). Please follow the Service's May 2007 Bald Eagle Management Guidelines to determine whether you can avoid impacts under the BGEPA for your projects." (USFWS)
[4]Historic
[5]Riga and Sweden Townships in Monroe County; Clarendon Township in Orleans County

7.0 Identification of Impairments and Threats

7.1 The Environmental Risk Assessment Process

The purpose of this summary of threats and impairments is to aid the preparation of a watershed management strategy that will describe and illustrate various impairments and threats in the watershed and evaluate approaches to addressing them. This strategy will enable watershed managers to make informed environmental decisions into the future.

What follows is a general representation of a complex and varied group of watershed "issues" organized into specific categories. This is intended to be the beginning of an assessment process that will aid in the formulation of watershed goals, objectives, and final management strategies. The identification of data gaps is an important component of this process. The entire process is frequently an iterative one in which factual information learned during the analysis, characterization or discussion phases can lead to a reevaluation of the problem formulation or to new data collection and analysis.

> ***Uncertainty should not be an excuse for inaction…the process of reducing uncertainty must become a guide for action.***
>
> *P. 4 WWF series on adapting water management*

Identification of threats and impairments is one of the first steps in the development of a watershed management strategy. The completed strategy will include an implementation program which will likely contain several basic elements, including

- Education and outreach to inform the public and encourage participation
- Implementation schedule
- Benchmarks and criteria for measuring progress
- Ongoing monitoring and research component to continue evaluation of the resource(s) and the effectiveness of any implementation (i.e. mitigation/restoration) efforts
- Financial estimates
- Responsible parties
- Formal framework for implementation and evaluation[82]

It will be important that the watershed management process allow for the incorporation of new information into watershed assessment on a continuing basis, which can then be used to improve the decision making process in an iterative fashion. This will be an ongoing process of analysis and deliberation assigned to a coordinated organization and associated technical advisory group to drive progress.[83] This watershed management planning process will make recommendations regarding the organizational structure near the completion of the process.

These are the primary products of watershed planning: (1) clearly established and articulated management goals, (2) characterization of decisions to be made within the context of the management goals, and (3) agreement on the scope, complexity, and focus of the assessment, including the expected output and the technical and financial support available to complete it.

To begin the process of developing these planning products, we must first begin to identify the problems as they are known to exist. As stated in the USEPA document *Guidelines for Ecological Risk Assessment*:

> Descriptions of the likelihood of adverse effects may range from qualitative judgments to quantitative probabilities. Although risk assessments may include quantitative risk estimates, quantitation of risks is not always possible. It is better to convey conclusions (and associated uncertainties) qualitatively than to ignore them because they are not easily understood or estimated.[84]

After the problems are identified and agreed upon in a public format the process of systematic assessment and prioritization may commence. These steps will proceed in subsequent project components during 2011 and 2012.

7.2 Resource Management and Risk Assessment in Perspective

The Black Creek watershed has been in a constant state of flux through time. That rate of change has increased significantly since European-American settlement and activity began to grow during the late 18^{th} and early 19^{th} Centuries. Since then the watershed has experienced a gradual transformation in the types of uses and their intensity. Land conversion from forest cover to agricultural cover was one of the most dramatic changes in the past 12,000 years, since the last glaciation. Today, in some locations in the watershed, marginal land that was cleared for agricultural use has reverted back to shrub and forest cover. Farming continues to be the predominant use of the land throughout most of the watershed, however, and has a significant influence on local water quality. Agricultural practices continue to evolve as farmers look for ways to make more efficient use of the land and lessen the negative impacts of agricultural production.

Population density has also gradually increased in the watershed over time. Communities began to grow and prosper during the 19^{th} Century as local businesses and industry expanded to serve local and regional needs. While population density was largely concentrated in villages before WWII, patterns of suburban development in the post-war period have become more prevalent throughout the watershed. While the rate of suburban growth has slowed significantly in the past 25 years, a number of unanticipated externalities attributed to suburban sprawl are nonetheless prevalent. Those externalities include increased stormwater runoff from construction sites and other sources, increased impervious surfaces, increased residential fertilizer application and runoff, the prevalence of failing onsite wastewater treatment systems, and increasing habitat fragmentation.

Habitat fragmentation resulting from land conversion for agriculture and human settlement has the potential to cause significant disruption to biological communities. Habitat fragmentation has occurred for thousands of years as a result of glaciation and other natural events, although this has generally occurred at a geologic pace and scale, allowing natural communities to adapt to changes gradually. The alteration of land cover across the watershed over the course of decades (as opposed to centuries) raises the likelihood of a reduction in species richness in the watershed. While nature is resilient and adaptable to changes in the environment, decline in regional biodiversity is nonetheless a primary concern, particularly in light of other external threats, such as climate change and the influx of invasive and exotic species.

Pollution resulting from industry and municipal sources has gradually changed over time, particularly over the course of the 20th Century. Industrial and municipal discharges of wastewater into receiving water bodies in most instances went unchecked prior to Congressional approval of the Federal Clean Water Act in 1972. While point source emissions continue to require close monitoring, the regulatory mechanisms to control them are in place and can be effective when applied. Point sources have been given strict oversight by the NYS DEC under approval and guidance from the US EPA. More recently, consolidation of municipal wastewater treatment plants into the Monroe County Pure Waters system has helped to alleviate costs to consumers and transfer wastewater to the Frank E. VanLare plant in Rochester, NY, for treatment and ultimate discharge into Lake Ontario. As a result, point sources have become less of a concern for watershed managers, although close monitoring of existing point source discharges remain an important priority in the watershed. Meanwhile, nonpoint sources have grown in their complexity and continue to be a difficult problem to address due to their diffuse and varying sources. Amendments to the Clean Water Act in 1987 have played an important role in expanding the research and development of nonpoint regulatory controls and management practices.

Management of the natural resources within the Black Creek watershed therefore presents a host of challenges. The process of problem formulation, analysis and risk characterization requires managers to frame the issues in their appropriate temporal, spatial and programmatic contexts. Furthermore, many of these issues are likely to be interrelated and new information is continually being developed – often by different entities – thereby further complicating the assessment and planning process. It is therefore critical that a singular process be established to systematically evaluate and organize data, information, assumptions, and uncertainties in an effort to better understand the challenges in a way that is useful to environmental decision making.[85]

7.3 Identification of Threats and Impairments

The following summary of threats and impairments is based on a review of existing literature (as cited in the appendix of this report) as well as consideration of significant national and regional trends in environmental assessment. Subsequent components of this watershed management planning process will seek to further explore the facts surrounding these issues, including levels of risk that they may impose on watershed resources. The development of a conceptual model (sometimes referred to as a *logic model*) may be a preferable approach.

7.3.1 Water Quality Impairments

Two segments of Black Creek have been placed on the NYS compendium of impaired waters, based on elevated phosphorus concentrations that prevent attainment of the stream’s designated use for water contact recreation and fishing. Agriculture and municipal inputs are cited as the sources of the excessive phosphorus. The segments are included on the state’s 303(d) list, and are categorized requiring a Total Maximum Daily Load (TMDL) approach to water quality management.

NYS DEC Section 303(d) Impaired Waters Requiring a TMDL/Other Strategy:

Black Creek, Lower, and minor tribs
Black Creek, Upper, and minor tribs

(refer to map under Section 5.2)

The 303(d) list is a powerful tool for water quality management. Since passage of the Clean Water Act in 1972, regulations have focused on controlling point sources of pollution through limits on the concentration of pollutants in effluent discharges. Concentration limits are typically defined by technology and economics. This strategy has been successful in bringing about significant improvement in the quality of many waterbodies. However, challenges remain. There are some waterbodies where technology-based limits on effluent quality will not effectuate compliance with water quality standards. Other waterbodies are affected by non-point sources of pollution such as runoff from urban areas or agricultural lands. The 303(d) list provides a mechanism for identifying those waterbodies where additional limits on point and non-point sources of pollution are needed.

The TMDL is a site-specific allocation of the pollutant (in this case, phosphorus) load that can reach the water and not degrade water quality for its designated use. It may be considered as an estimate of assimilative capacity. In order to quantify a TMDL for Black Creek, it is necessary to define an in-stream target concentration that would fully support the designated use for the stream.

For many water quality parameters, there is a numerical standard associated with a maximum contaminant level that would protect a designated use. This is not the case for phosphorus in streams. NYS regulations (NYSCRR 6 Part 703.2) include a narrative standard for phosphorus that specifies: "none in amounts that will result in growth of algae, weeds, and slimes that will impair the waters from their best use." This narrative standard has been translated by NYSDEC to a numerical guidance value as for all class AA, A, and B ponded waters except lakes Champlain, Erie, and Ontario (NYSDEC 1988). To date, NYSDEC has not issued nutrient criteria for flowing waters, such as Black Creek.

The NYSDEC is, however, in the process of developing nutrient criteria that would provide a benchmark for acceptable phosphorus levels in Black Creek; that is, concentrations that would mitigate the cited impairment. Progress has been slow, and it appears that nutrient criteria for flowing waters will not be released for comment before 2012.

In addition to or in lieu of specific nutrient criteria, the premise of adopting a method for using invertebrate sampling as a method of determining aquatic health could be considered and developed for the watershed by local watershed managers.[86] Physical, chemical and other biological measures could be used as well as macroinvertebrates to describe comprehensively the water and habitat quality of aquatic environments. However, with the ultimate goal being to provide water quality that will support a diversity of aquatic life, the assessment of water quality that utilizes the assemblages of aquatic organisms living in the stream would seem to be of primary importance in determining if improvements in water quality are meeting the desired goal.

With the exception of phosphorus, governed by the narrative standard, data analysis to date indicates that the water quality of Black Creek is generally in compliance with ambient water quality standards. There are a few exceptions. Aluminum has been measured at concentrations exceeding the ambient water quality standard for this parameter; natural geologic conditions are considered to be the cause. Abundance of total coliform bacteria in the stream is elevated following storm events, particularly downstream of active agricultural areas. Total dissolved solids concentrations are elevated; again, this is attributed to background surficial geology. Mercury has not been detected in the stream, but the analytical limit of detection is well above the ambient water quality standard for this metal, so a definitive statement regarding compliance cannot be made.

Overall, Black Creek exhibits generally good water quality conditions. There are elevated concentrations of nutrients and bacteria associated with agricultural areas. The designated uses appear to be met based on available monitoring and reporting data. Moreover, long-term monitoring at the USGS gauging site in Churchville indicates relatively stable conditions, with no increasing trends in nitrogen or phosphorus concentrations. Nor is there evidence of increased watershed yield (export) of these nutrients. The historical increase in chloride concentration instream appears to have stabilized in recent years.

7.3.2 Known or Suspected Threats

The following threats to water quality and living resources have been compiled based on the information gathered and analyzed in this report and through a review of literature germane to water and natural resource planning and protection in New York State. These issues are listed alphabetically and are not prioritized. Prioritization of issues based on magnitude and location will occur in subsequent project components.

7.3.2.1 Agriculture

The Black Creek watershed is largely agricultural in character with approximately 50% of its land area devoted specifically to cultivation of agricultural crops. A total of 8 Concentrated Animal Feeding Operations (CAFOs) are located directly within the boundary of the Black Creek watershed – 5 medium sizes and 3 large sized. In addition, 7 other CAFOs lie within 1 mile of the watershed boundary. The *2001 Genesee River Basin Waterbody Inventory and Priority Waterbodies List* (PWL) cited agriculture as a known source of pollution in each of the three primary sections of the main stem of the Black Creek (Upper, Middle and Lower). Water quality monitoring data and/or studies have been completed by the NYS DEC or partner organizations and have concluded that the use of the waterbody was impacted in some form resulting from agricultural sources. These uses include aquatic life, recreation, and aesthetics. The types of pollutants cited as likely to result from agricultural sources include nutrient enrichment, algal/weed growth, and silt/sedimentation each of which impact the waterbody to varying levels of severity.

In most cases, adverse water quality impacts resulting from agriculture are likely a result of poor agricultural practices. However, the character of the watershed – particularly its landscape and geology – lends itself to contaminant risk to surface and ground water supplies, complicating the Best Management Practice implementation. Poor agricultural practices may result in the following:

- Silt/sedimentation and associated nutrient loading/runoff
- Livestock access to stream banks and stream beds
- Excessive manure and other fertilizer application
- Destruction, removal or failure to maintain an adequate vegetated stream buffer strip/area adjacent to streams
- Excessive pesticide and herbicide use and contamination resulting from misapplication or improper mixing

In addition, the karst area of the watershed where cracks, fractures, and other solution channel irregularities are present provide a direct connection between surface water and ground water. As documented in the publication *Manure Management Guidelines for Limestone Bedrock/Karst Area of*

Genesee County, New York: Practices for Risk Reduction, these areas present increased risk to contaminating groundwater due to rapid infiltration. USGS scientific investigations in conjunction with Cornell University and SWCD planning efforts will aid in the mitigation of nutrient management within these highly-sensitive areas of the watershed. While USGS scientific investigations have begun to map the specific locations of karst geology in Genesee County, further detailed analysis in other locations in the watershed are warranted.

7.3.2.2 Climate Change

The impact of climate change on freshwater ecosystems is explored in the document *Adapting Water Management: A primer on coping with climate change*.

> The impacts of climate change on freshwater ecosystems can be characterized by shifts in water quality (e.g., pollutants, temperature, dissolved oxygen), water quantity, and water timing (normal flood and dry periods)…Across the planet, numerous aspects of precipitation are changing, such as the amount of annual or seasonal precipitation; the seasonal timing of precipitation (such as snow versus rain); the intensity of precipitation events (how much per unit of time); the frequency and severity of extreme events like droughts and floods; and the net accumulation or loss of water in places like glaciers and the poles. Moreover, all of these aspects of precipitation are expected to continue to shift over the coming century.[87]

According to a fact sheet produced by the Union of Concerned Scientists summarizing findings from *Confronting Climate Change in the Great Lakes Region*, the impacts of climate change on New York communities and ecosystems can be summarized as follows:

> In the Great Lakes region, the impacts of climate change will likely be manifested by average annual temperatures increasing; frequency and severity of rainstorms both increasing; winters becoming shorter; and the duration of lake ice decreasing (thereby influencing regional precipitation). More specifically, by the end of the 21st century, temperatures are projected to rise 7 – 13° F in winter and 7 – 14° F in summer. Overall, extreme heat will be more common. While annual average precipitation may not change much, precipitation is likely to increase in winter and decrease in summer. This may equate to drier soils and perhaps more droughts in NYS. The frequency of heavy rainstorms, both 24-hour and multi-day, will continue to increase. Declines in ice cover on the Great Lakes and inland lakes have been recorded during the past 100 – 150 years, although this trend has been moderated in areas of lake-effect snow. Ice cover declines are expected to continue.

Additional potential impacts from climate change include:

Water Supply and Pollution

- Lake levels are expected to decline in both inland lakes and the Great lakes, as more moisture evaporates due to warmer temperatures and less ice cover.
- Reduced summer water levels are likely to diminish the recharge of groundwater, cause small streams to dry up, and reduce the area of wetlands, resulting in poorer water quality and less habitat for wildlife.
- Pressure to increase water extraction…will grow…
- Development and climate change will degrade the flood-absorbing capacities of wetlands and floodplains, resulting in increased erosion, flooding, and runoff polluted with nutrients, pesticides, and other toxins.

Human Health
- Of particular concern is the large projected increase in extreme heat days (exceeding 97° F) by 2080 – 2100.
- Some waterborne infectious diseases such as cryptosporidiosis or giardiasis may become more frequent.
- Changes in transmission occurrence of many infectious diseases, such as Lyme disease and West Nile encephalitis may occur.

Property and Infrastructure
- More frequent extreme rainstorms and floods, exacerbated by stream channeling and more paved surfaces, may result in greater property damage.
- Municipalities will have to upgrade water-related infrastructure including levees, sewer pipes, and wastewater treatment plants in anticipation of more frequent extreme downpours.

Agriculture
- Increased atmospheric CO_2 and nitrogen as well as a longer growing season could boost yields of some crops, although severe rainstorms and flooding will likely depress productivity; an increase in soil erosion may also be anticipated.
- Severe climate changes will likely combine to create more favorable conditions for a number of pests and pathogens.

Recreation and Tourism
- Populations of cold water fish species and even some cool water fish may decline, while warm water species may increase.
- The summer recreation season will likely expand as temperatures warm, although effects of extreme heat/heavy rains and possible risks from insect and waterborne diseases may dampen outdoor enthusiasm.
- Continued stress on wetlands, thereby reducing habitat and food resources for migratory birds and waterfowl.[88]

Natural Resource and Habitat Protection
- Increased incursion on non-native, exotic species into natural habitats

7.3.2.3 Failing Onsite Wastewater Treatment Systems

The NYSDEC publication “Top Ten Water Quality Issues in NYS” cites failing onsite wastewater treatment systems (septic systems) as a prevalent causes/source of water quality impact in the assessed waters of New York State.[89] In a sense, failing onsite wastewater treatment systems can be considered as an externality of suburban sprawl. The problem is described as follows:

> While most residences are connected to sewer systems and larger centralized wastewater treatment plants, about one-quarter of New Yorkers and a comparable number of businesses and institutions are served by onsite wastewater treatment systems. Onsite systems are effective and economical when properly designed, installed and maintained. However the lack of an adequate onsite system, poor routine maintenance, increased density of homes served by onsite systems, undersized and overused systems (particularly due to conversion of vacation cottages and camps into year-round residences), and the installation of systems on sites with unacceptable conditions can all lead to onsite system failure and water quality impacts.
>
> Acute failures resulting in wastewater pooling on the ground, impacts to beaches or backups into buildings are potential health problems. Chronic problems can result in bacterial contamination of groundwater and nutrient loadings to nearby lakes and other recreational waters that spur excessive aquatic weed and algal growth (see also Aquatic Weeds and Invasive Species).[90]

The *2001 Genesee River Basin Waterbody Inventory and Priority Waterbodies List* (PWL) cites failing OWTS as a possible source of pollutant in the middle section of the Black Creek and surrounding tributaries, specifically "in the hamlets of Bethany, Stafford and Morganville." (page 29). Real property information in combination with other GIS data sources (such as public sewer lines) can begin to identify the locations of populations served by onsite wastewater treatment systems. Presently, the Monroe County real property database is equipped to provide this information. Furthermore, Genesee and Orleans County Health Departments are working cooperatively to begin tracking location and maintenance information associated with septic systems and drinking water wells utilizing a GIS database. Once the locations and conditions of septic systems and leach fields are identified, a more detailed assessment as to the operation and maintenance needs of those facilities can occur.

7.3.2.4 Habitat Fragmentation/Degradation and Reduction of Open Spaces

Habitat fragmentation is the disruption of once large continuous blocks of habitat into less continuous habitat, primarily by human disturbances such as land clearing and conversion of vegetation from one type to another.[91] *Habitat quality* is defined as the ability of the environment to provide conditions appropriate for individual and population persistence.[92] The negative consequences of habitat degradation are manifested in the reduction of species diversity, negatively affecting the production or survival of a species. Furthermore, emerging research proposes that climate change may further worsen the effects of habitat fragmentation on biodiversity, particularly due to disturbances caused by extreme weather events.[93] Fragmentation therefore reduces the extent and connectivity of remaining habitats, and species may or may not be able to persist as a result of those changes.

Given that habitat is defined with reference to a particular species, planning for habitat at the regional level is an extraordinarily complex process. Poor habitat quality can be the result of the combination of a number of complex interrelationships. Of significant concern is that the detrimental effects of habitat degradation are often not noticed until well after the destruction has occurred. Identifying and protecting those areas critical to the survival of sensitive or rare species is therefore an important aspect of watershed planning in the Black Creek watershed.

In the absence of a comprehensive regional approach to habitat and open space protection, uniform enforcement of existing regulations that are already in place that complement these goals is an important step forward. These include:

- Article 15 NYS Env. Conservation Law – Protection of Waters
- Article 24 NYS Env. Conservation Law – Freshwater Wetlands
- Section 404 of the Federal Clean Water Act regulating discharges to waters of the US, including the filling of wetlands

In addition, the creation of or enforcement of local laws which prevent development from occurring within floodplains and the active river area can help to protect critical aquatic and terrestrial habitats.

A review of existing approaches to the acquisition and permanent protection of sensitive lands within and around the watershed will also be an important consideration. Currently, the NYS Open Space Conservation Plan identifies, *Ecological Corridors*, *Exceptional Forest Communities*, *Grassland Preservation and Restoration* (specifically in the Towns of Covington and Middlebury in Wyoming

County), and *Significant Wetlands* as conservation priorities in and around the region of the Black Creek watershed. Further defining how those priorities can be achieved within the watershed will be an important step forward.

Furthermore, as described in Section 4.1.8: Understanding the Active River Area, delineation and analysis of the ARA zones within the Black Creek watershed can play a significant role informing stream restoration progress and projects.

7.3.2.5 Industrial and Municipal Discharges

As authorized by the Clean Water Act, the National Pollutant Discharge Elimination System (NPDES) permit program controls water pollution by regulating point sources that discharge pollutants into waters of the United States. Point sources are discrete conveyances such as pipes or man-made ditches. Individual homes that are connected to a municipal system, use a septic system, or do not have a surface discharge do not need an NPDES permit; however, industrial, municipal, and other facilities must obtain permits if their discharges go directly to surface waters. In New York State, the NPDES program is administered by the NYS DEC and referred to as the State Pollution Discharge Elimination System (SPDES).

SPDES permit for Private, Commercial or Institutional (P/C/I) Facilities program is designed to eliminate the pollution of New York waters and to maintain the highest quality of water possible – consistent with public health, public enjoyment of the resource, protection and propagation of fish and wildlife, and industrial development in the state.

SPDES permits for Concentrated Animal Feeding Operations, Construction Site Discharges and Municipal Separated Storm Sewer Systems are discussed under sections 7.3.1 and 7.3.4 respectively. Information pertaining to the regulation and monitoring of these facilities throughout the watershed is included in Section 3.0.

7.3.2.6 Nuisance and Invasive Species

As described on the website of the Invasive Species Taskforce NYSDEC website:

> **The Problem**
> Invasive species are non-native species that can cause harm to the environment or to human health. As a threat to our biodiversity, they have been judged second only to habitat loss. Invasives come from all around the world; the rate of invasion is increasing along with the increase in international trade that accompanies globalization.
>
> Invasive species have caused many problems in the past, are causing problems now, and pose threats to our future. A wide variety of species are problematic for many sectors of our world: our ecosystems, including both all natural systems and also managed forests; our food supply, including not only agriculture but also harvested wildlife, fish and shellfish; our built environments, including landscaping, infrastructure, industry, gardens, and pets. Invasive species have implications, too, for recreation and for human health.
>
> **Strategic Need**
> Existing management efforts are limited. Although the invasive species issue is recognized by professionals as a major threat to our natural resources, few resources have been allocated toward

solutions. The National Invasive Species Council has been established by executive order to coordinate efforts among federal agencies, but there is no overarching federal legislation that recognizes the magnitude of invasive species as an issue. Thus, there is no dedicated funding stream available for their management.[94]

In response to this need to coordinate management efforts, the New York State Invasive Species Task Force (ISTF) was formed. The ISTF is described below:

New legislation was passed in 2003 that called for a team to explore the invasive species issue and to provide recommendations to the Governor and the Legislature by November 2005. The statute describes the intended membership of the Task Force and directs that it be co-led by two New York State agencies: the Department of Environment Conservation and the Department of Agriculture and Markets. Other members of the Task Force include:

- NYS Department of Transportation
- NYS Thruway Authority (and Canal Corporation)
- NYS Museum (and Biodiversity Research Institute)
- NYS Office of Parks, Recreation and Historical Preservation
- NYS Department of State
- Adirondack Park Agency
- New York Sea Grant
- Cornell University
- Invasive Plant Council
- The Nature Conservancy
- NYS Farm Bureau
- Empire State Marine Trades Association
- NYS Nursery and Landscape Association

The Task Force has taken numerous steps toward accomplishing its task. It first established a Steering Committee to oversee the day-to-day work of the Task Force. Early on, it arranged for the whole Task Force to consult with the leader of our federal counterpart, the National Invasive Species Council. The next big task was to design and conduct an in-depth survey of all Task Force member organizations. Then, they established several smaller teams to investigate in depth, to analyze existing efforts, to identify needs, and to develop recommendations. Each team has been designed to pull together organizations that share a common area of interest or expertise. The Task Force has reached out to numerous stakeholders to invite them to participate as members of these teams.

The Task Force has been meeting at various locations around New York. These meetings are open to the public and dates, times and locations are announced in the Environmental Notice Bulletin. Formal public review of the Draft Report of the Invasive Species Task Force will be accomplished through a combination of both in-person public meetings and internet communication. It is planned for the summer of 2005.[95]

The Final Report of the New York State Invasive Species Task Force is available online at http://www.dec.ny.gov/docs/wildlife_pdf/istfreport1105.pdf . The report outlines the nature and extent of the invasive species problem in specific regions of New York State, identifies existing efforts to manage invasive species, and provides specific recommendations.

A summary of report findings is included in Table 7.1.

Table 7.1. Summary of Findings of the Final Report of the New York State Invasive Species Task Force
Aquatic and Terrestrial Species and Issues of Concern in the Great Lakes Region of NYS (list identifies significant regional concerns and is not a comprehensive assessment of species present in or threatening the watershed)
• Mussels, Gobies, and Botulism • Didymosphenia geminata, commonly known as didymo or “rock snot“ • Emerald Ash Borer • Sudden Oak Death • European Starling • Purple Loosestrife • Eurasian Watermilfoil • Captive and ornamental wildlife • Pet trade • Live food trade • Live bait • Hemlock Woolly Adelgid • Norway Maple • Common Reed (Phragmites) • Giant Hogweed • Kudzu • Oriental Bittersweet • Japanese Knotweed
Existing Efforts to Manage Invasive Species
• USDA Food Safety and Inspection Service and Animal and Plant health Inspection Service • Early detection and rapid response • Cooperative Agricultural Pest Survey Program • Taxonomic and Diagnostic support • Pest databases • Regional Coordination and Outreach • Effective monitoring • Sustained funding and Meaningful restoration
Recommendations
1. Establish a permanent leadership structure to coordinate invasive species efforts 2. Prepare and implement a comprehensive invasive species management plan 3. Allocate appropriate resources for invasive species efforts 4. Establish a comprehensive education and outreach effort 5. Integrate databases and information clearinghouses 6. Convene a regular invasive species conference 7. Formalize New York State policy and practices on invasive species 8. Establish a center for invasive species research 9. Coordinate and streamline regulatory processes 10. Encourage non-regulatory approaches to prevention 11. Influence Federal actions to support invasive species prevention, eradication and control 12. Recognize and fund demonstration projects

Given that many species have spread across wide regions of the US, the coordination of invasive species management must occur at the state or national level in order to be effective. Effective coordination of outreach efforts within the watershed can be an effective regional strategy to implementing the statewide effort to control and eradicate invasive species of concern.

Detailed information on the identification and tracking of invasive species in New York State can be found at the New York Invasive Species Program website http://nyis.info/, a publication of Cornell University Cooperative Extension and NYS Sea Grant. Additional information can also be found at the New York State DEC Nuisance and Invasive Species Resources website, http://www.dec.ny.gov/animals/265.html

7.3.2.7 Spills and Contamination

As described on the NYS DEC website:

> Accidental releases of petroleum, toxic chemicals, gases, and other hazardous materials occur frequently throughout New York State. Even small releases have the potential to endanger public health and contaminate groundwater, surface water, and soils. Every year, the New York State Department of Environmental Conservation receives approximately 16,000 reports of confirmed and suspected releases to the environment. Approximately ninety percent of those releases involve petroleum products. The rest involve various hazardous substances, unknown materials, or other materials such as untreated sewage and cooking grease.
>
> Environmental damage from such releases depends on the material spilled and the extent of contamination. Many of these reports are releases of small quantities, typically a few gallons, that are contained and cleaned up quickly with little damage to the environment. In other instances material releases seep through the soil and eventually into the groundwater, which can make water supplies unsafe to drink. Uncontained spills, especially those that impact surface water, can kill or injure plants, fish, and wildlife, and cause damage to their habitats.[96]

New York State (NYS) responds to reports of petroleum and other hazardous material releases through the Spill Response Program maintained by the NYS Department of Environmental Conservation (DEC). SUNY Brockport noted 242 spills recorded by the DEC as of 2001. Since that time, 20 additional spills have occurred in the watershed (2002 – present).

7.3.2.8 Stormwater Management

Stormwater and erosion are best understood in the context of the land's interaction with precipitation and runoff. Changes in the character or cover of the land can cause changes in runoff volumes, rates, and velocities, which can lead to sedimentation and nonpoint source pollution. Sedimentation occurs when soil, sand, silt, clay, and minerals eroded from the land surface and are transported to receiving waterbodies. Erosion and sedimentation are natural processes, but these processes can be accelerated when land cover is altered. Nonpoint source pollution includes sediments, as well as any materials that may be present along with sediments, such as litter, oils, chemicals, bacteria from animal fecal matter, pesticides, fertilizers and other nutrients (particularly phosphorus).

Sediment overload causes a number of problems for aquatic organisms. Because fine sediment particulates are suspended in water, the resulting cloudiness decreases the amount of sunlight that can reach aquatic plants that provide food and oxygen for aquatic organisms. As sediment settles, it fills the void between rocks, destroying habitat used by many invertebrates. Sediment also clogs the gills of fish, crayfish, and other underwater organisms. Sediment can bury fish and insect eggs and prevent them from hatching. Sediment particles often pick up other forms of pollution such as toxic substances, nutrients, or bacteria, which are then transferred into receiving waterbodies, which can also have adverse impacts.

In 1987, amendments to the Clean Water Act required states in coordination with the US EPA to develop an approach to addressing stormwater pollution. The primary regulatory mechanism used in New York State today is referred to as Stormwater Phase II as embodied by two main regulatory permits:

- Multi- Sector General Permit for Stormwater Discharges Associated with Industrial Activities
- Municipal Separate Storm Sewer Systems Permit, GP-0-10-002
- SPDES General Permit for Stormwater Discharges from Construction Activity, GP-0-10-001[97]

The second and third rules have primary relevance to the municipalities in the Black Creek watershed. The Municipal Separate Storm Sewer Systems Permit requires operators of municipal separate storm sewer systems (MS4s) to develop Stormwater Management Program (SWMP) and submit annual reports to the NYSDEC. MS4s regulated under GP-0-10-002 in the Black Creek watershed include the Towns of Chili, Ogden, and Sweden.

The SPDES General Permit for Stormwater Discharges from Construction Activity requires operators of small construction sites (greater than one acre) to obtain SPDES permits that implement programs and practices to control polluted stormwater runoff. All municipalities in NYS are regulated under GP-0-10-001 which is enforced by NYSDEC regional offices. Construction site operators are required to file a Notice of Intent (NOI) with the DEC in advance of land disturbance activities and develop a Stormwater Pollution Prevention Plan (SWPPP) to be kept on-site during the construction period.

State and federal stormwater regulations as described above went into effect in 2003 and since that time municipalities have been working in close coordination with SWCD offices and regional planning entities to meet the new requirements in an efficient and effective manner. These efforts have largely been focused on the urbanized/regulated areas in NYS, however, which excludes much of the Black Creek watershed. It will be important to ensure that uniform enforcement of the construction permit take place throughout all parts of the Black Creek watershed into the future.

The regulatory permits were revised by the NYSDEC in 2010 to reflect the evolution of the stormwater program. The 2010 updates to the *NYS Stormwater Management Design Manual* also reflect these changes.[98] The latest additions to the Design Manual are intended to address runoff reduction and planning and design of green infrastructure. Incorporation of stormwater mitigation and other green infrastructure measures early on during the design phase of new developments and minimizing land disturbance by preserving natural features and reducing the construction of impervious surfaces are major steps forward. It will be important for local municipalities to update their local regulatory framework to aid in the implementation of these guidelines.

7.3.2.9 Streambank Erosion

G/FLRPC, in consultation with LU Engineers, utilizing funds from the Great Lakes Commission Program on Erosion and Sediment Control completed a study in 2005 entitled *Controlling Sediment in Black and Oatka Creeks*. The purpose of the project was to identify areas experiencing significant streambank erosion and plan for the restoration or remediation of the most severely-eroded sites. Site inventory data were reviewed from previous stream inventories and assessments completed by Wyoming, Genesee and Monroe County SWCD staff for both the Black and Oatka Creeks. Previous inventories rated sites along the stream channels for bank condition, stream condition, erosion and sedimentation potential. An initial list of high-erosion potential sites was generated from these previous inventories. Additional sites were suggested by SWCD staff.

An initial list of 41 candidate sites was developed from SWCD staff suggestions and from the stream inventories and further refined in subsequent meetings. To date, these inventories have been used to conduct mitigation projects at at least 1 site (Rt 33 bank erosion, Town of Chili) identified in this study. The complete list of sites is included in the report *Identification and Analysis of the Riparian Corridor in the Black & Oatka Creek Watersheds*.[99]

Review and update of this initial assessment of locations with specific erosion and sedimentation should occur. Sites that were prioritized for remediation should continue to be monitored and addressed if and when funds become available. Furthermore, stream segments should be reviewed in order to ascertain the degree to which streambank erosion and sedimentation continues to occur in the watershed.

7.3.2.10 Water Quantity, Flow and Channel Maintenance

Water quantity issues were well documented in the 2003 *Black Creek State of the Basin Report* (SUNY Brockport) and are summarized below:

> Black Creek experiences significant fluctuations in stage and discharge. Excess quantities of water produce the flooding that is typical in the lower part of the watershed. Extreme low flows have caused the channel to dry up in some segments of the channel and its major tributaries.
>
> 6.2.1 Flooding
> The most significant flooding occurs in the lower Black Creek Watershed in the Towns of Riga and Chili with lesser flooding in Bergen and Byron. Construction of the Mt. Morris Dam upstream of the confluence of Black Creek and the Genesee River has significantly alleviated backwater flooding along Black Creek. Coordination of discharges at the Mt. Morris Dam with the downstream Court Street Dam is necessary to prevent backwater events during periods of high discharge in the Genesee River. Headwater flooding of Black Creek and its principal tributaries from heavy rains and/or rapid snow melt remains a risk. Different land uses contribute to the overall flood risk, and the locations of specific land uses within the Black Creek Watershed affect the level of risk.
>
> Flooding of wetlands is not usually a problem since flooding is a normal and a necessary wetland function. Forested lands do not typically experience significant damage from flooding, but flood events could create an interruption of activities in the uses of forested lands. When agricultural lands flood, damage can occur to buildings and equipment. Crop damage can occur, but detrimental effects on pastures is negligible. Significant pollution is possible if areas that generate animal waste are flooded. Proper siting of agricultural activities minimizes the impacts of flooding on both farm practices and the surrounding environment. Flooding can produce significant damage for commercial and residential areas. The risk can become severe where permanent structures are built at levels below expected flood elevations.
>
> The best flood management strategies are those that allow flexible land use practices but minimize the location of permanent, damagable [sic] structures and their contents in flood zones. State and Federal

programs can help landowners to apply BMP through assistance and advisement programs. County and town governments can uniformly regulate land use standards for flood prone areas.

6.2.2 Base flow
Low flow periods occasionally occur in dry late summer and early fall seasons. During these times Black Creek may be almost totally dependent on groundwater discharge to provide flow. Local segments of Black Creek have been known to barely flow at these times.

7.4 Next Steps in the Watershed Planning Process

Watershed planning begins with *problem formulation*. Problem formulation is defined as the process for generating and evaluating preliminary hypotheses about why ecological effects have occurred, or may occur, from human activities. Section 7.3 is the first step toward problem formulation in the Black Creek watershed. These problems will be reviewed, deliberated and revised by the Project Advisory Committee and then be released to the public for similar review in a public setting.

Problem formulation results in three products: (1) assessment endpoints that adequately reflect management goals and the ecosystem [or watershed] they represent, (2) conceptual models that describe key relationships between a stressor and assessment endpoint or between several stressors and assessment endpoints, and (3) an analysis plan.

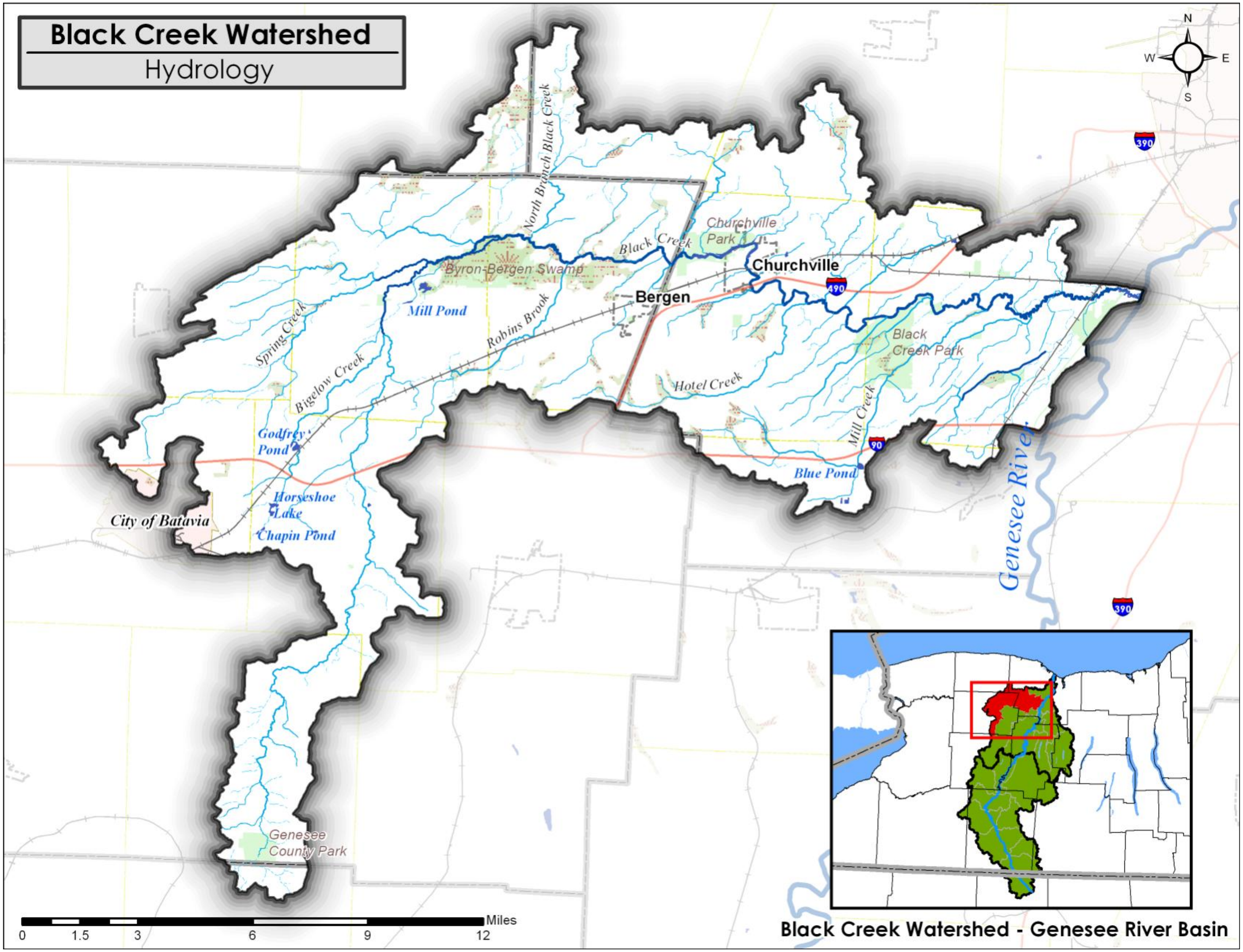
The first two products – assessment endpoints and conceptual models – will be developed in subsequent phases that follow the completion of this Characterization report. Together with other project components (such as the evaluation of the regulatory and programmatic environment), each of these tasks will contribute to and ultimately comprise the final watershed management plan for the Black Creek watershed.

SECTION 7.0 ENDNOTES

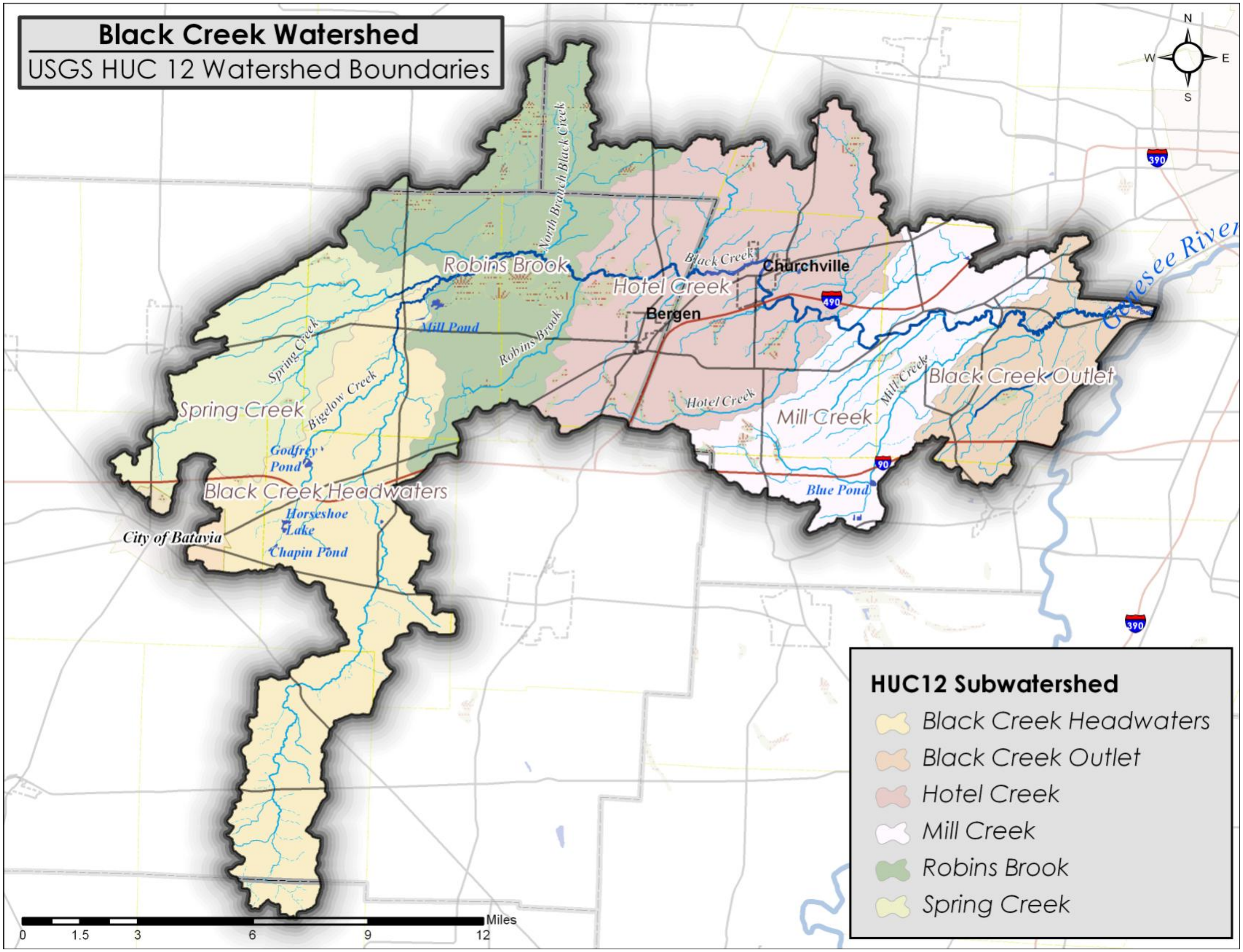
[82] Adapted from Chapter 12 of the *Handbook for Developing Watershed Plans to Restore and Protect Our Waters*. USEPA.
[83] *Guidelines for Ecological Risk Assessment*. (page 12)
[84] *Guidelines for Ecological Risk Assessment*. (page 1)
[85] *Guidelines for Ecological Risk Assessment*. [Online] In *US EPA*. Retrieved 2/2/11 from oaspub.epa.gov/eims/eimscomm.getfile?p_download_id=36512 (page 1)
[86] Invertebrates as Indicators. [Online] In USEPA. Retrieved 8/8/11 from http://www.epa.gov/bioiweb1/html/invertebrate.html
[87] *Adapting Water Management: A primer on coping with climate change*. [Online] In *World Wildlife Foundation*. Retrieved 3/1/11 from http://www.worldwildlife.org/climate/Publications/WWFBinaryitem12534.pdf
[88] *Great Lakes Communities and Ecosystems at Risk*. [Online] In *Union of Concerned Scientists*. Retrieved 3/1/11 from http://www.ucsusa.org/greatlakes/
[89] http://www.dec.ny.gov/docs/water_pdf/top10inadqtonsite.pdf
[90] Same as above
[91] Franklin, Alan B, Barry R. Noon, and T. Luke George. *What is Habitat Fragmentation?* [Online] In Global Restoration Network. Retrieved 3/1/11 from http://www.globalrestorationnetwork.org/uploads/files/LiteratureAttachments/368_what-is-habitat-fragmentation.pdf
[92] Franklin, Alan B, Barry R. Noon, and T. Luke George.
[93] Opdam, Paul and Dirk Wascher. Climate change meets habitat fragmentation: linking landscape and biogeographical scale levels in research and conservation. Biological Conservation 117 (2004) 285–297. Retrieved 11/11/11 from http://research.eeescience.utoledo.edu/lees/Teaching/EEES4760_07/Opdam.PDF.
[94] *Invasive Species Task Force*. [Online] In *New York State Department of Environmental Conservation*. Retrieved 3/1/11 from http://www.dec.ny.gov/animals/6989.html
[95] *Invasive Species Task Force*. [Online]
[96] Chemical and Petroleum Spills. [Online] In *New York State Department of Environmental Conservation*. Retrieved 3/1/11 from http://www.dec.ny.gov/chemical/8428.html
[97] Stormwater. [Online] In New York State Department of Environmental Conservation. Retrieved 3/1/11 from http://www.dec.ny.gov/chemical/8468.html
[98] NYS Stormwater Management Design Manual (August 2010). [Online] In. *New York State Department of Environmental Conservation*. Retrieved 3/1/11 from http://www.dec.ny.gov/chemical/29072.html
[99] *Identification and Analysis of the Riparian Corridor in the Black & Oatka Creek Watersheds*. [Online] In *G/FLRPC*. Retrieved 3/1/11 from http://gflrpc.org/Publications/RiparianCorridor.htm

Appendices

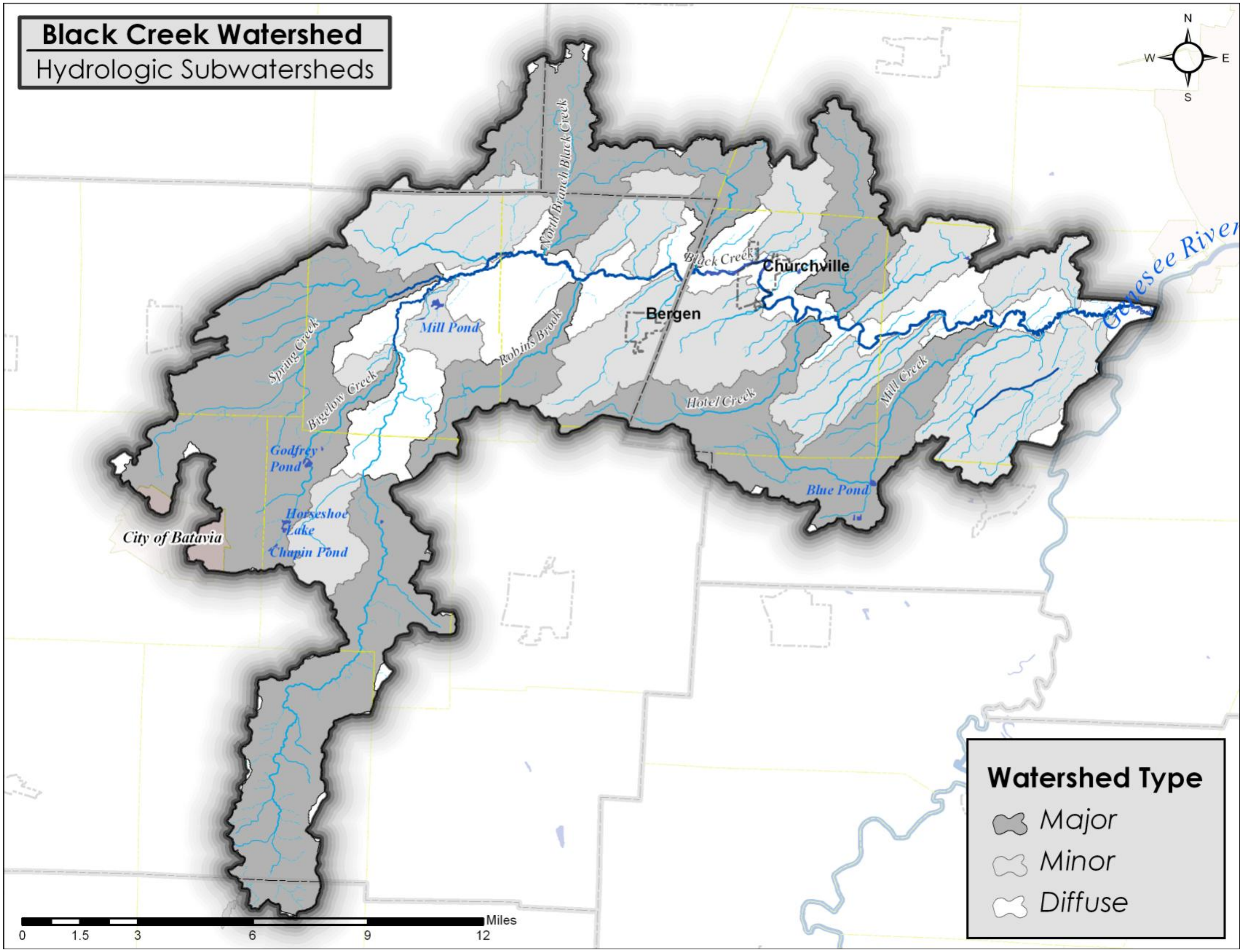
Map 1


Black Creek Watershed
Hydrology
N
W
E
S
North Branch Black Creek
Churchville Park
Black Creek
Churchville
Byron-Bergen Swamp
Bergen
Mill Pond
Spring Creek
Robins Brook
Black Creek Park
Hotel Creek
Bigelow Creek
Mill Creek
Godfrey Pond
Blue Pond
Genesee River
Horseshoe Lake
City of Batavia
Chapin Pond
Genesee County Park
390
490
90
0
1.5
3
6
9
12
Miles
Black Creek Watershed - Genesee River Basin

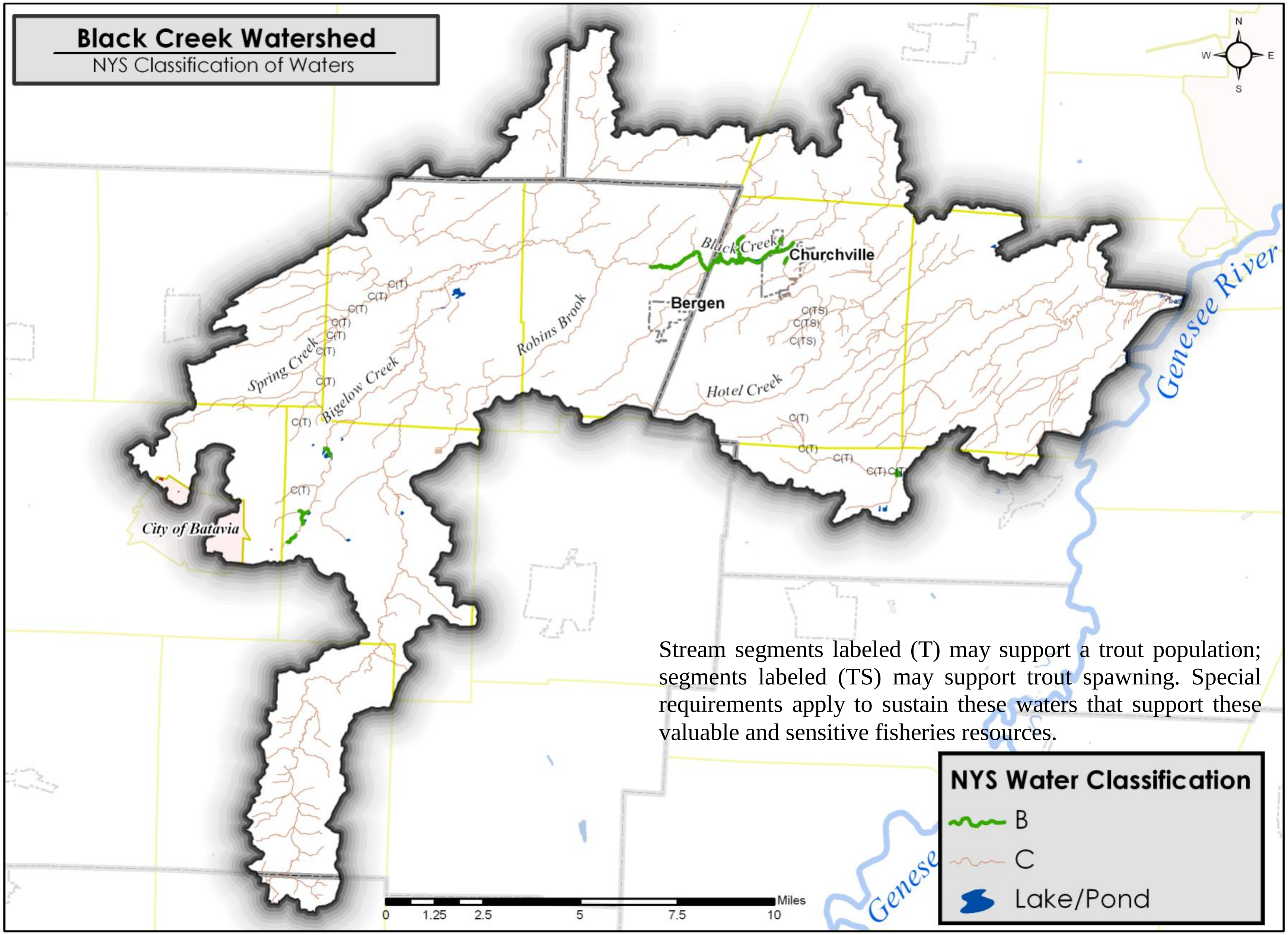
Map 2


Black Creek Watershed
USGS HUC 12 Watershed Boundaries
Robins Brook
Hotel Creek
Churchville
Bergen
Black Creek
North Branch Black Creek
Mill Pond
Robins Brook
Spring Creek
Bigelow Creek
Spring Creek
Godfrey Pond
Black Creek Headwaters
Horseshoe Lake
Chapin Pond
City of Batavia
Hotel Creek
Mill Creek
Mill Creek
Black Creek Outlet
Blue Pond
Genesee River
490
390
90
HUC12 Subwatershed
Black Creek Headwaters
Black Creek Outlet
Hotel Creek
Mill Creek
Robins Brook
Spring Creek
0 1.5 3 6 9 12 Miles
N S E W

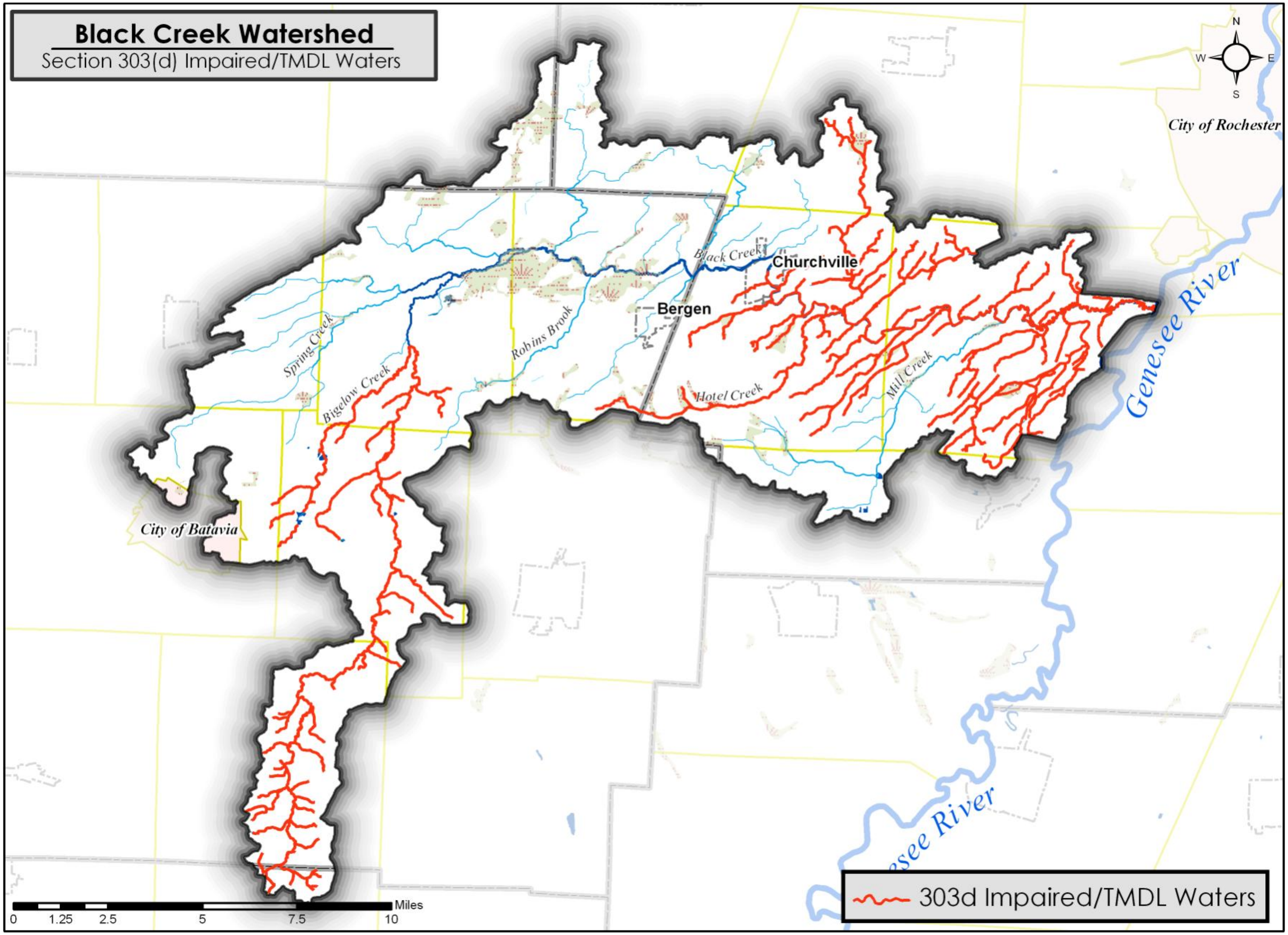
Map 3


Black Creek Watershed
Hydrologic Subwatersheds
N
W
E
S
Genesee River
North Branch Black Creek
Black Creek
Churchville
Bergen
Mill Pond
Robins Brook
Spring Creek
Bigelow Creek
Hotel Creek
Mill Creek
Godfrey Pond
Horseshoe Lake
Chapin Pond
City of Batavia
Blue Pond
Watershed Type
Major
Minor
Diffuse
0
1.5
3
6
9
12
Miles

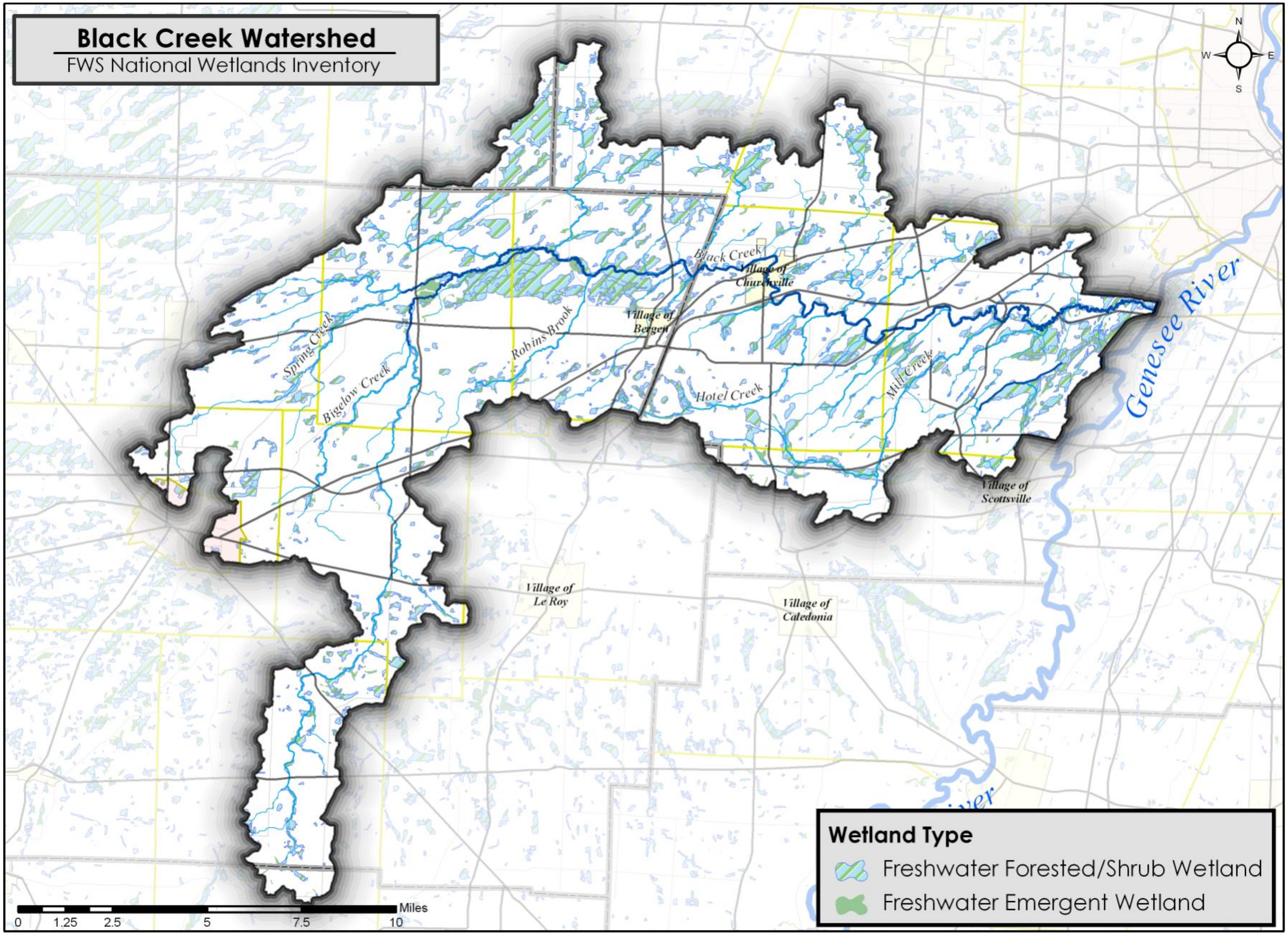
Map 4


Black Creek Watershed
NYS Classification of Waters
N
W
E
S
Black Creek
Churchville
Bergen
Robins Brook
Spring Creek
Bigelow Creek
Hotel Creek
City of Batavia
Genesee River
C(T)
C(TS)
Stream segments labeled (T) may support a trout population; segments labeled (TS) may support trout spawning. Special requirements apply to sustain these waters that support these valuable and sensitive fisheries resources.
NYS Water Classification
B
C
Lake/Pond
0
1.25
2.5
5
7.5
10
Miles

Map 5

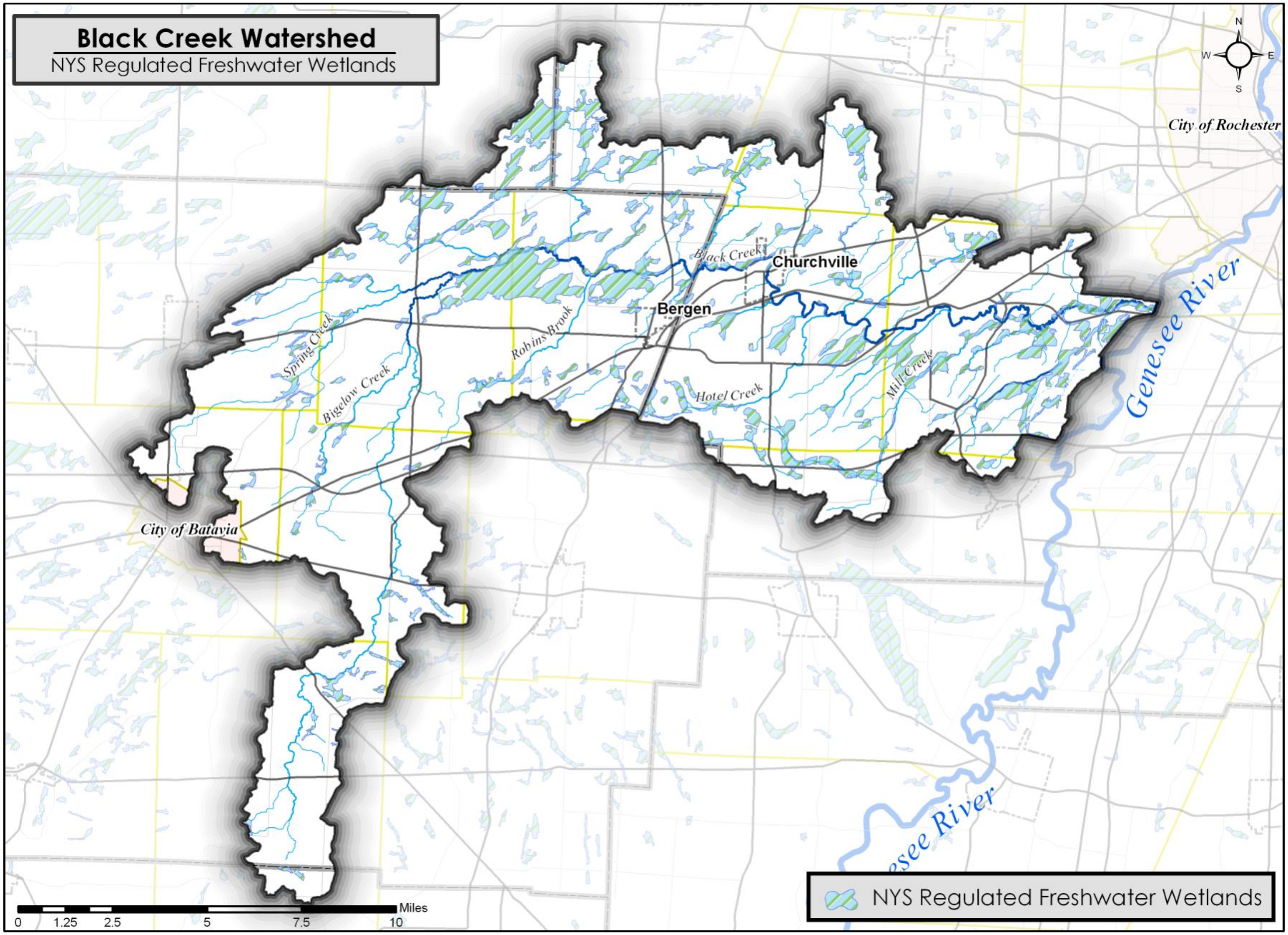

Black Creek Watershed
Section 303(d) Impaired/TMDL Waters
N
W
E
S
City of Rochester
Black Creek
Churchville
Bergen
Spring Creek
Robins Brook
Bigelow Creek
Hotel Creek
Mill Creek
Genesee River
City of Batavia
Genesee River
303d Impaired/TMDL Waters
0
1.25
2.5
5
7.5
10
Miles

Map 6

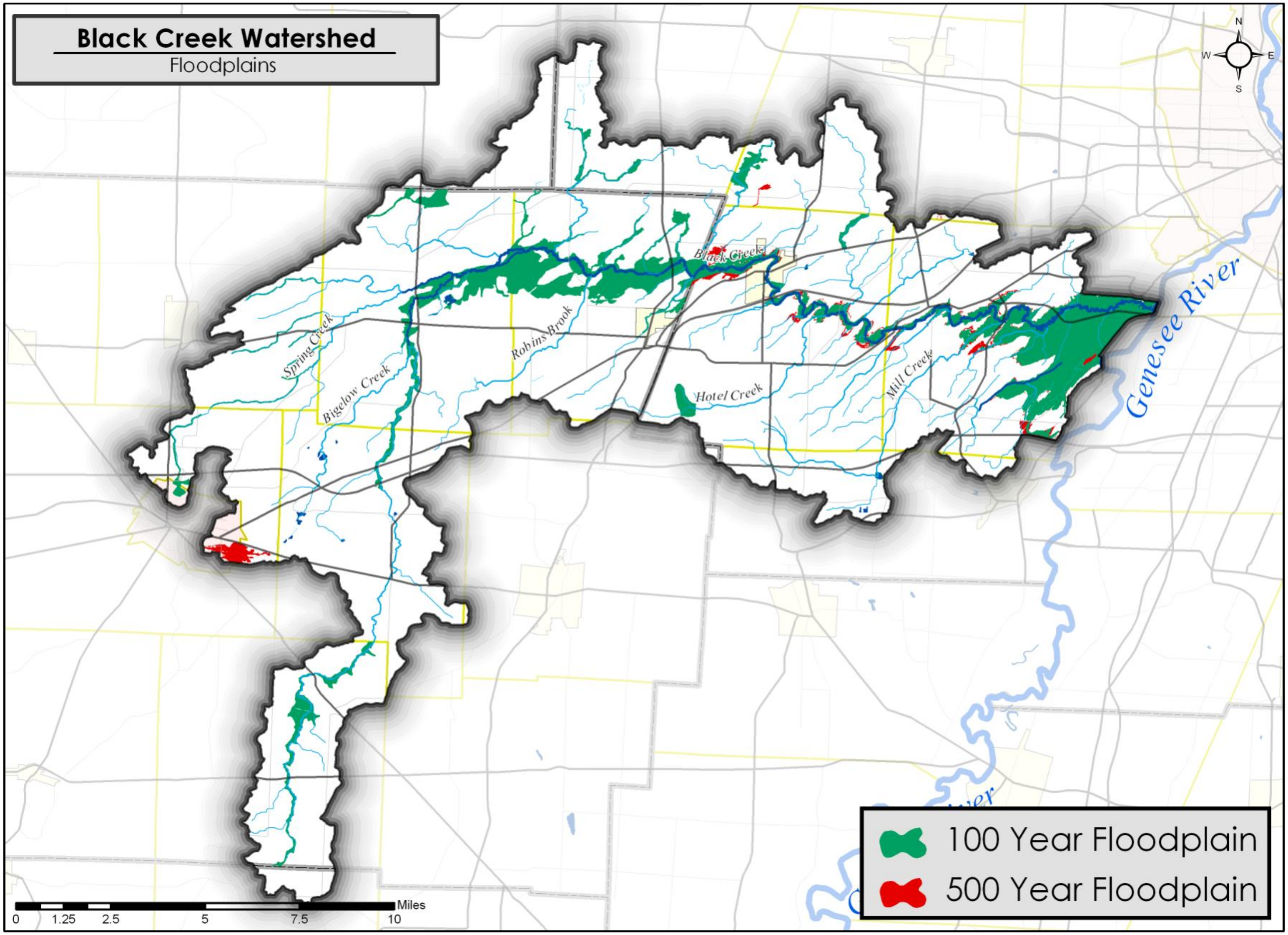


Black Creek Watershed
FWS National Wetlands Inventory
N
W
E
S
Black Creek
Village of Churchville
Village of Bergen
Spring Creek
Bigelow Creek
Robins Brook
Hotel Creek
Mill Creek
Genesee River
Village of Scottsville
Village of Le Roy
Village of Caledonia
Wetland Type
Freshwater Forested/Shrub Wetland
Freshwater Emergent Wetland
0
1.25
2.5
5
7.5
10
Miles

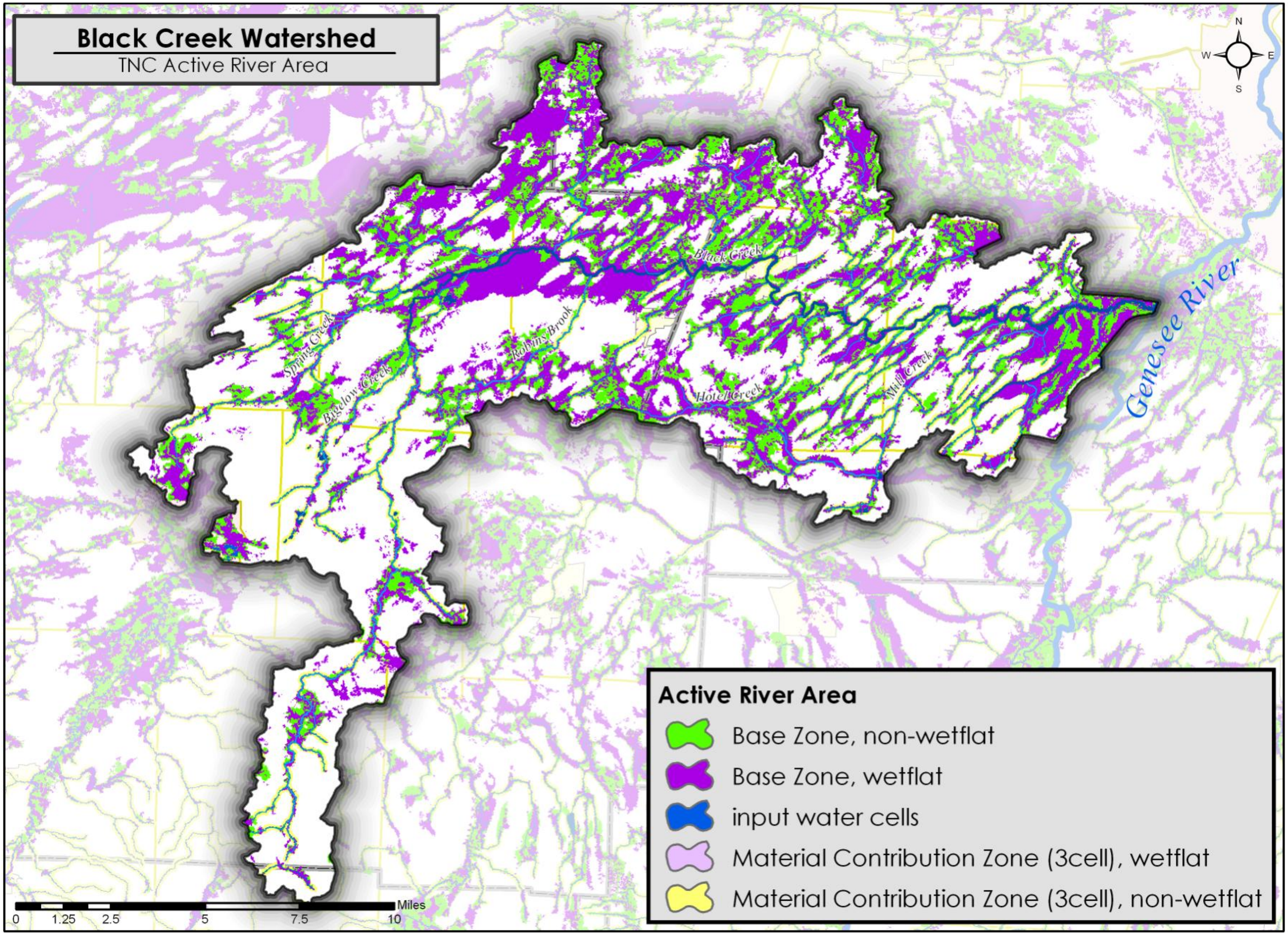
Map 7


Black Creek Watershed
NYS Regulated Freshwater Wetlands
City of Rochester
Churchville
Bergen
Black Creek
Spring Creek
Bigelow Creek
Robins Brook
Hotel Creek
Mill Creek
Genesee River
City of Batavia
N
S
E
W
0
1.25
2.5
5
7.5
10
Miles
NYS Regulated Freshwater Wetlands

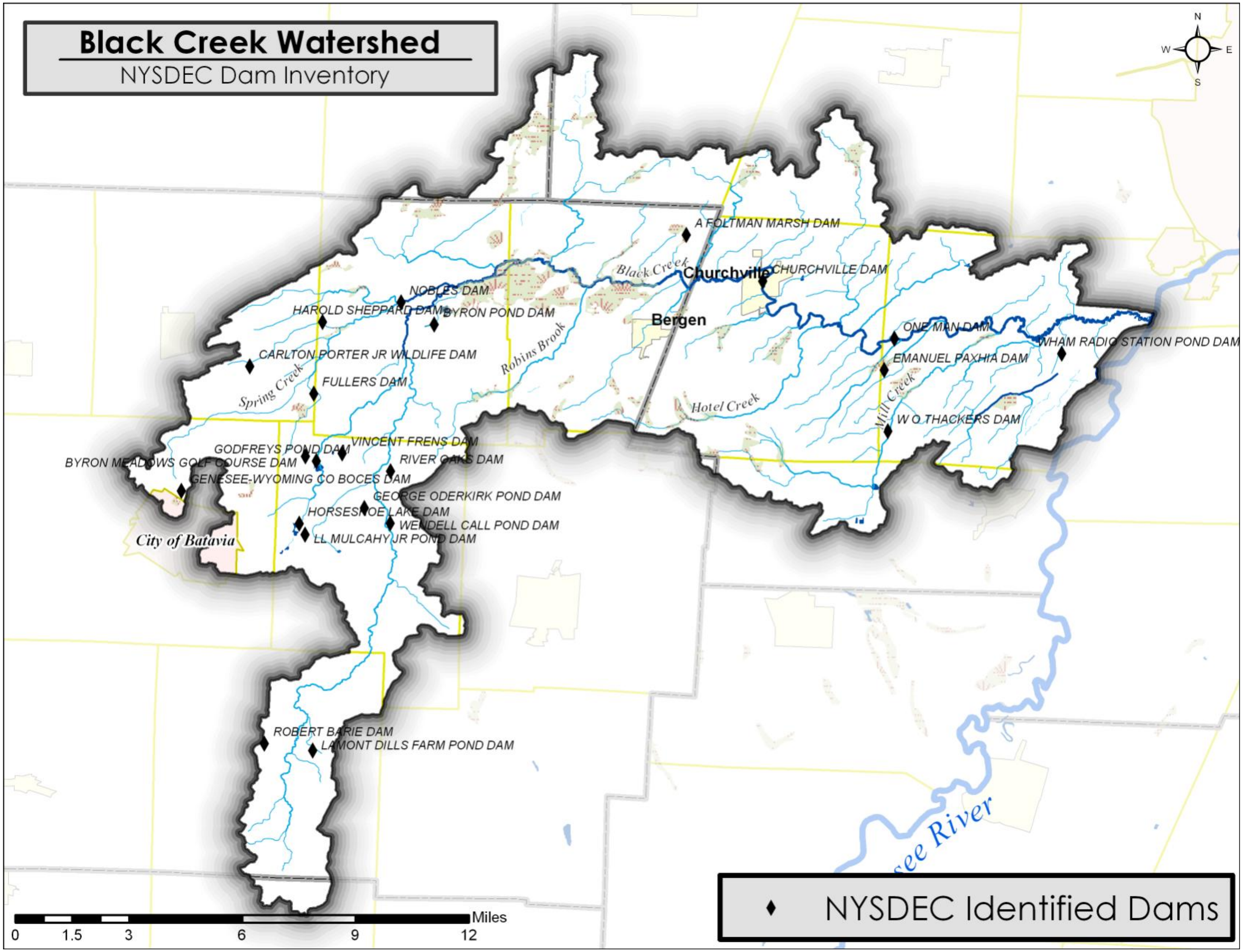
Map 8


Black Creek Watershed
Floodplains
N
W
E
S
Black Creek
Spring Creek
Bigelow Creek
Robins Brook
Hotel Creek
Mill Creek
Genesee River
100 Year Floodplain
500 Year Floodplain
Miles
0
1.25
2.5
5
7.5
10

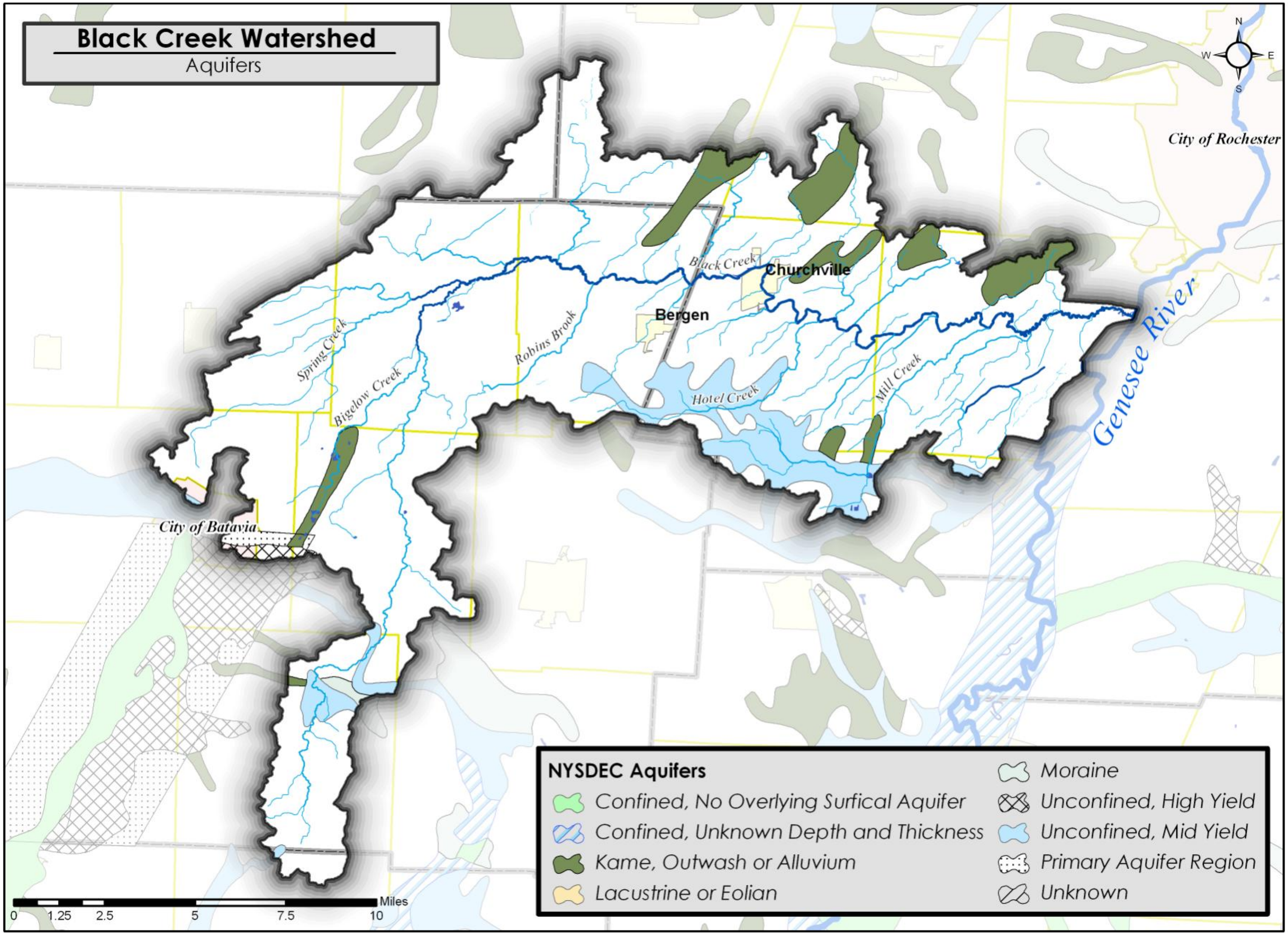
Map 9


Black Creek Watershed
TNC Active River Area
Black Creek
Spring Creek
Bigelow Creek
Robins Brook
Hotel Creek
Mill Creek
Genesee River
N
W
E
S
Active River Area
Base Zone, non-wetflat
Base Zone, wetflat
input water cells
Material Contribution Zone (3cell), wetflat
Material Contribution Zone (3cell), non-wetflat
0
1.25
2.5
5
7.5
10
Miles

Map 10

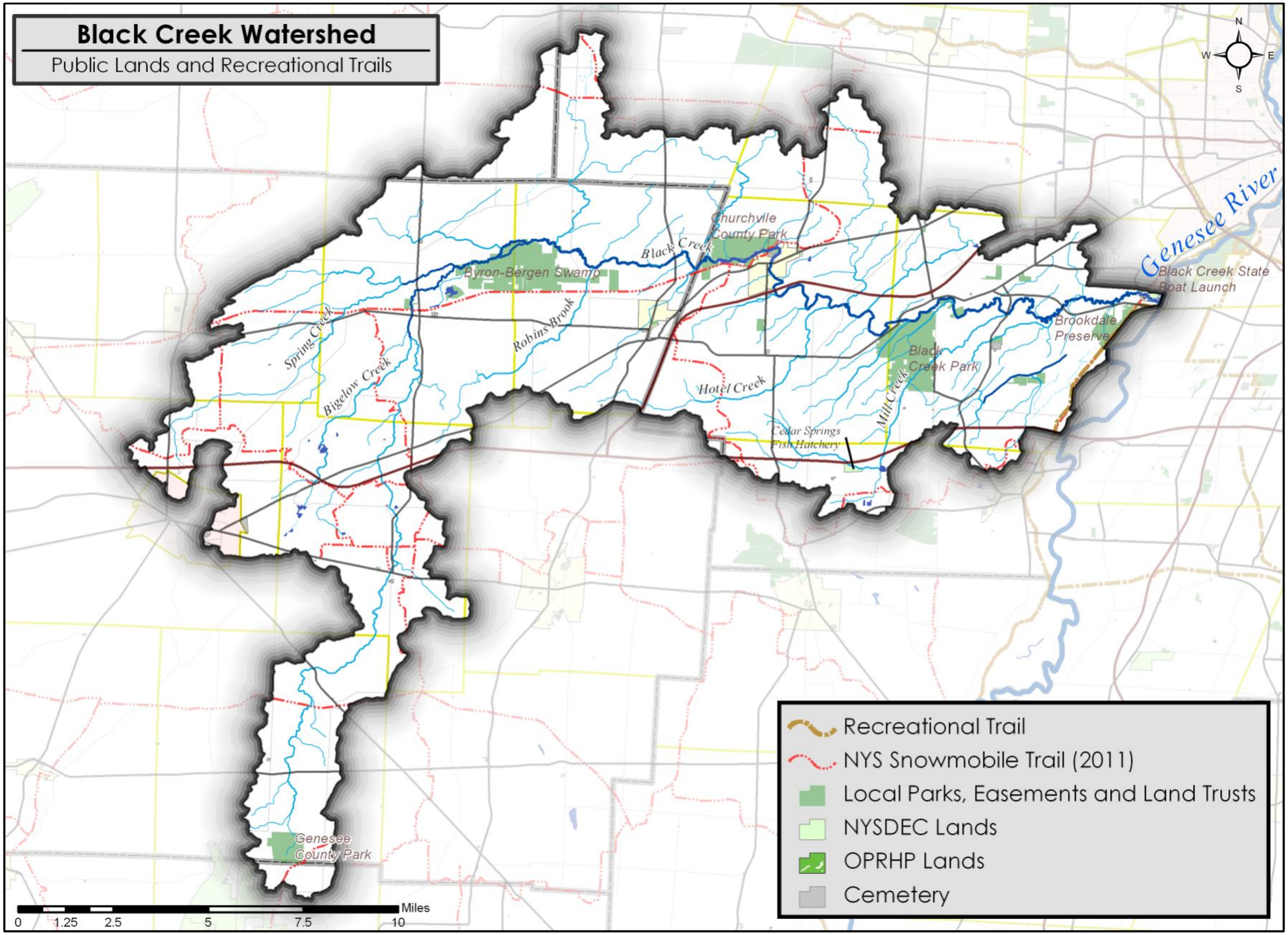

Black Creek Watershed
NYSDEC Dam Inventory
N
W
E
S
A FOLTMAN MARSH DAM
Black Creek
Churchville
CHURCHVILLE DAM
NOBLES DAM
HAROLD SHEPPARD DAM
BYRON POND DAM
Bergen
ONE MAN DAM
WHAM RADIO STATION POND DAM
EMANUEL PAXHIA DAM
CARLTON PORTER JR WILDLIFE DAM
Robins Brook
Spring Creek
FULLERS DAM
Hotel Creek
Mill Creek
W O THACKERS DAM
GODFREYS POND DAM
VINCENT FRENS DAM
BYRON MEADOWS GOLF COURSE DAM
RIVER OAKS DAM
GENESEE-WYOMING CO BOCES DAM
GEORGE ODERKIRK POND DAM
HORSESHOE LAKE DAM
WENDELL CALL POND DAM
City of Batavia
LL MULCAHY JR POND DAM
ROBERT BARIE DAM
LAMONT DILLS FARM POND DAM
see River
Miles
0
1.5
3
6
9
12
NYSDEC Identified Dams

Map 11

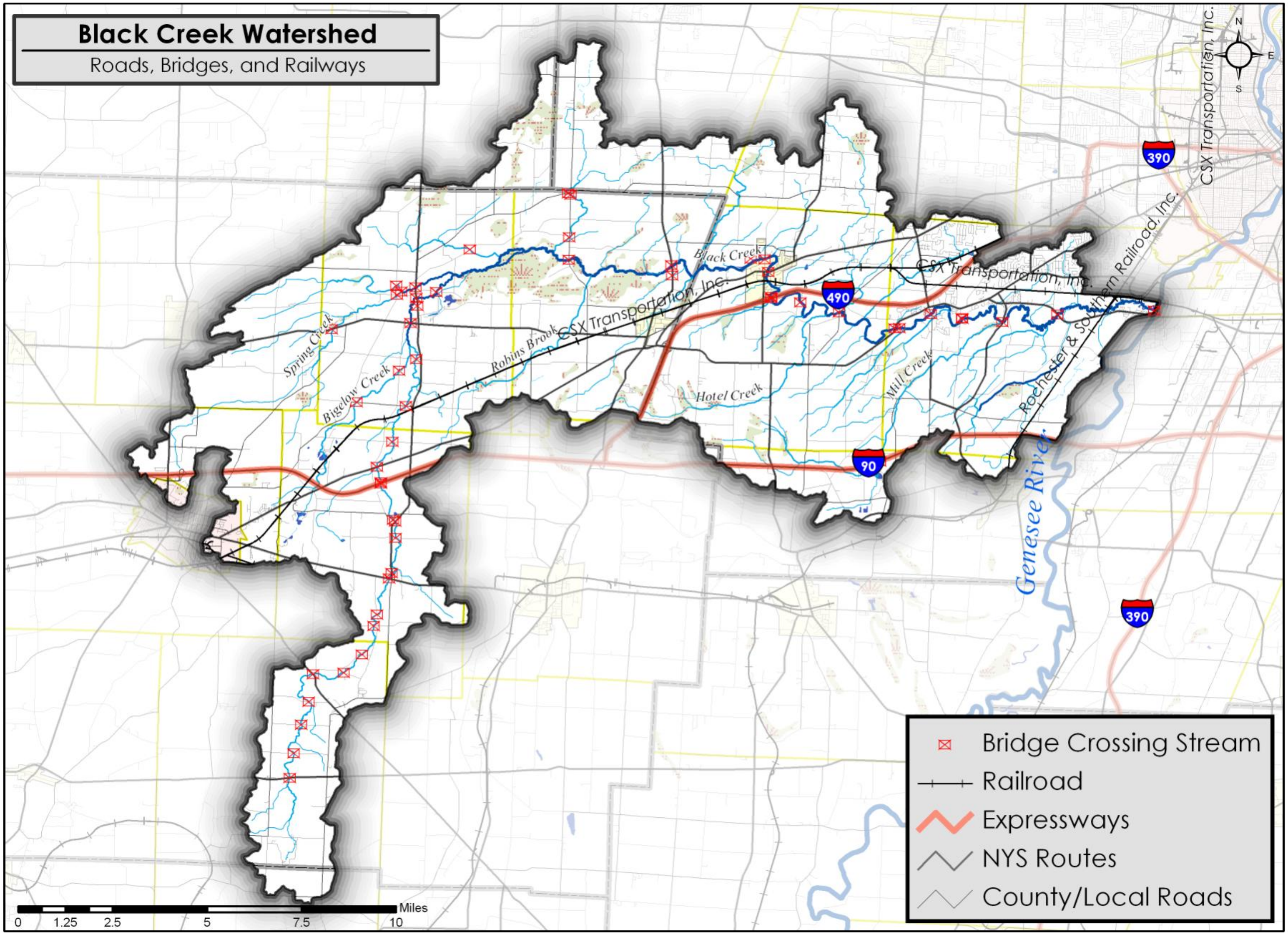


Black Creek Watershed
Aquifers
City of Rochester
Black Creek
Churchville
Bergen
Spring Creek
Bigelow Creek
Robins Brook
Hotel Creek
Mill Creek
Genesee River
City of Batavia
NYSDEC Aquifers
Confined, No Overlying Surfical Aquifer
Confined, Unknown Depth and Thickness
Kame, Outwash or Alluvium
Lacustrine or Eolian
Moraine
Unconfined, High Yield
Unconfined, Mid Yield
Primary Aquifer Region
Unknown
0 1.25 2.5 5 7.5 10
Miles
N
W
E
S

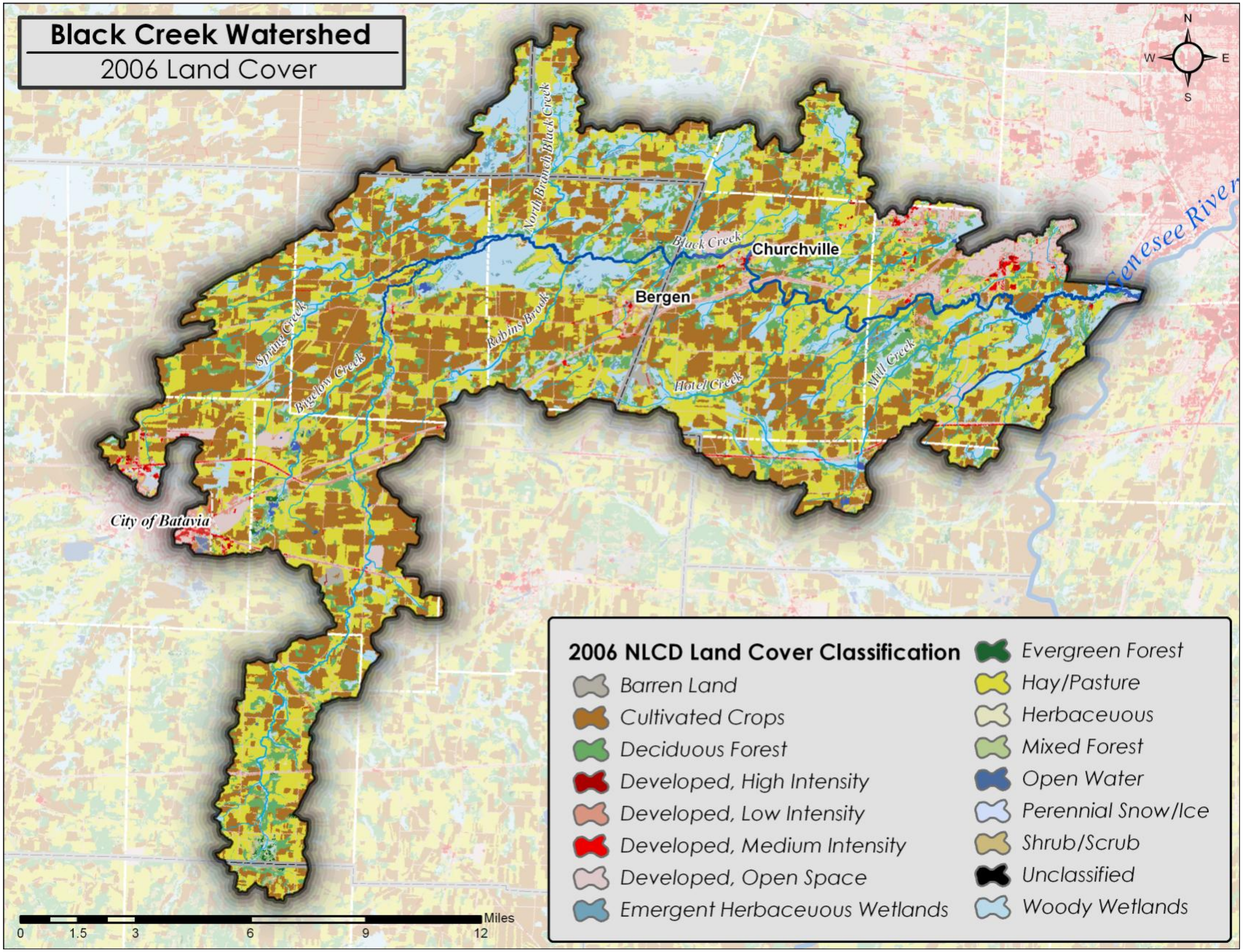
Map 12


Black Creek Watershed
Public Lands and Recreational Trails
Genesee River
Black Creek State Boat Launch
Brookdale Preserve
Black Creek Park
Churchville County Park
Black Creek
Byron-Bergen Swamp
Robins Brook
Spring Creek
Bigelow Creek
Hotel Creek
Mill Creek
Cedar Springs Fish Hatchery
Genesee County Park
Recreational Trail
NYS Snowmobile Trail (2011)
Local Parks, Easements and Land Trusts
NYSDEC Lands
OPRHP Lands
Cemetery
Miles
0
1.25
2.5
5
7.5
10
N
S
E
W

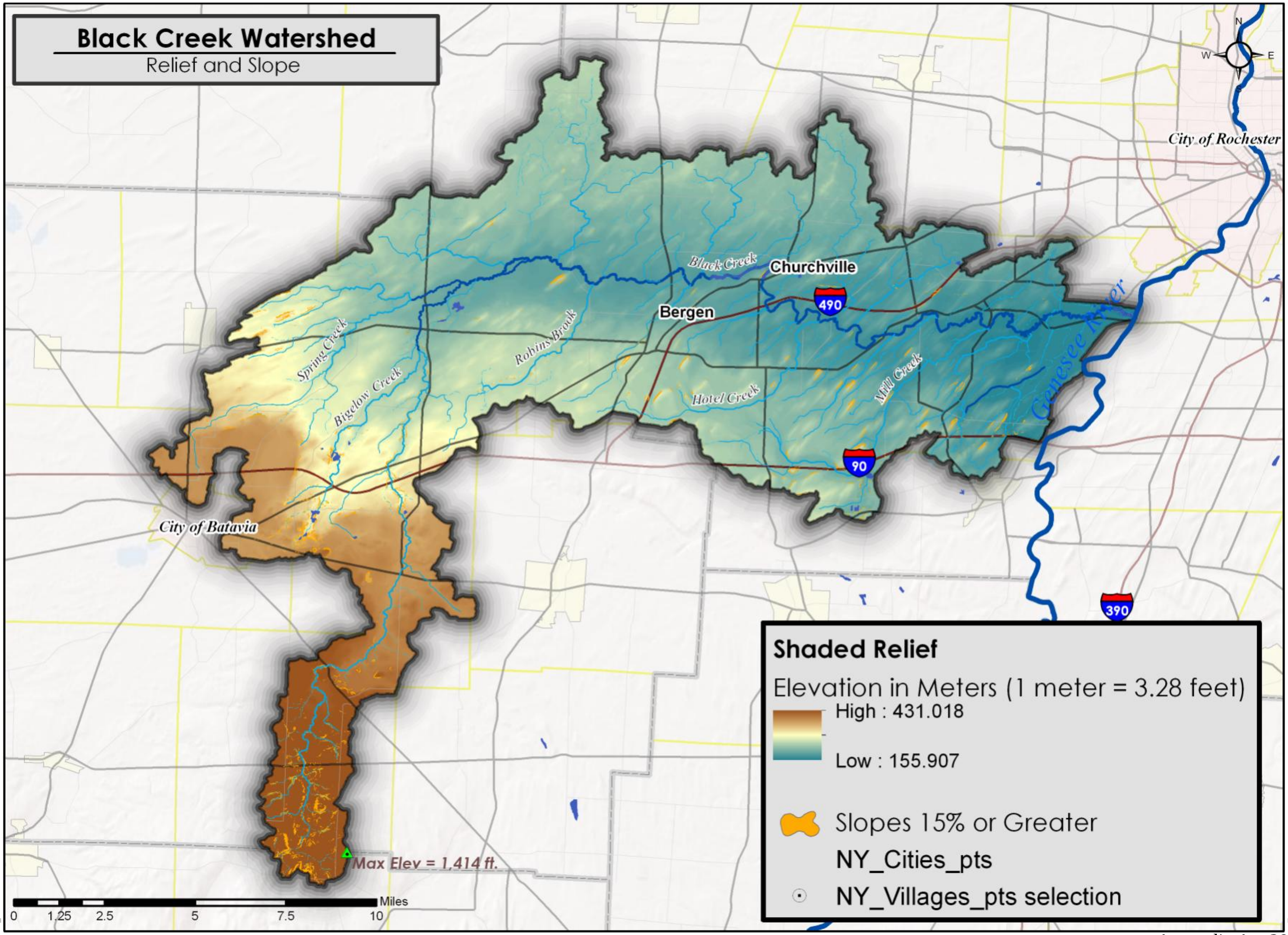
Map 13


Black Creek Watershed
Roads, Bridges, and Railways
Black Creek
Spring Creek
Bigelow Creek
Robins Brook
Hotel Creek
Mill Creek
CSX Transportation, Inc.
Rochester & Southern Railroad, Inc.
Genesee River
390
490
90
Bridge Crossing Stream
Railroad
Expressways
NYS Routes
County/Local Roads
0 1.25 2.5 5 7.5 10 Miles

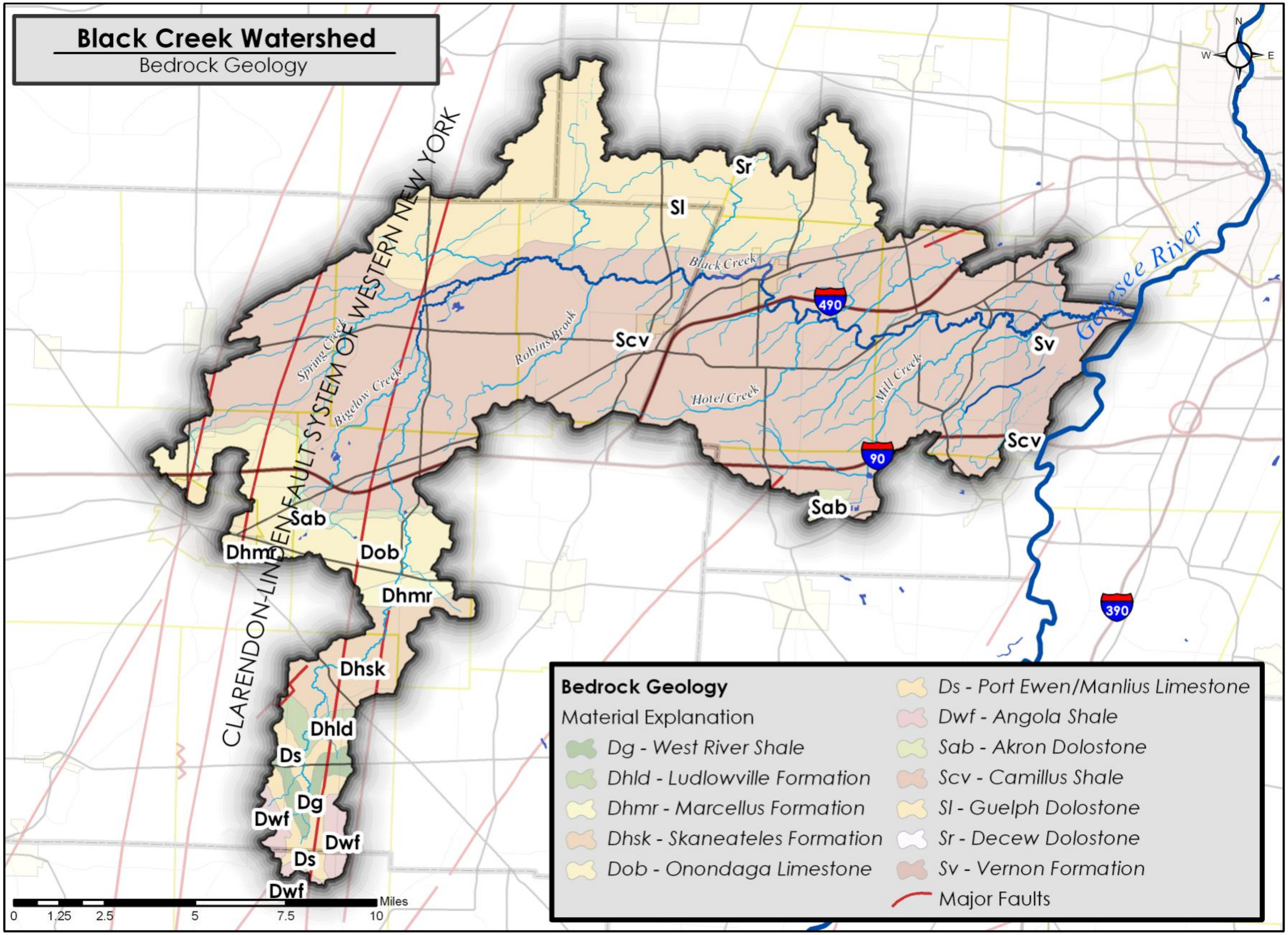
Map 14


Black Creek Watershed
2006 Land Cover
N
W
E
S
North Branch Black Creek
Black Creek
Churchville
Bergen
Genesee River
Spring Creek
Bigelow Creek
Robins Brook
Hotel Creek
Mill Creek
City of Batavia
0
1.5
3
6
9
12
Miles
2006 NLCD Land Cover Classification
Barren Land
Cultivated Crops
Deciduous Forest
Developed, High Intensity
Developed, Low Intensity
Developed, Medium Intensity
Developed, Open Space
Emergent Herbaceuous Wetlands
Evergreen Forest
Hay/Pasture
Herbaceuous
Mixed Forest
Open Water
Perennial Snow/Ice
Shrub/Scrub
Unclassified
Woody Wetlands

Map 15

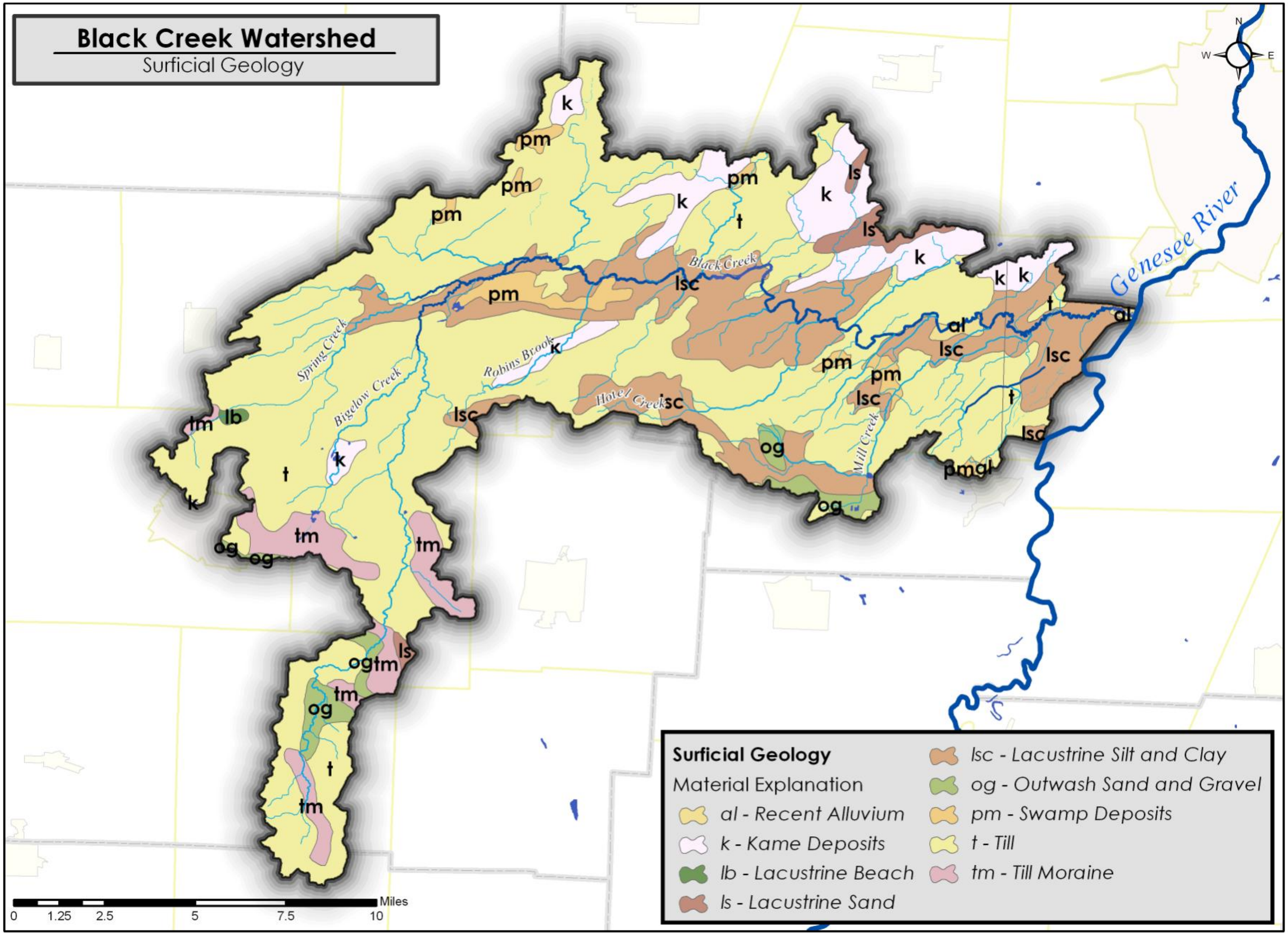

Black Creek Watershed
Relief and Slope
City of Rochester
Black Creek
Churchville
490
Bergen
Spring Creek
Robins Brook
Bigelow Creek
Hotel Creek
Mill Creek
Genesee River
90
City of Batavia
390
Max Elev = 1,414 ft.
0
1.25
2.5
5
7.5
10
Miles
Shaded Relief
Elevation in Meters (1 meter = 3.28 feet)
High : 431.018
Low : 155.907
Slopes 15% or Greater
NY_Cities_pts
NY_Villages_pts selection

Map 16



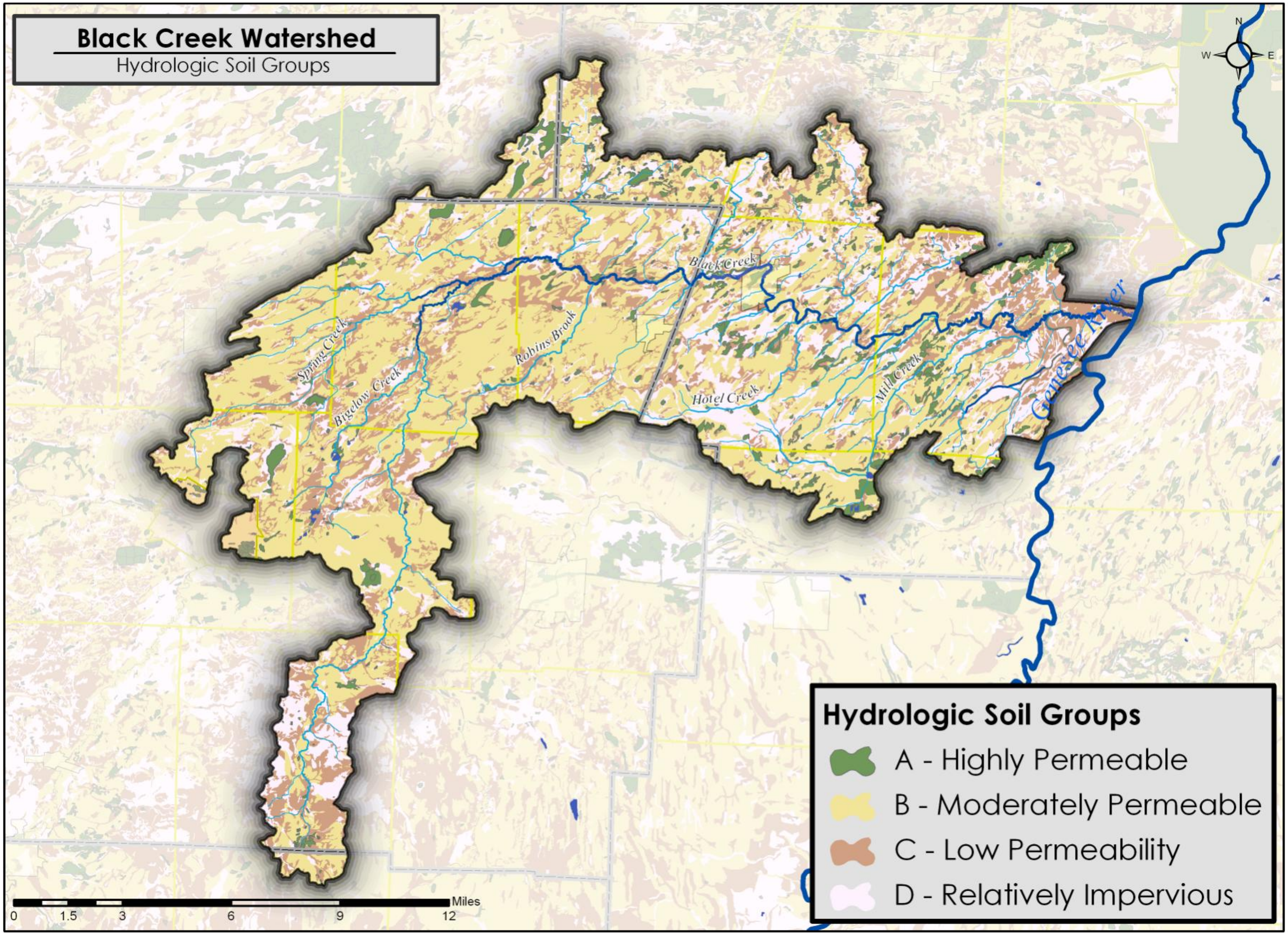
Black Creek Watershed
Bedrock Geology
CLARENDON-LINDEN FAULT SYSTEM OF WESTERN NEW YORK
Sr
Sl
Scv
Sv
Sab
Dhmr
Dob
Dhsk
Dhld
Ds
Dg
Dwf
Black Creek
Spring Creek
Bigelow Creek
Robins Brook
Hotel Creek
Mill Creek
Genesee River
490
90
390
N
W
E
0
1.25
2.5
5
7.5
10
Miles
Bedrock Geology
Material Explanation
Dg - West River Shale
Dhld - Ludlowville Formation
Dhmr - Marcellus Formation
Dhsk - Skaneateles Formation
Dob - Onondaga Limestone
Ds - Port Ewen/Manlius Limestone
Dwf - Angola Shale
Sab - Akron Dolostone
Scv - Camillus Shale
Sl - Guelph Dolostone
Sr - Decew Dolostone
Sv - Vernon Formation
Major Faults

Map 17

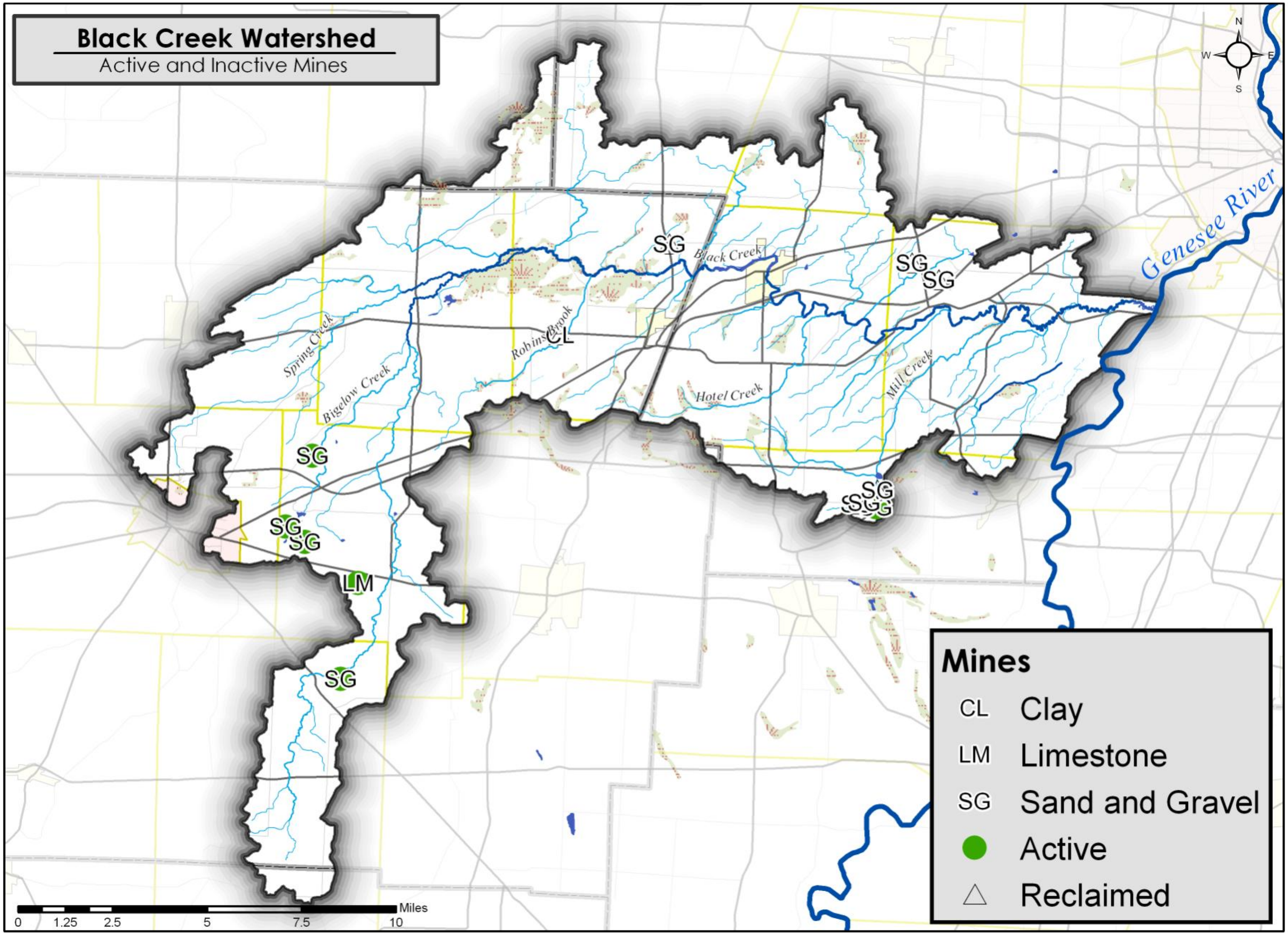


Black Creek Watershed
Surficial Geology
Genesee River
Black Creek
Spring Creek
Bigelow Creek
Robins Brook
Hotel Creek
Mill Creek
N
W
E
Surficial Geology
Material Explanation
al - Recent Alluvium
k - Kame Deposits
lb - Lacustrine Beach
ls - Lacustrine Sand
lsc - Lacustrine Silt and Clay
og - Outwash Sand and Gravel
pm - Swamp Deposits
t - Till
tm - Till Moraine
Miles
0 1.25 2.5 5 7.5 10

Map 18

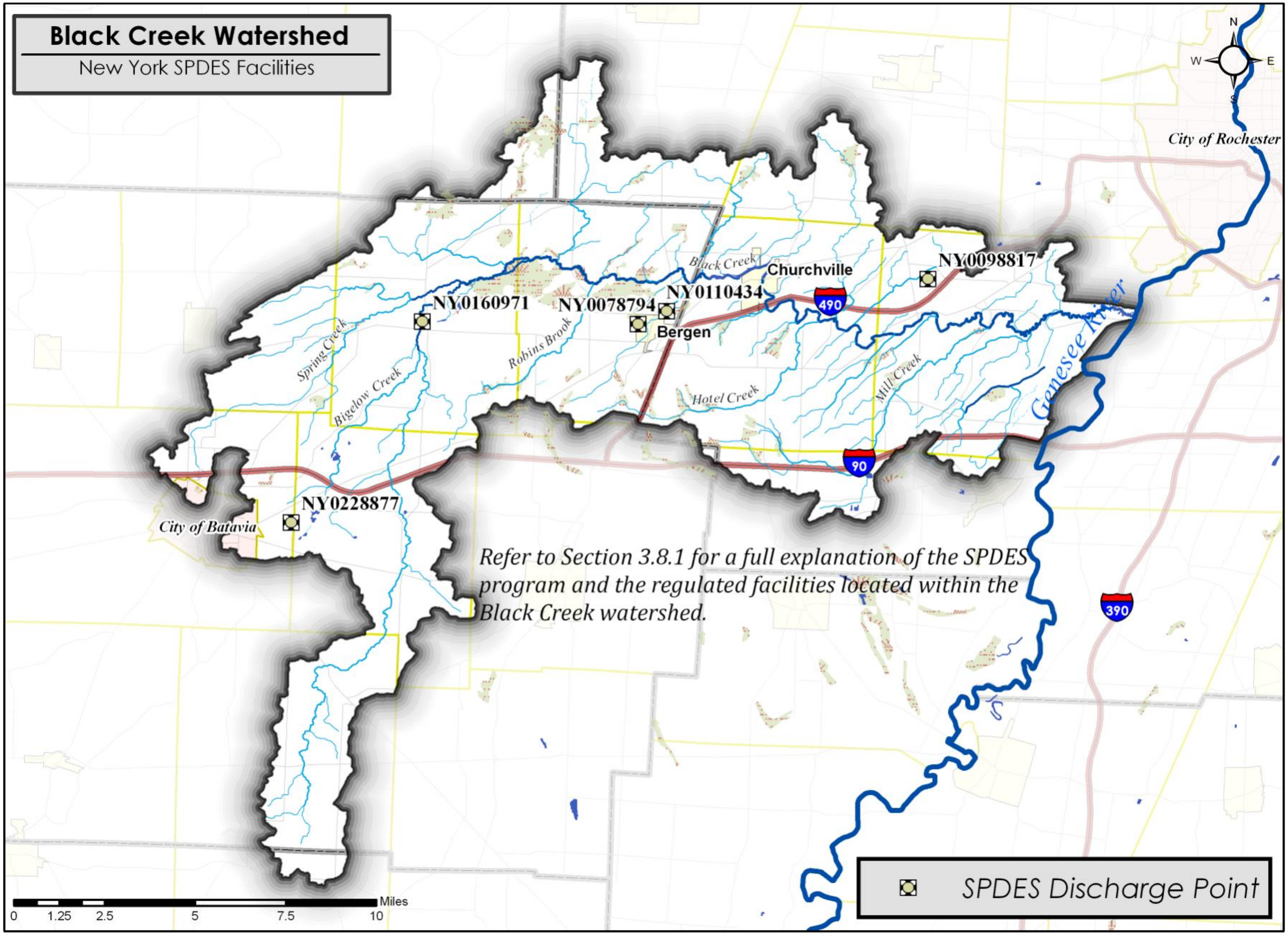

Black Creek Watershed
Hydrologic Soil Groups
Black Creek
Spring Creek
Bigelow Creek
Robins Brook
Hotel Creek
Mill Creek
Genesee River
N
W
E
0
1.5
3
6
9
12
Miles
Hydrologic Soil Groups
A - Highly Permeable
B - Moderately Permeable
C - Low Permeability
D - Relatively Impervious

Map 19



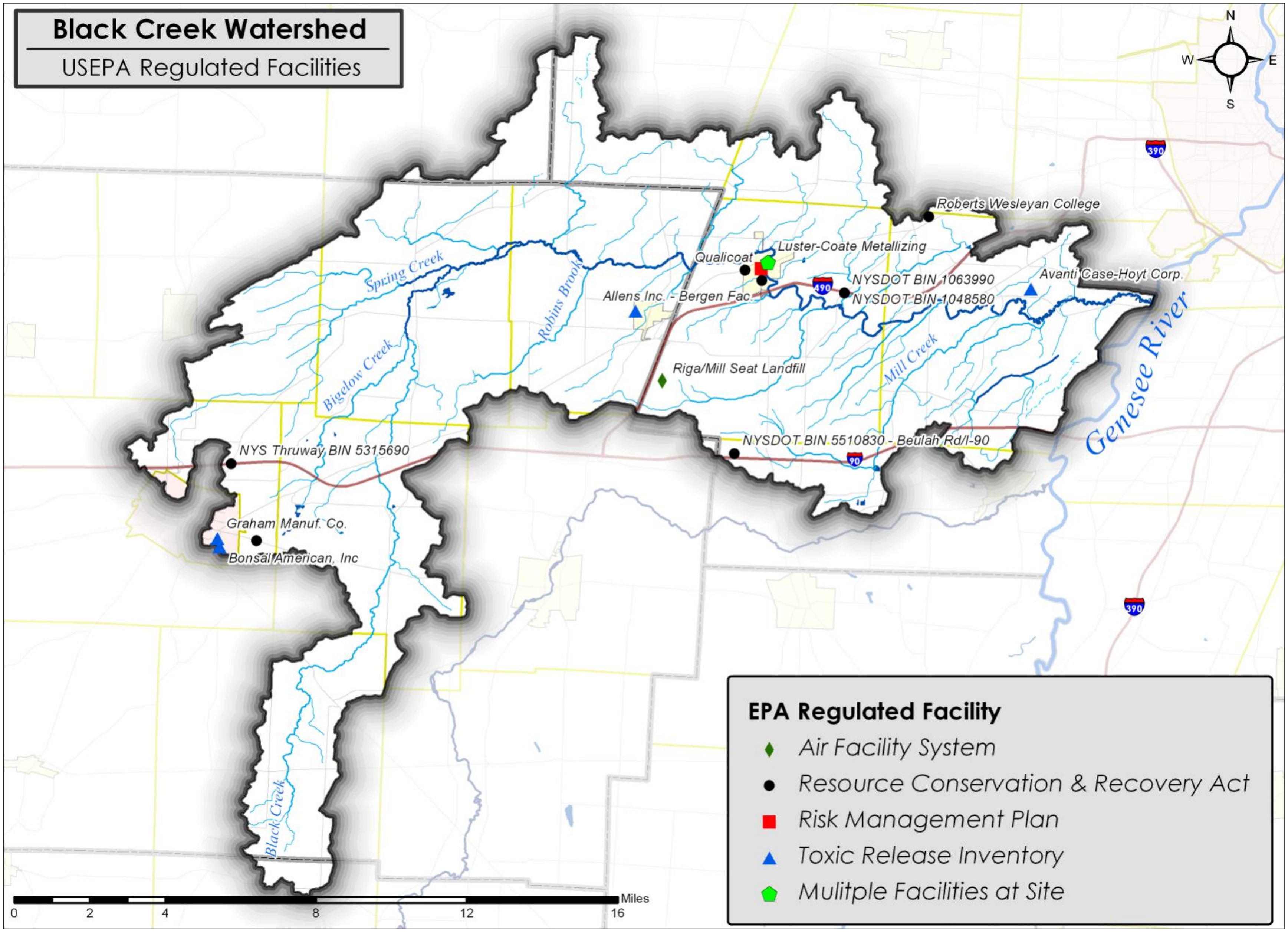
Black Creek Watershed
Active and Inactive Mines
N
W
E
S
Genesee River
Black Creek
Spring Creek
Bigelow Creek
Robins Brook
Hotel Creek
Mill Creek
SG
CL
LM
Mines
CL Clay
LM Limestone
SG Sand and Gravel
Active
Reclaimed
Miles
0 1.25 2.5 5 7.5 10

Map 20



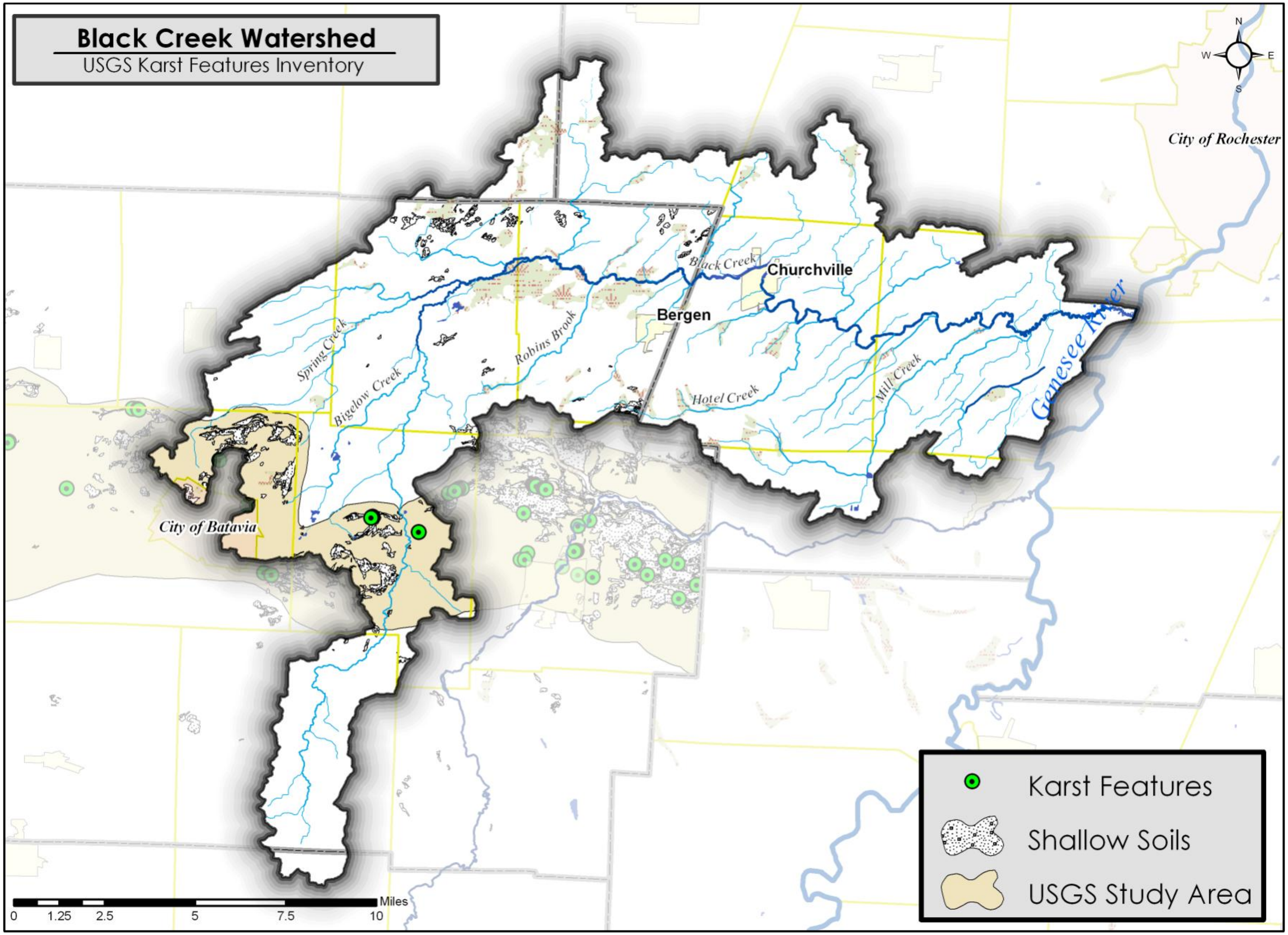
Black Creek Watershed
New York SPDES Facilities
N
W
E
S
City of Rochester
NY0098817
Churchville
Black Creek
NY0110434
NY0160971
NY0078794
Bergen
490
Genesee River
Spring Creek
Bigelow Creek
Robins Brook
Hotel Creek
Mill Creek
90
NY0228877
City of Batavia
Refer to Section 3.8.1 for a full explanation of the SPDES program and the regulated facilities located within the Black Creek watershed.
390
SPDES Discharge Point
Miles
0 1.25 2.5 5 7.5 10

Map 21



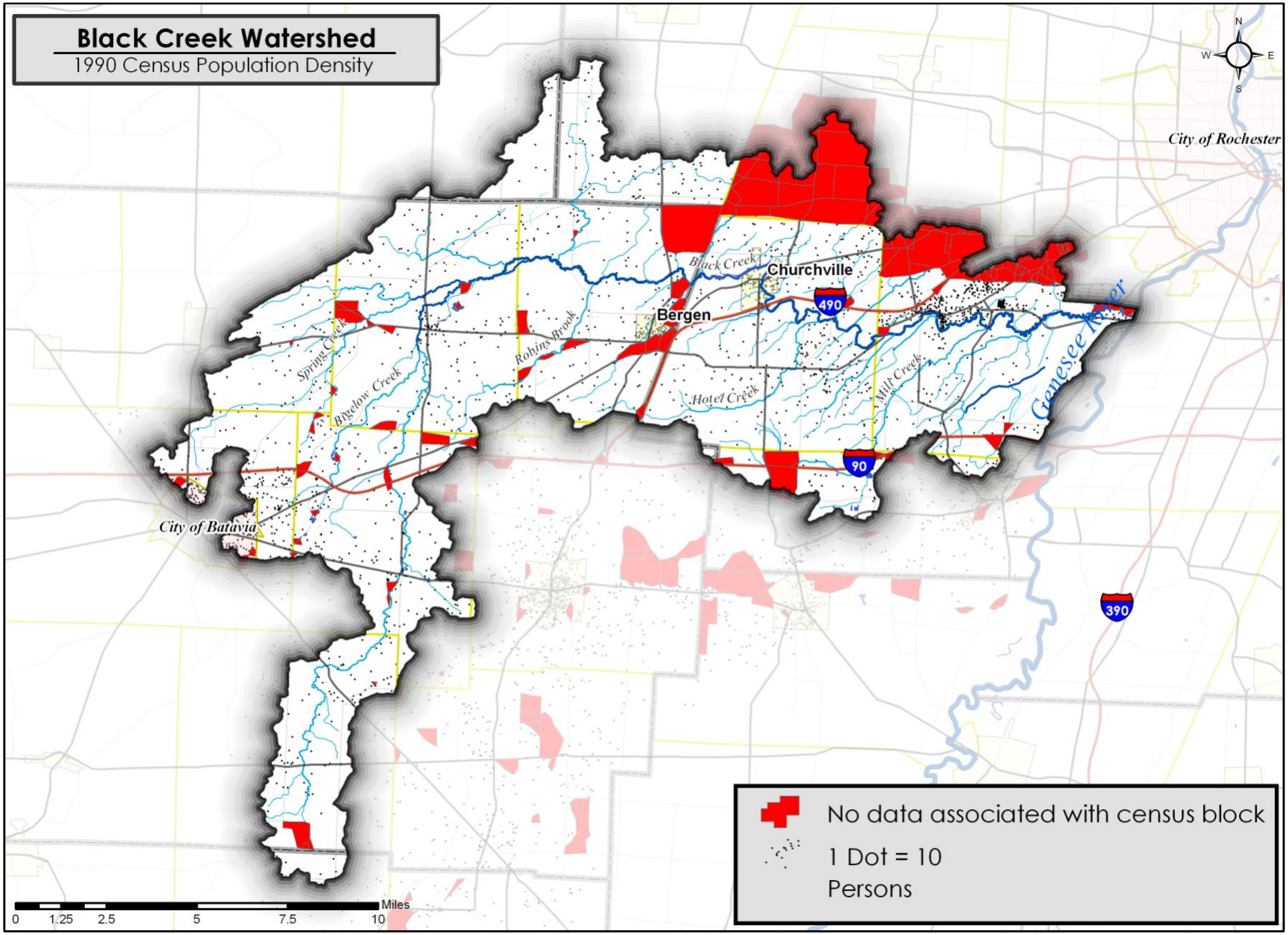
Black Creek Watershed
USEPA Regulated Facilities
N
W
E
S
Roberts Wesleyan College
Luster-Coate Metallizing
Qualicoat
NYSDOT BIN 1063990
NYSDOT BIN 1048580
Avanti Case-Hoyt Corp.
Allens Inc. - Bergen Fac.
Spring Creek
Robins Brook
Bigelow Creek
Mill Creek
Riga/Mill Seat Landfill
Genesee River
NYS Thruway BIN 5315690
NYSDOT BIN 5510830 - Beulah Rd/I-90
Graham Manuf. Co.
Bonsal American, Inc
Black Creek
390
490
90
Miles
0
2
4
8
12
16
EPA Regulated Facility
Air Facility System
Resource Conservation & Recovery Act
Risk Management Plan
Toxic Release Inventory
Mulitple Facilities at Site

Map 22

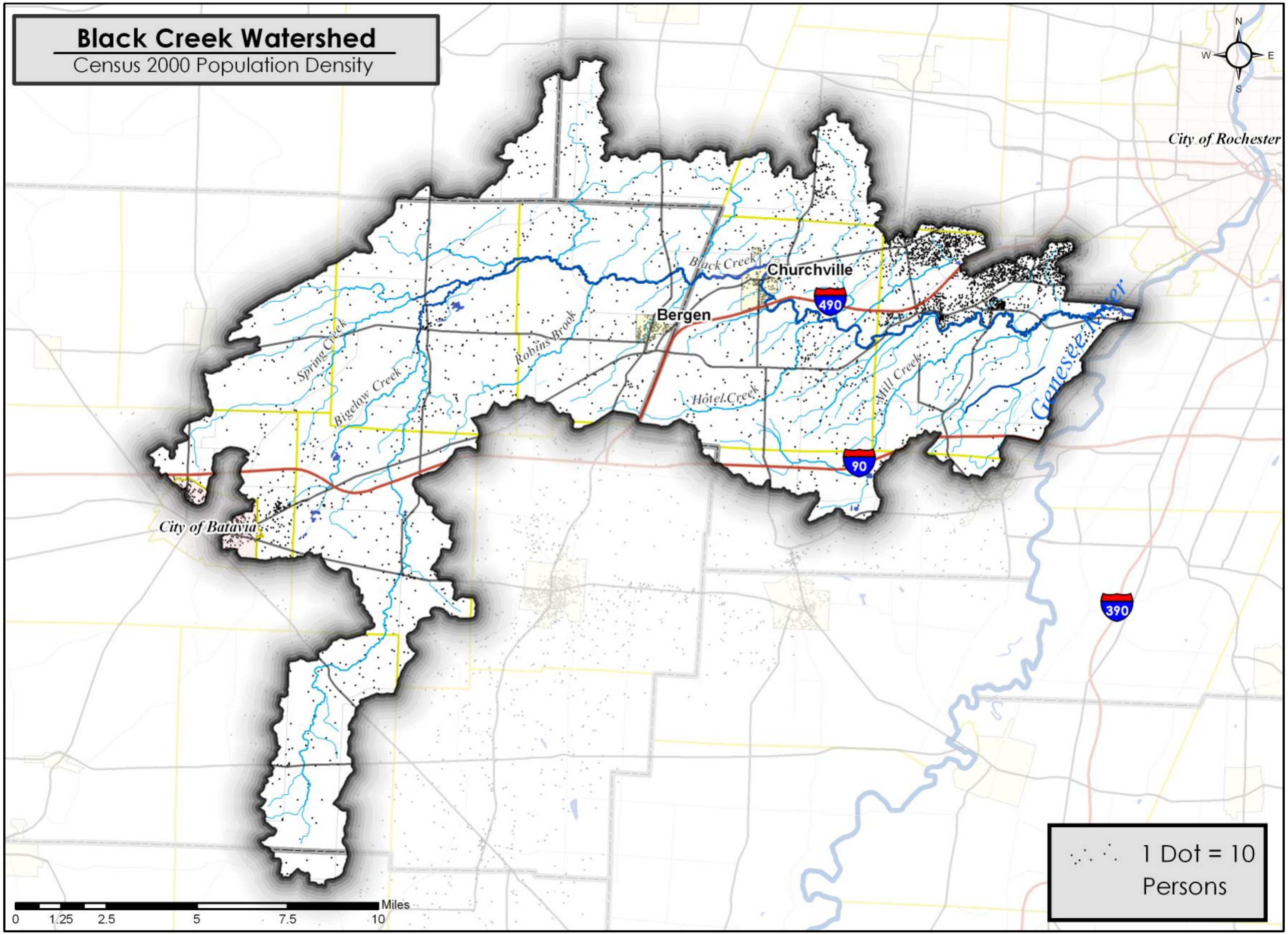


Black Creek Watershed
USGS Karst Features Inventory
N
W
E
S
City of Rochester
Black Creek
Churchville
Bergen
Spring Creek
Bigelow Creek
Robins Brook
Hotel Creek
Mill Creek
Genesee River
City of Batavia
0
1.25
2.5
5
7.5
10
Miles
Karst Features
Shallow Soils
USGS Study Area

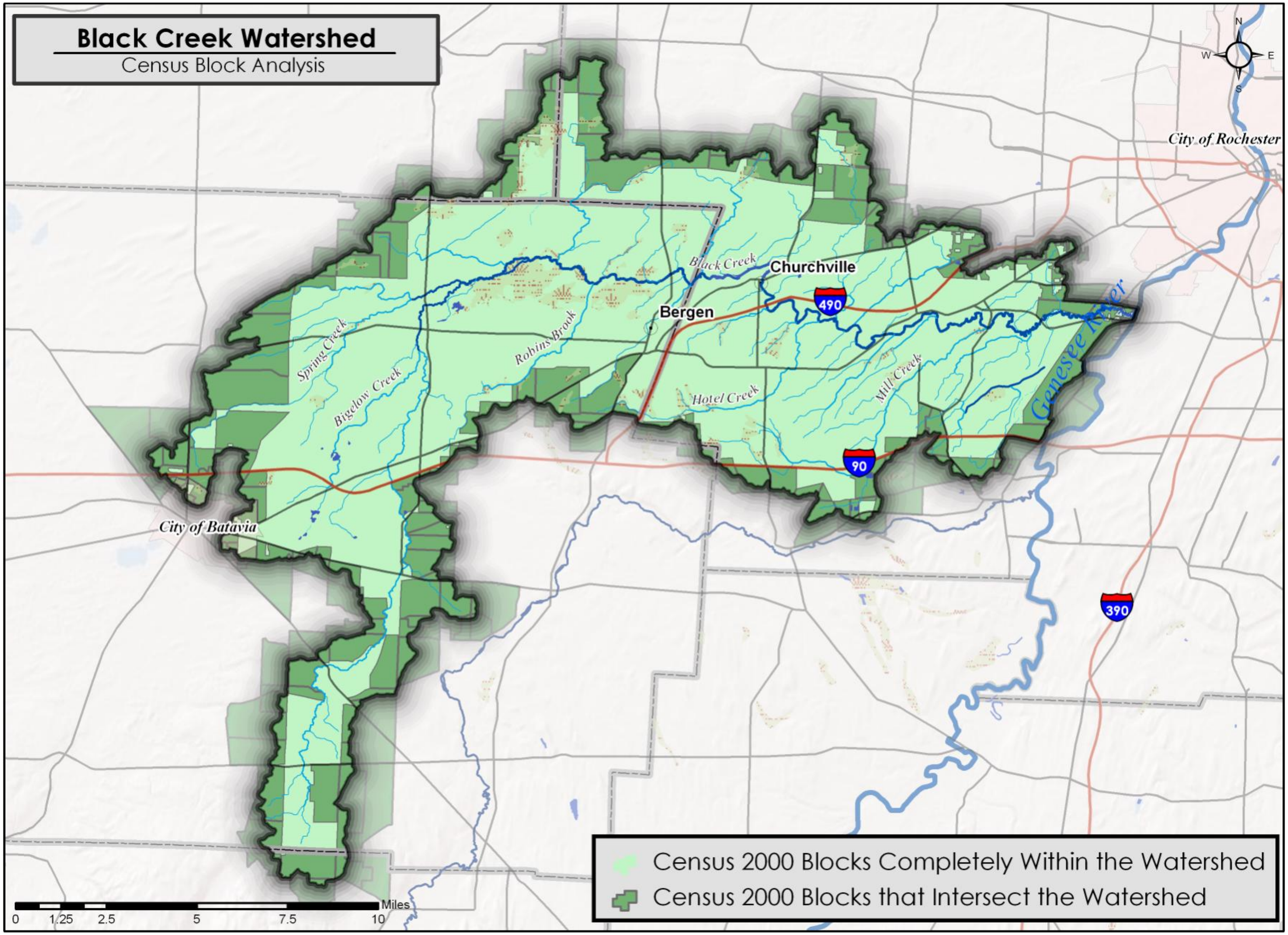
Map 23


Black Creek Watershed
1990 Census Population Density
City of Rochester
Churchville
Bergen
Black Creek
Spring Creek
Bigelow Creek
Robins Brook
Hotel Creek
Mill Creek
Genesee River
City of Batavia
490
90
390
No data associated with census block
1 Dot = 10
Persons
Miles
0
1.25
2.5
5
7.5
10

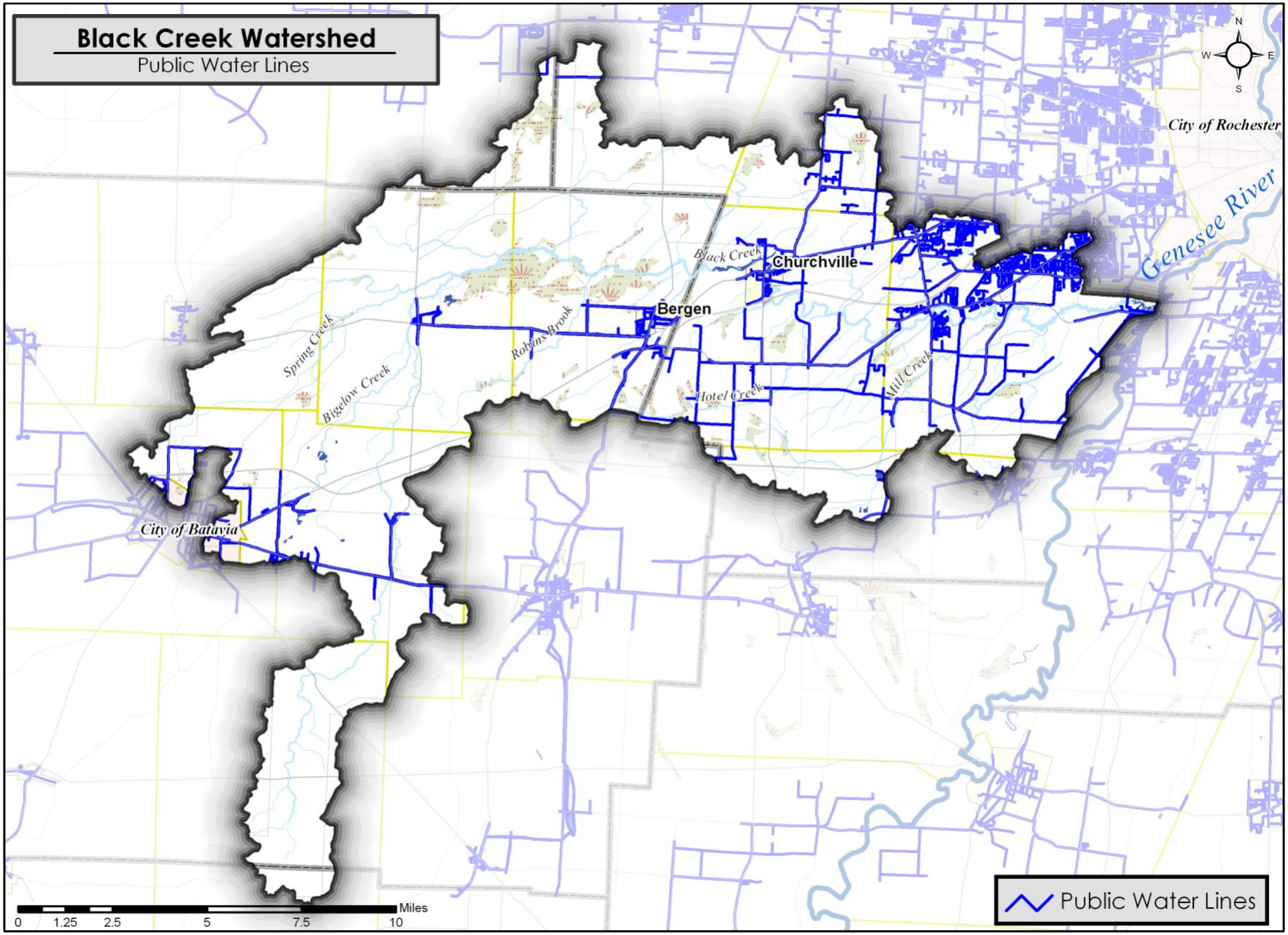
Map 24


Black Creek Watershed
Census 2000 Population Density
City of Rochester
Black Creek
Churchville
Bergen
490
Robins Brook
Spring Creek
Bigelow Creek
Hotel Creek
Mill Creek
Genesee River
90
City of Batavia
390
1 Dot = 10 Persons
Miles
0 1.25 2.5 5 7.5 10
N
W
E
S

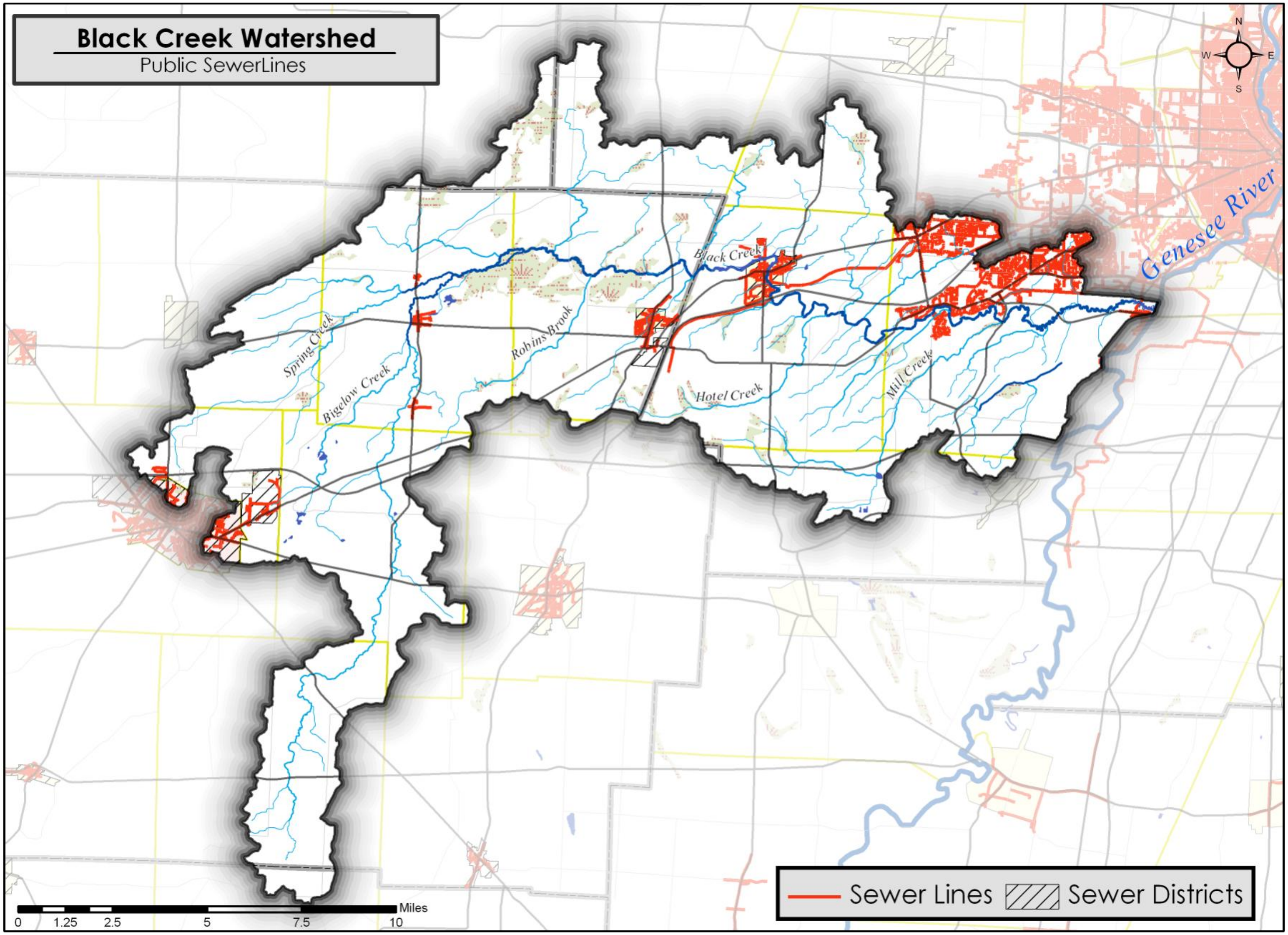
Map 25


Black Creek Watershed
Census Block Analysis
City of Rochester
Black Creek
Churchville
Bergen
490
Spring Creek
Robins Brook
Bigelow Creek
Hotel Creek
Mill Creek
Genesee River
90
City of Batavia
390
Census 2000 Blocks Completely Within the Watershed
Census 2000 Blocks that Intersect the Watershed
0
1.25
2.5
5
7.5
10
Miles
N
W
E
S

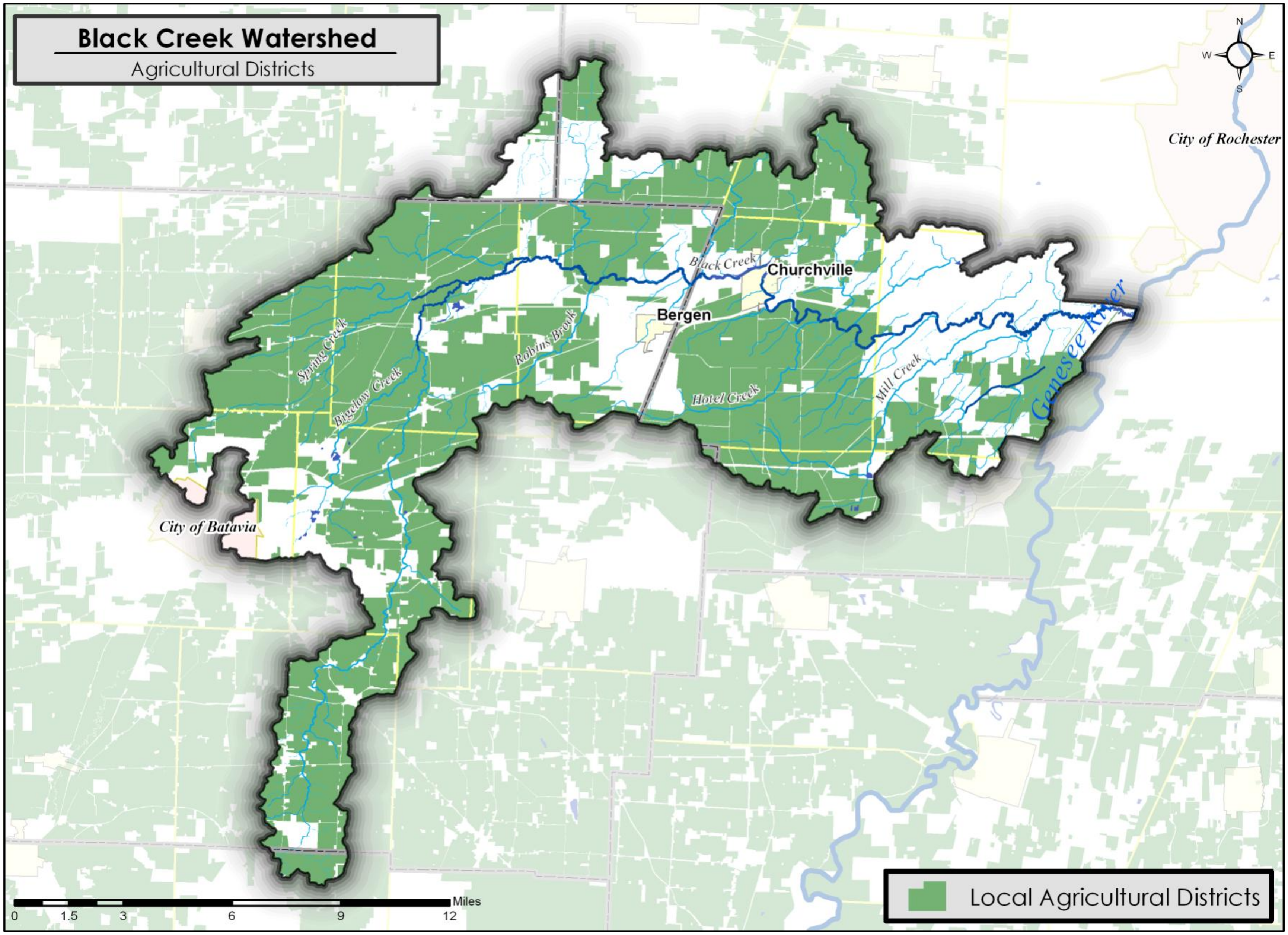
Map 26


Black Creek Watershed
Public Water Lines
N
W
E
S
City of Rochester
Genesee River
Black Creek
Churchville
Bergen
Spring Creek
Bigelow Creek
Robins Brook
Hotel Creek
Mill Creek
City of Batavia
0
1.25
2.5
5
7.5
10
Miles
Public Water Lines

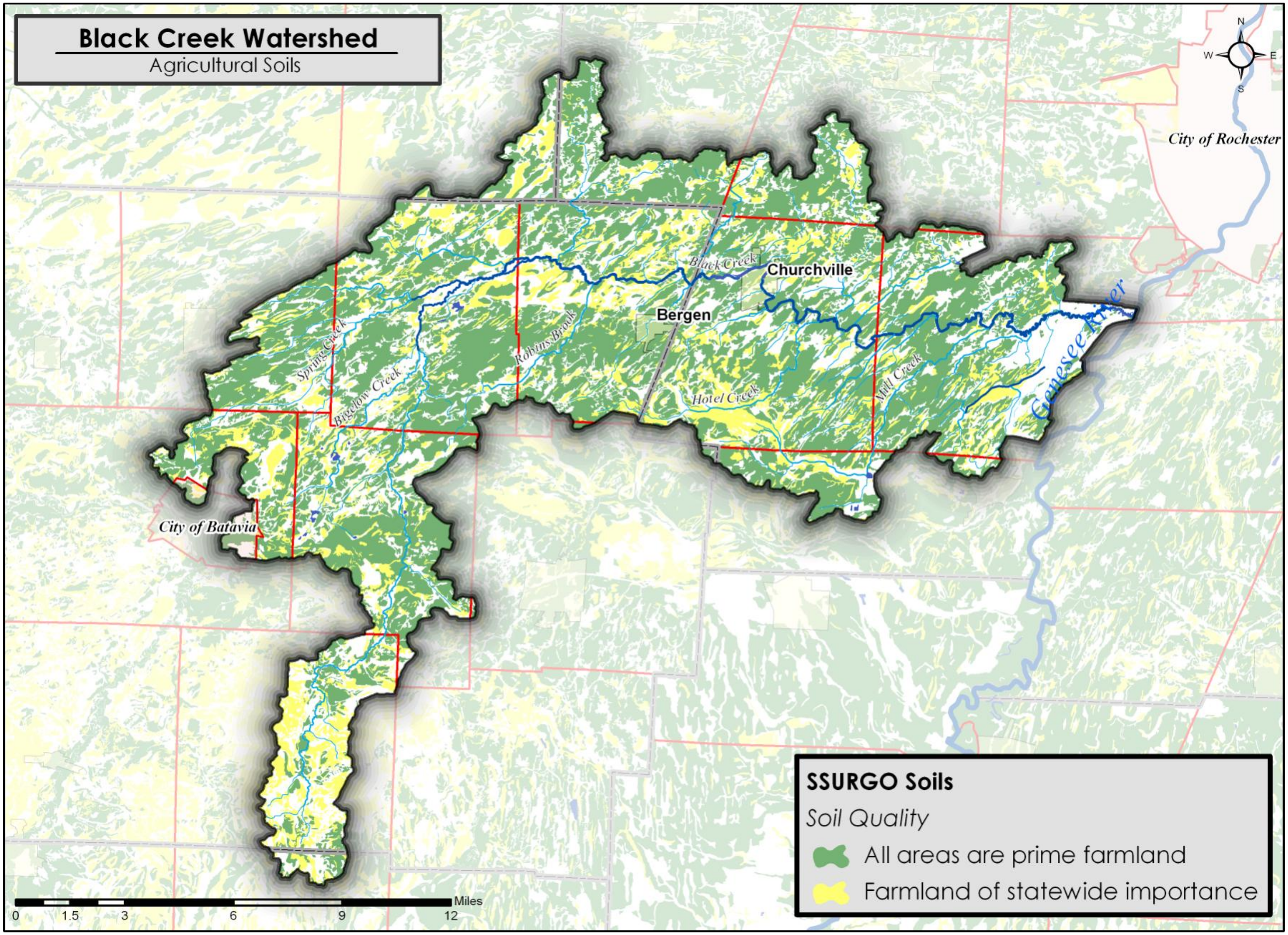
Map 27


Black Creek Watershed
Public SewerLines
Black Creek
Spring Creek
Bigelow Creek
Robins Brook
Hotel Creek
Mill Creek
Genesee River
N
W
E
S
Sewer Lines
Sewer Districts
Miles
0
1.25
2.5
5
7.5
10

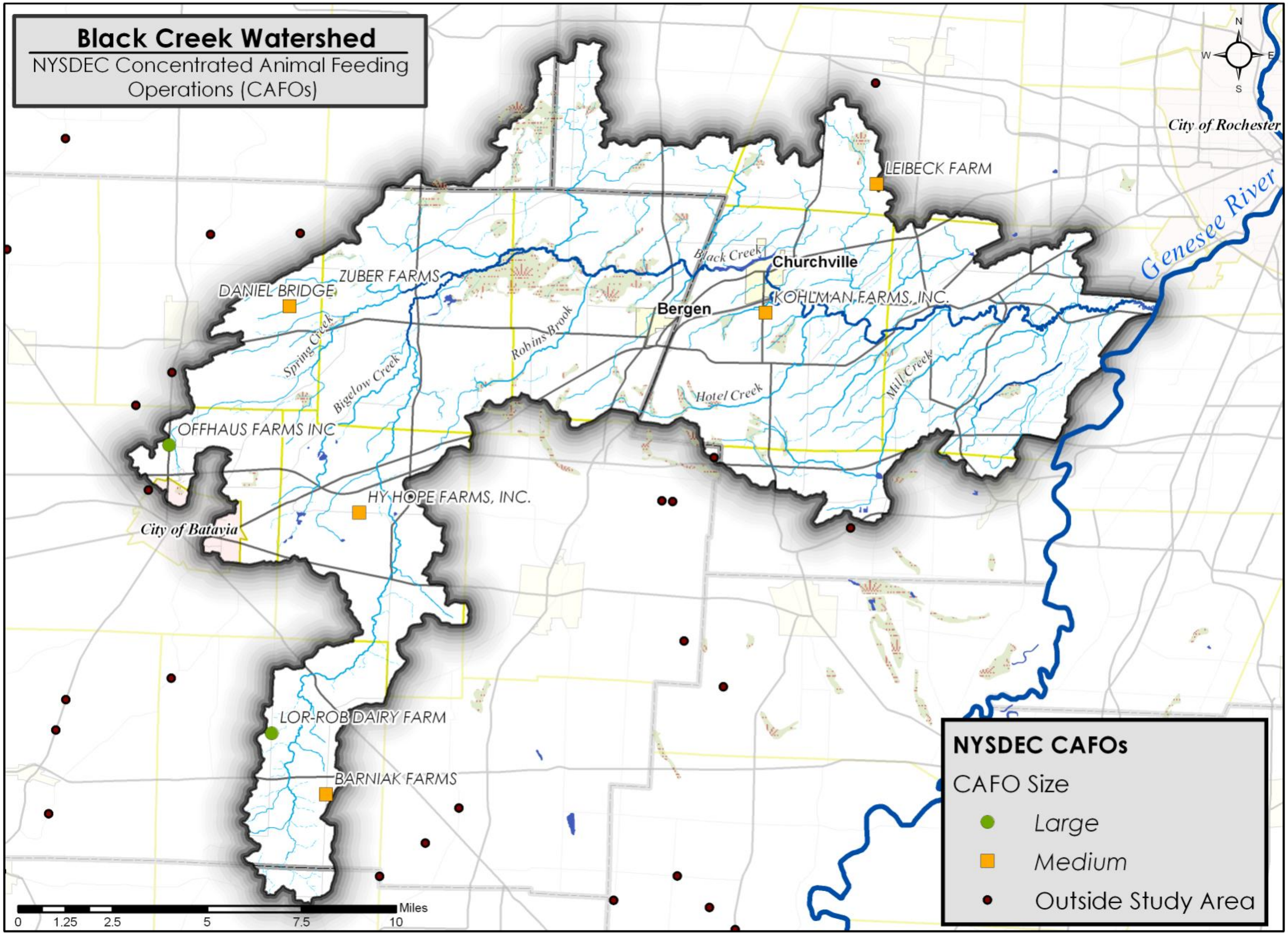
Map 28


Black Creek Watershed
Agricultural Districts
N
W
E
S
City of Rochester
Black Creek
Churchville
Bergen
Spring Creek
Bigelow Creek
Robins Brook
Hotel Creek
Mill Creek
Genesee River
City of Batavia
0 1.5 3 6 9 12
Miles
Local Agricultural Districts

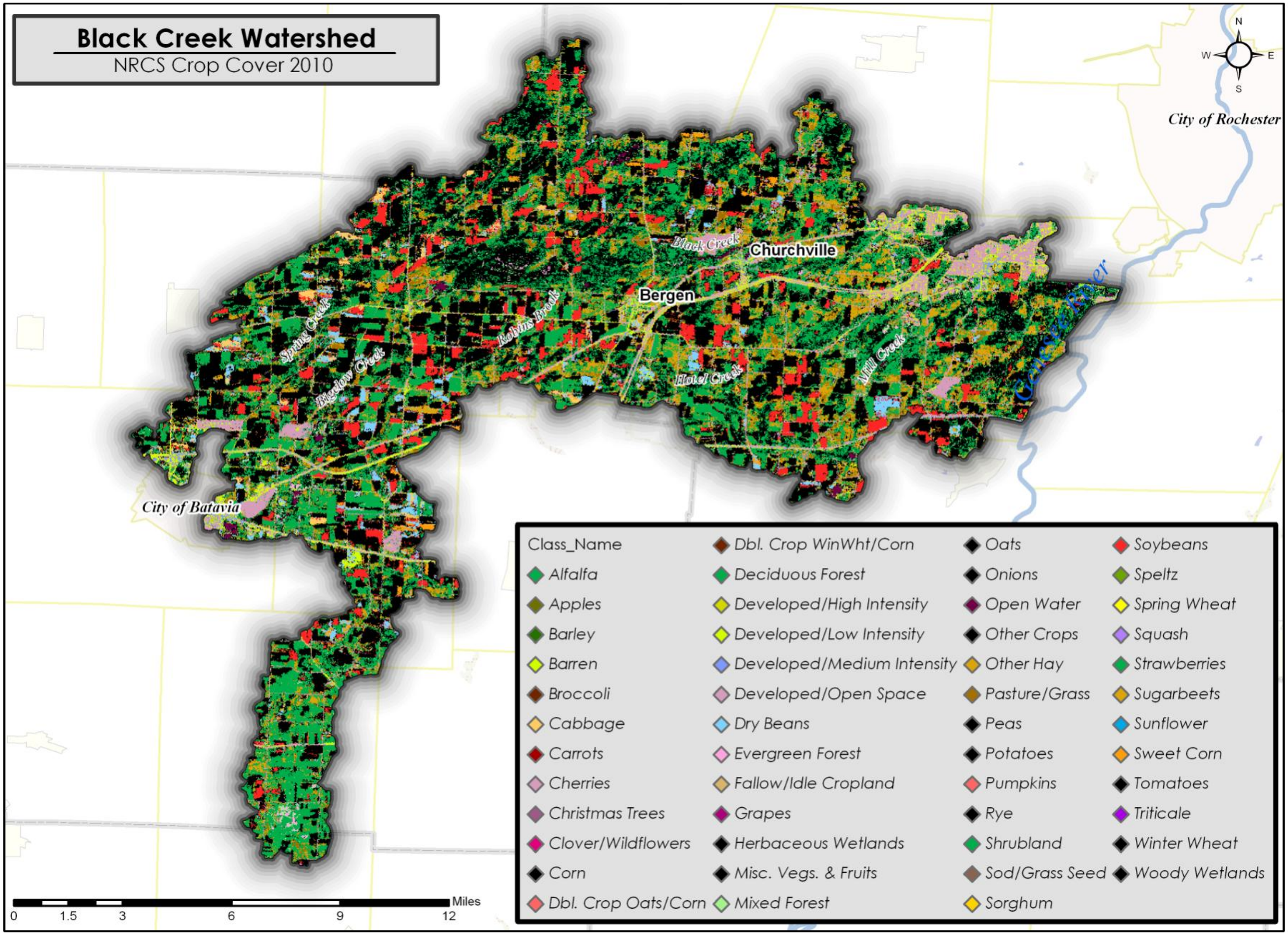
Map 29


Black Creek Watershed
Agricultural Soils
City of Rochester
Black Creek
Churchville
Bergen
Spring Creek
Bigelow Creek
Robins Brook
Hotel Creek
Mill Creek
Genesee River
City of Batavia
N
W
E
S
0
1.5
3
6
9
12
Miles
SSURGO Soils
Soil Quality
All areas are prime farmland
Farmland of statewide importance

Map 30


Black Creek Watershed
NYSDEC Concentrated Animal Feeding Operations (CAFOs)
City of Rochester
LEIBECK FARM
Genesee River
Black Creek
Churchville
ZUBER FARMS
DANIEL BRIDGE
KOHLMAN FARMS, INC.
Bergen
Spring Creek
Robins Brook
Bigelow Creek
Mill Creek
Hotel Creek
OFFHAUS FARMS INC
HY HOPE FARMS, INC.
City of Batavia
LOR-ROB DAIRY FARM
BARNIAK FARMS
NYSDEC CAFOs
CAFO Size
Large
Medium
Outside Study Area
0 1.25 2.5 5 7.5 10
Miles
N
W
E
S

Map 31


Black Creek Watershed
NRCS Crop Cover 2010
N
W
E
S
City of Rochester
Black Creek
Churchville
Bergen
Spring Creek
Robins Brook
Bigelow Creek
Hotel Creek
Mill Creek
Genesee River
City of Batavia
Class_Name
Alfalfa
Apples
Barley
Barren
Broccoli
Cabbage
Carrots
Cherries
Christmas Trees
Clover/Wildflowers
Corn
Dbl. Crop Oats/Corn
Dbl. Crop WinWht/Corn
Deciduous Forest
Developed/High Intensity
Developed/Low Intensity
Developed/Medium Intensity
Developed/Open Space
Dry Beans
Evergreen Forest
Fallow/Idle Cropland
Grapes
Herbaceous Wetlands
Misc. Vegs. & Fruits
Mixed Forest
Oats
Onions
Open Water
Other Crops
Other Hay
Pasture/Grass
Peas
Potatoes
Pumpkins
Rye
Shrubland
Sod/Grass Seed
Sorghum
Soybeans
Speltz
Spring Wheat
Squash
Strawberries
Sugarbeets
Sunflower
Sweet Corn
Tomatoes
Triticale
Winter Wheat
Woody Wetlands
0
1.5
3
6
9
12
Miles

Maps and GIS Data Sources

Map 1: General Overview of the Black Creek Watershed

National Hydrography Dataset. http://nhd.usgs.gov/

Map 2: USGS HUC 12 Watershed Boundaries

National Hydrography Dataset. http://nhd.usgs.gov/

Map 3: Hydrologic Watersheds

Hydrologic subwatershed boundaries were drawn digitically utilizing two sources. The original subwatershed boundary classification created by SUNY Brockport for the 2003 *Black Creek Watershed State of the Basin* report was used as a guide to draw new boundaries utilizing the highly-accurate catchment boundaries included in the National Hydrography Dataset noted above. Individual catchments were selected and categorized based on their respective subwatershed drainage area. Some subwatershed boundaries may be subject to error due to the presence of isolated flowlines in the NHD (i.e. streams that do not connect to the larger drainage network).

Map 4: NYS Classification of Waters

This data set provides the water quality classifications of New York State's lakes, rivers, streams and ponds, collectively referred to as water bodies. All water bodies in the state are provided a water quality classification based on existing, or expected best usage, of each water body or water body segment. Under New York State's Environmental Conservation Law (ECL), Title 5 of Article 15, certain waters of the state are protected on the basis of their classification. Streams and small water bodies located in the course of a stream that are designated as C (T) or higher (i.e., C (TS), B, or A) are collectively referred to as "protected streams."

Map 5: Ambient Water Quality Standards (303d)

303(d) Listed Impaired Waters
August 1, 2010 National Extract
US EPA Office of Water

This dataset provide geospatial and attribute data identifying the spatial extent of waters listed under 303(d). These waters can be linked to the 303(d) information stored in EPAs Assessment and TMDL Tracking and Implementation System (ATTAINS) for query and display via EPAs WATERS Expert Query Tool. The source_feature_id field in the waterbody shapefile can be linked to the listed_water_id in EPA's Assessment and TMDL Tracking and Implementation System (ATTAINS).

Map 6: NYS Regulated Freshwater Wetlands

Freshwater Wetlands (DEC; NAD83) Coverages (wetlands boundary datasets) are published by county, and are updated as amendments occur, or as errors in the data are discovered and corrected. For the most recent updates to coverages by county, visit the Cornell University Geospatial Information Repository at http://cugir.mannlib.cornell.edu/ .

Publication dates of county wetlands coverages are as follows:

Genesee County (November 30, 1998)
Monroe County (September 24, 2008)
Orleans County (November 30, 1998)
Wyoming County (November 30, 1998)

Map 7: US Fish and Wildlife Service National Wetlands Inventory

The U.S. Fish and Wildlife Service is the principal Federal agency that provides information to the public on the extent and status of the Nation's wetlands. The agency has developed a series of topical maps to show wetlands and deepwater habitats. This geospatial information is used by Federal, State, and local agencies, academic institutions, and private industry for management, research, policy development, education and planning activities. Digital GIS data can be viewed and downloaded at http://www.fws.gov/wetlands/

Map 8: Floodplains

Digital Flood Insurance Rate Map for Monroe County obtained from the Federal Emergency Management Agency's (FEMA) Map Service Center. All other flood information derived from local sources, including:

- Genesee County Department of Planning. http://www.fema.gov/
- Orleans County Soil and Water Conservation District (originally created by G/FLRPC)
- Wyoming County Soil and Water Conservation District

Map 9: Active River Area

Active River Area developed by The Nature Conservancy. ARA GIS data layer provided by and reprinted with permission from The Central and Western New York chapter office.

Map 10: NYS Inventory of Dams

This dataset is used to show the location of dams in New York State's inventory of dams, and lists selected attributes of each dam. GIS data available for download at http://www.nysgis.state.ny.us/gisdata/inventories/details.cfm?DSID=1130

Map 11: Unconsolidated Aquifers

These aquifers are those in upstate NY that consist of sand and gravel and yield large supplies of water to wells. Bedrock aquifers, although significant in some areas, are not addressed here. Source data is 1:250,000, same scale as the NYS Geological Survey surficial and bedrock geology maps on which they were based. Together these maps form a consistent set of geologic and groundwater maps for use in regional management of the groundwater resources of the State. GIS data available for download from http://www.nysgis.state.ny.us/gisdata/inventories/details.cfm?DSID=1141

Map 12: Public Lands and Recreation Trails

Public lands data compiled from multiple sources under the Genesee/Finger Lakes Regional Planning Council Finger Lakes Open Lands Conservation Project (2010). Project overview available online from http://gflrpc.org/Publications/FLOLCP/index.htm.

Sources include:

Genesee County Planning Department

- Genesee County Tax Parcel Boundaries (2010)

Livingston County Planning Department

- Livingston County Tax Parcel Boundaries (2010)

Monroe County

- Monroe County Tax Parcel Boundaries (2010)

Orleans County Assessor's Office

- Orleans County Tax Parcel Boundaries (2010)

Wyoming County Assessor's Office

- Wyoming County Tax Parcel Boundaries (2010)

NYS Department of Environmental Conservation:

- DEC Lands (2010)
- Public Fishing Rights (2010)
- Public Fishing Stream Parking Areas

NYS Office of Parks, Recreation & Historic Preservation

- New York State Historic Sites and Park Boundary
- State-funded Snowmobile Trails

Genesee Transportation Council

- Regional Trails Inventory

Map 13: Roads, Bridges and Railways

Bridge data includes vector point file of bridges that carry or cross a public road. Bridge ID Number (BIN) attribute used to identify each bridge. Statewide coverage. UTM NAD 83 Zone 18. Copyright 2001 by NYS Dept. of Transportation. Railway lines are a vector line file of active and inactive railroad lines. UTM NAD 83 Zone 18. Copyright 2001 by NYS Dept. of Transportation.

Map 14: 2006 National Land Cover Database

Homer, C. C. Huang, L. Yang, B. Wylie and M. Coan. 2004. Development of a 2001 National Landcover Database for the United States. Photogrammetric Engineering and Remote Sensing, Vol. 70, No. 7, July 2004, pp. 829-840.

The 2006 National Land Cover Dataset is available through the USGS at http://www.mrlc.gov/nlcd06_data.php

Map 15: Relief and Slope

Information derived from USGS 10 meter resolution Digital Elevation Models (DEMs). DEMs consist of a raster grid of regularly spaced elevation values that have been primarily derived from the USGS topographic map series. Available for download at http://www.nysgis.state.ny.us/gisdata/inventories/details.cfm?DSID=817

Map 16: Bedrock Geology

NYS Museum. NYS Geological Survey: Bedrock Attributes. GIS data available from http://www.nysgis.state.ny.us/gisdata/inventories/member.cfm?organizationID=558

Map 17: Surficial Geology

NYS Museum. NYS Geological Survey: Surficial Geology. GIS data available from http://www.nysgis.state.ny.us/gisdata/inventories/member.cfm?organizationID=558

Map 18: Hydrologic Soil Groups

Hydrologic Soil Group derrived from NRCS Soil Survey Geographic Database (SSURGO) data for each county in the study area. GIS data available by county from http://datagateway.nrcs.usda.gov/. Hydrologic soil group attributes were generated utilizing the ssurgoImport.xls utility.

Map 19: Active and Inactive Mines

Downloadable Mining Database. [Online] In New York State Department of Environmental Conservation. Retrieved 2/3/11 from http://www.dec.ny.gov/lands/5374.html

Map 20: NY State Pollution Discharge Elimination System Point Discharge Locations

The purpose of the State Pollutant Discharge Elimination System (SPDES) Program is to protect human Health and the environment. The SPDES permit program in the Department's Division of Water regulates municipal and industrial wastewater treatment facilities that discharge directly into navigable waters. GIS data layer depicted was updated April 2009 and is available at http://www.nysgis.state.ny.us/gisdata/inventories/details.cfm?DSID=1010

Map 21: US EPA Regulated Facilities

To improve public health and the environment, the EPA collects information about facilities or sites subject to environmental regulation. GIS data is available for download from http://www.epa.gov/enviro/geo_data.html Information on the following programs active within the Black Creek watershed are illustrated:

- Superfund National Priorities List (NPL)
- RCRAInfo - EPA and State Treatment, Storage, Disposal facilities
- Toxic Release Inventory System - All reported years including the just released 2009 data
- RCRAInfo - Large Quantity Generators (LQG)
- Air Facility System (AFS) - Major discharges of air pollutants
- RCRAInfo - Corrective Actions
- RMP - Risk Management Plan

- SSTS - Section Seven Tracking System (Pesticides)
- ACRES - Brownfields Properties

Map 22: USGS Karst Features Inventory

Shapefiles Associated with the following study:
Reddy, J.E., and Kappel, W.M., 2010, Comiplation of existing hydrogeologic and geospatial data for the assessment of focused recharge to the carbonate-rock aquifer in Genesee County, New York: U.S. Geological Survey Scientific Investigations Map 3132, 17 p., 20 sheets, at http://pubs.usgs.gov/sim/3132/.

Map 23: 1990 Census Population Density

Boundary file: http://arcdata.esri.com/data/tiger2000/tiger_statelayer.cfm
Population Data: http://data.nhgis.org/nhgis/tables.do. Minnesota Population Center. *National Historical Geographic Information System: Pre-release Version 0.1.* Minneapolis, MN: University of Minnesota 2004.

Map 24: 2000 Census Population Density

Boundary and population data obtained from http://arcdata.esri.com/data/tiger2000/tiger_statelayer.cfm

Map 25: Black Creek Watershed Census Black Analysis

Boundary data obtained from http://arcdata.esri.com/data/tiger2000/tiger_statelayer.cfm

Map 26: Public Water Lines

Water line data compiled from multiple sources under the Genesee/Finger Lakes Regional Planning Council *Finger Lakes Open Lands Conservation Project* (2010). Project overview available online from http://gflrpc.org/Publications/FLOLCP/index.htm.

Map 27: Public Sewer Lines

Sewer line data compiled from multiple sources under the Genesee/Finger Lakes Regional Planning Council Finger Lakes Open Lands Conservation Project (2010). Project overview available online from http://gflrpc.org/Publications/FLOLCP/index.htm.

Map 28: Agricultural Districts

Map illustrates polygon coverages representing generalized geographic boundaries of lands under the protection of NYS Agricultural District Law, as administered by the New York State Department of Agriculture and Markets. Data sets should not be used for legal jurisdictional determinations without consulting associated metadata. 2010. GIS data available from http://cugir.mannlib.cornell.edu/datatheme.jsp?id=2

Publication date of geospatial data depicted in map:

Genesee County:	March 11, 2010
Monroe County:	March 11, 2010
Orleans County:	February 13, 2009
Wyoming County:	February 13, 2009

Map 29: Agricultural Soils

Hydrologic Soil Group derrived from NRCS Soil Survey Geographic Database (SSURGO) data for each county in the study area. GIS data available by county from http://datagateway.nrcs.usda.gov/. Attributes listed under soil quality were sorted according to agricultural suitability listed in the Legend.

Map 30: Concentrated Animal Feeding Operations

Provided by the New York State Department of Environmental Conservation.

Map 31: USDA-NASS 2009 Crop Cover

U.S. Department of Agriculture, National Agricultural Statistics Service (NASS), Research and Development Division, Geospatial Information Branch, Spatial Analysis Research Section (SARS). Available for download through the USDA NRCS Geospatial Gateway: http://datagateway.nrcs.usda.gov/

Note that printing resolution at this scale does not adequately capture raster cell distribution throughout the watershed. A smaller scale is required in order to fully reveal crop distribution of the 30 x 30m raster cells.

Additional GIS Source information:

Climate – Rain

Processed Annual Precipitation. USDA/NRCS - National Cartography & Geospatial Center. Vector dataset provides derived average annual precipitation according to a model using point precipitation and elevation data for the 30-year period of 1971-2000.

Climate – Temperature

Processed Annual Average Temperature. USDA/NRCS - National Cartography & Geospatial Center. Vector dataset provides derived average annual temperature according to a model using point temperature data for the 30-year period of 1971-2000.

Ecozones

Derrived from US EPA Western Ecology Division. http://www.epa.gov/wed/pages/ecoregions.htm

Build Out Analysis Methodology

1. This analysis reviewed the potential for future residential growth only in locations that were pre-determined to have a high potential for future residential growth.

2. Determine "high growth" towns for analysis by reviewing the following data sources and noting salient trends:

A) 5 Year residential permit average
B) Population % change 2000-2009(est.)
C) Availability of public water utilizing the 2008 G/FLRPC public water GIS files
D) Villages were excluded from this analysis

3. Within selected "high growth" towns, determine the zoning districts for further analysis

A) Identify Residential, Agricultural, and Agricultural/Residential zones in selected municipalities that are at least partially within the watershed and have access to public water. Zones that have water lines intersecting them at any point are considered to have access to public water.
B) Excluded Mobile Home Park Zones
C) Excluded Mixed Use/PUD zones; it is extremely difficult to determine how these zones will ultimately be developed if a proposal is submitted.
D) Zones must be at least partially within the watershed for further consideration

4. Determine bulk regulations for identified zoning districts

A) Bulk Regulations refer to the minimum and maximum standards for lot sizes and address geometric and structural issues such as building setbacks and building height.
B) The bulk regulations were reviewed in an effort to establish the typical single family residential lot size in each selected zone.
    a. This study excluded the potential for multi-family buildings/lots given the vast multitude of potential scenarios that these options would create for each zoning district

4. Determine total land area open to potential development

A) Zones that meet all of the aforementioned criteria will be extracted and clipped by watershed boundary for further analysis
   a. This study will only analyze the area of zoning districts that fall within the boundary of the Black Creek watershed
B) Among zones remaining for future consideration, consider bulk regulations and RPS parcel data to determine if those zones have adequate vacant property to accommodate new development. "Developable" parcels are those that meet the following criteria:
   a. Parcels identified as "vacant" residential property in RPS records
   b. Large lots were reviewed using aerial photography and included for further analysis if they were either farms or had significant land in open space. Lots with 1, 2, or 3 family structures were considered if they were 10 acres in size or larger because it is assumed that these would be large enough to be subdivided without affecting existing structures or residences
   c. All agricultural properties were considered as "vacant" properties open to future residential development.
      i. While agricultural use is in many cases are protected or specifically zoned "agricultural" in order to preserve such use, the property could feasibly be sold or re-zoned in the future for the purposes of residential development and are therefore considered for further analysis
   d. Zones must have enough vacant property to allow for minimum lot size development in order to qualify for further build out analysis. Minimum lot sizes are determined by reviewing bulk regulations for the zone.
C) Determine the total "developable" land area for each identified zoning district
   a. was established for each zoning district. All vacant property determined to qualify for potential future development was summed to arrive at A raw figure of total area in square feet

5. Determine potential constraints to development within each zone

A) Constraints to development were examined only on parcels considered developable, and subtracted from the amount of total developable land.
B) In several instances zones were deleted from further analysis because constraints prevented them from having any parcels large enough to build on.
C) Environmental constraints include:
   a. NYS Regulated Freshwater Wetlands (+100ft buffer)
   b. Surface water (lakes, ponds, streams, creeks, rivers, + a standard 50ft buffer area)
   c. Land area that has a slope great than 15% based on GIS 30 meter Digital Elevation Model analysis
D) In addition, a standard deduction of 25% from the remaining land area open for development would be reduced to accommodate for anticipated infrastructure (such as roads, sidewalks, power lines, stormwater facilities, etc.), natural features (including poor soils), and irregularly-shaped parcel boundaries. (this is in accordance with the Monroe County Department of Transportation study "Ballantyne Corridor Study" (2005)).
E) Land area within the identified 100-year flood zone was not considered to be a constraint. In all towns, 100 year flood zones were considered open to new development with proper precautions and approval. In some instances, towns have identified locations of high flood risk and zoned accordingly; these zoning districts were therefore removed from analysis early on in the build out study.
F) Additional park, recreation or open space requirements. Some towns have provisions that require or "may" require a certain amount of land to be set aside for these purposes. These standards are generally not specific in nature and left to the discretion of the local planning or regulatory body. A percentage in an amount deemed appropriate based on the local regulation would be further deduced from the land area available for development.
G) Lots already developed will be identified through aerial imagery and subtracted

6. Final calculation of potential land available for development.

A) Each zone will have a customized series of calculations performed in order to determine the estimated land area open to potential residential development. This is generally determined by conducting the following steps in Excel.
B) Environmental constraints (see 5.C) are subtracted from the total gross land open to development

C) 25% standard reduction is applied to this figure (see 5.D)
D) If necessary, a specific percentage of land area assumed necessary for parks, recreation or open space is then applied based on language in the code (see 5.F)
E) Lots already developed subtracted
F) A figure estimating the net land area available for development is determined within each zone

7. Assuming a specific rate of growth and development, determine when the zone within the watershed will become "built-out."

A) The minimum lot size for each zone is established under bulk regulations; this figure will be divided into the net land area available for development in order to determine a general estimate of the number of new residential lots that the zone can accommodate.
B) The average number of residential permits issued in the town in a five-year period is used to determine the rate of development
C) The estimated remaining number of years until build out occurs is determined by dividing the estimated number of lots that the zone can accommodate by the number of building permits issued annually (5 year average)

Population Change of Towns in the Black Creek Watershed, 1980 – 2010 (includes population of villages and cities within)								
Municipality	Population 1980[c]	Population 1990[ci]	Population 2000[cii]	Population 2010[ciii]	*Percent Change*			
					1980-1990	*1990-2000*	*2000-2010*	***1980-2010***
Town of Batavia	5,565	6,055	5,915	6,809	*9%*	*-2%*	15%	**22%**
Town of Bergen	2,568	2,794	3,182	3,120	*9%*	*14%*	-2%	**21%**
Town of Bethany	1,876	1,808	1,760	1,765	*-4%*	*-3%*	0.3%	**-6%**
Town of Byron	2,242	2,345	2,493	2,369	*5%*	*6%*	-5%	**6%**
Town of Chili	23,676	25,178	27,638	28,625	*6%*	*10%*	4%	**21%**
Town of Clarendon	2,148	2,705	3,392	3,648	*26%*	*25%*	8%	**70%**
Town of Elba	2,487	2,407	2,439	2,370	*-3%*	*1%*	-3%	**-5%**
Town of Middlebury	1,561	1,532	1,508	1,441	*-2%*	*-2%*	-4%	**-8%**
Town of Ogden	14,693	16,912	18,492	19,856	*15%*	*9%*	7%	**35%**
Town of Riga	4,309	5,114	5,437	5,590	*19%*	*6%*	3%	**30%**
Town of Stafford	2,508	2,593	2,409	2,459	*3%*	*-7%*	2%	**-2%**
Town of Sweden	14,859	14,181	13,716	14,175	*-5%*	*-3%*	3%	**-5%**
Town of Wheatland	4,897	5,093	5,149	4,775	*4%*	*1%*	-7%	**-2%**
Totals	**83,389**	**88,717**	**93,530**	**97,002**	6%	*5%*	4%	**16%**
County Figures								
Genesee	59,400	60,060	60,370	60,079	1%	1%	-0.5%	***1%***
Monroe	702,238	713,968	735,343	744,344	2%	3%	1%	***6%***
Orleans	38,496	41,846	44,171	42,883	9%	6%	-3%	***11%***
Wyoming	39,895	42,507	43,424	42,155	7%	2%	-3%	***6%***
Totals	**840,029**	**858,381**	**883,308**	**889,461**	3%	*3%*	1%	***6%***

Data notes

[c] US Census Bureau. 1980 Census of Population, Detailed Population Characteristics of New York

[ci] US Census Bureau. American FactfFinder. Data Set: 1990 Summary Tape File 1 - 100% data, Total Population.

[cii] US Census Bureau. American FactfFinder. Data Set: 2000 Summary File 1100% data, Total Population.

[ciii] US Census Bureau. Census 2010, Summary File 1 General Profile 1: Persons by Race, Age, and Sex, Urban and Rural

2010 USDA-NASS Cropland Data Layer

Refer to http://www.nass.usda.gov/research/Cropland/SARS1a.htm

Unabridged 2010 Cropland Data Layer Analysis for the Black Creek Watershed		
Crop/Land Cover	**Acres**	**% Share of Watershed**
Corn	24,414.28	18.45%
Forest Categories Combined:	24,194.8	18.28%
Deciduous Forest	22,577.75	17.06%
Mixed Forest	1,351.94	1.02%
Evergreen Forest	265.09	0.20%
Wetland Categories Combined:	16,644.9	12.58%
Woody Wetlands	15,734.44	11.89%
Herbaceous Wetlands	490.16	0.37%
Open Water	420.33	0.32%
Developed Space Combined:	13,115.3	9.91%
Developed/Open Space	9,039.24	6.83%
Developed/Low Intensity	3,233.18	2.44%
Developed/Medium Intensity	699.43	0.53%
Developed/High Intensity	143.44	0.11%
Other Hay	12,716.76	9.61%
Alfalfa	12,080.04	9.13%
Soybeans	8,197.47	6.19%
Other Various Cash Crops Combined:	7,147.3	5.40%
Dry Beans	2,637.60	1.99%
Peas	1,386.63	1.05%
Cabbage	916.49	0.69%
Sweet Corn	594.02	0.45%
Sugarbeets	374.96	0.28%
Oats	283.55	0.21%
Apples	280.66	0.21%
Misc. Vegs. & Fruits	157.90	0.12%
Onions	120.76	0.09%
Barley	72.50	0.05%
Speltz	65.61	0.05%
Rye	64.94	0.05%
Potatoes	41.59	0.03%
Clover/Wildflowers	32.02	0.02%
Grapes	29.58	0.02%
Squash	23.57	0.02%
Carrots	20.91	0.02%
Dbl. Crop WinWht/Corn	10.90	0.01%
Other Crops	9.34	0.01%
Triticale	7.34	0.01%
Christmas Trees	4.67	0.004%
Cherries	3.11	0.002%
Tomatoes	2.00	0.002%
Sorghum	1.33	0.001%
Strawberries	1.33	0.001%
Pumpkins	1.33	0.001%
Dbl. Crop Oats/Corn	0.89	0.001%
Sod/Grass Seed	0.67	0.001%
Spring Wheat	0.44	0.0003%
Broccoli	0.44	0.0003%
Sunflower	0.22	0.0002%
Winter Wheat	6,482.81	4.90%
Pasture/Grass	4,167.23	3.15%
Barren	345.60	0.26%
Shrub/Fallow/Idle Lands Combined:	3173.1	2.40%
Shrubland	2,313.13	1.75%
Fallow/Idle Cropland	514.40	0.39%

National Land Cover Dataset

The 2006 National Land Cover Dataset is available through the USGS at http://seamless.usgs.gov/data_availability.php?serviceid=Dataset_13

Homer, C. C. Huang, L. Yang, B. Wylie and M. Coan. 2004. Development of a 2001 National Landcover Database for the United States. Photogrammetric Engineering and Remote Sensing, Vol. 70, No. 7, July 2004, pp. 829-840.

2001 NLCD Categories:[civ]

11 – Open Water: All areas of open water, generally with less than 25% cover of vegetation or soil.

21 – Developed, Open Space: Includes areas with a mixture of some constructed materials, but mostly vegetation in the form of lawn grasses. Impervious surfaces account for less than 20 percent of total cover. These areas most commonly include large-lot single-family housing units, parks, golf courses, and vegetation planted in developed settings for recreation, erosion control, or aesthetic purposes

22 – Developed, Low Intensity: Includes areas with a mixture of constructed materials and vegetation. Impervious surfaces account for 20-49 percent of total cover. These areas most commonly include single-family housing units.

23 – Developed, Medium Intensity: Includes areas with a mixture of constructed materials and vegetation. Impervious surfaces account for 50-79 percent of the total cover. These areas most commonly include single-family housing units.

24 – Developed, High Intensity: Includes highly developed areas where people reside or work in high numbers. Examples include apartment complexes, row houses and commercial/industrial. Impervious surfaces account for 80 to100 percent of the total cover.

31 – Barren Land (Rock/Sand/Clay): Barren areas of bedrock, desert pavement, scarps, talus, slides, volcanic material, glacial debris, sand dunes, strip mines, gravel pits and other accumulations of earthen material. Generally, vegetation accounts for less than 15% of total cover.

41 – Deciduous Forest: Areas dominated by trees generally greater than 5 meters tall, and greater than 20% of total vegetation cover. More than 75 percent of the tree species shed foliage simultaneously in response to seasonal change.

42 – Evergreen Forest: Areas dominated by trees generally greater than 5 meters tall, and greater than 20% of total vegetation cover. More than 75 percent of the tree species maintain their leaves all year. Canopy is never without green foliage.

43 – Mixed Forest: Areas dominated by trees generally greater than 5 meters tall, and greater than 20% of total vegetation cover. Neither deciduous nor evergreen species are greater than 75 percent of total tree cover.

52 – Shrub/Scrub: Areas dominated by shrubs; less than 5 meters tall with shrub canopy typically greater than 20% of total vegetation. This class includes true shrubs, young trees in an early successional stage or trees stunted from environmental conditions.

71 – Grassland/Herbaceous: Areas dominated by grammanoid or herbaceous vegetation, generally greater than 80% of total vegetation. These areas are not subject to intensive management such as tilling, but can be utilized for grazing.

81 – Pasture/Hay: Areas of grasses, legumes, or grass-legume mixtures planted for livestock grazing or the production of seed or hay crops, typically on a perennial cycle. Pasture/hay vegetation accounts for greater than 20 percent of total vegetation.

82 – Cultivated Crops: Areas used for the production of annual crops, such as corn, soybeans, vegetables, tobacco, and cotton, and also perennial woody crops such as orchards and vineyards. Crop vegetation accounts for greater than 20 percent of total vegetation. This class also includes all land being actively tilled.

90 – Woody Wetlands: Areas where forest or shrubland vegetation accounts for greater than 20 percent of vegetative cover and the soil or substrate is periodically saturated with or covered with water.

95 – Emergent Herbaceous Wetlands: Areas where perennial herbaceous vegetation accounts for greater than 80 percent of vegetative cover and the soil or substrate is periodically saturated with or covered with water

2006 NLCD Land Cover – Subwatersheds of Black Creek Watershed

	Spring Creek		Headwaters		Robins Brook		Hotel Creek		Mill Creek		Outlet	
NLCD Category	Acres	%	Acres	%	Acres	%	Acres	%	Acres	%	Acres	%
11 - Open Water	6.89	0.0%	113.20	0.4%	28.02	0.1%	46.04	0.1%	59.82	0.3%	21.79	0.2%
21 - Developed, Open Space	676.53	4.8%	2,073.83	7.0%	733.01	3.1%	2,022.46	6.3%	2,254.86	11.4%	940.51	9.2%
22 - Developed, Low Intensity	374.07	2.7%	856.22	2.9%	204.16	0.9%	766.82	2.4%	872.45	4.4%	235.74	2.3%
23 - Developed, Medium Intensity	120.54	0.9%	183.03	0.6%	14.01	0.1%	94.07	0.3%	228.84	1.2%	79.62	0.8%
24 - Developed, High Intensity	27.80	0.2%	67.16	0.2%	0.44	0.0%	27.80	0.1%	38.47	0.2%	7.34	0.1%
31 - Barren Land	0.00	0.0%	159.46	0.5%	0.00	0.0%	145.22	0.5%	29.58	0.1%	0.00	0.0%
41 - Deciduous Forest	930.28	6.6%	2,610.69	8.8%	1,821.19	7.8%	3,964.86	12.4%	2,377.40	12.0%	913.38	8.9%
42 - Evergreen Forest	16.23	0.1%	135.66	0.5%	12.90	0.1%	52.93	0.2%	24.24	0.1%	13.12	0.1%
43 - Mixed Forest	122.32	0.9%	530.19	1.8%	187.70	0.8%	532.86	1.7%	431.00	2.2%	253.75	2.5%
52 - Shrub/Scrub	68.94	0.5%	469.92	1.6%	153.90	0.7%	295.79	0.9%	237.07	1.2%	108.97	1.1%
71 - Grass/Herbaceous	10.01	0.1%	51.37	0.2%	43.37	0.2%	93.85	0.3%	75.61	0.4%	23.80	0.2%
81 - Pasture Hay	4,463.46	31.6%	10,115.41	34.1%	5,794.72	24.7%	9,910.80	30.9%	5,827.63	29.4%	2,900.25	28.3%
82 - Cultivated Crops	6,199.70	44.0%	10,876.66	36.7%	8,027.79	34.2%	9,133.53	28.5%	4,946.95	25.0%	2,556.87	24.9%
90 - Woody Wetlands	1,070.83	7.6%	1,287.89	4.3%	6,199.26	26.4%	4,708.10	14.7%	2,268.43	11.4%	2,093.18	20.4%
95 - Emergent Herbaceous Wetlands	15.79	0.1%	91.63	0.3%	234.63	1.0%	307.57	1.0%	154.12	0.8%	105.86	1.0%
Total	14,103.39		29,622.33		23,455.09		32,102.70		19,826.50		10,254.18	

2006 NLCD Land Cover – 150' Riparian Buffer Analysis within Subwatersheds of Black Creek Watershed												
	Spring Creek		**Headwaters**		**Robins Brook**		**Hotel Creek**		**Mill Creek**		**Outlet**	
NLCD Category	**Acres**	**%**	**Acres**	**%**	**Acres**	**%**	**Acres**	**%**	**Acres**	**%**	**Acres**	**%**
11 - Open Water	3.8	0.2%	30.2	1.0%	8.5	0.3%	28.7	0.8%	16.9	0.6%	20.5	0.9%
21 - Developed, Open Space	60.0	3.8%	155.5	5.0%	66.7	2.5%	143.2	3.9%	147.4	5.4%	177.0	8.0%
22 - Developed, Low Intensity	11.8	0.7%	25.4	0.8%	9.8	0.4%	38.0	1.0%	51.8	1.9%	25.4	1.1%
23 - Developed, Medium Intensity	4.2	0.3%	6.4	0.2%	0	0	9.6	0.3%	23.4	0.8%	13.6	0.6%
24 - Developed, High Intensity	0	0%	0	0%	0	0%	3.1	0.1%	4.4	0.2%	0.4	0%
31 - Barren Land	0	0%	0	0%	0	0%	1.1	0.0%	6.9	0.3%	0	0%
41 - Deciduous Forest	127.2	8.1%	472.8	15.2%	234.4	8.9%	533.7	14.6%	373.2	13.6%	182.8	8.2%
42 - Evergreen Forest	6.9	0.4%	10.7	0.3%	1.8	0.1%	8.0	0.2%	7.1	0.3%	4.2	0.2%
43 - Mixed Forest	27.6	1.7%	150.1	4.8%	39.6	1.5%	122.8	3.4%	111.0	4.0%	62.9	2.8%
52 - Shrub/Scrub	7.6	0.5%	79.8	2.6%	16.2	0.6%	30.0	0.8%	26.0	0.9%	16.2	0.7%
71 - Grass/Herbaceous	0.0	0.0%	12.5	0.4%	1.1	0.0%	4.9	0.1%	8.2	0.3%	5.3	0.2%
81 - Pasture Hay	**546.0**	**34.6%**	**1116.0**	**35.9%**	435.4	16.5%	904.0	24.7%	714.6	26.0%	407.0	18.4%
82 - Cultivated Crops	368.7	23.4%	472.6	15.2%	379.0	14.3%	518.6	14.2%	426.1	15.5%	474.6	21.4%
90 - Woody Wetlands	407.4	25.8%	542.0	17.4%	**1377.1**	**52.1%**	**1187.1**	**32.4%**	**768.6**	**28.0%**	**771.3**	**34.8%**
95 - Emergent Herbaceous Wetlands	7.3	0.5%	36.5	1.2%	75.8	2.9%	129.9	3.5%	62.9	2.3%	55.2	2.5%
Total	1,578.6		3110.4		2645.4		3662.8		2748.6		2216.4	

Data notes

[civ] NLCD Class Definitions. [Online] In Multi-Resolution Land Characteristics Consortium. Retrieved 12/13/10 from http://www.mrlc.gov/nlcd_definitions.php

Table E-1: Summary of Ambient Water Quality Standards (AWQS) for parameters sampled from Black Creek in recent years from available datasets, with overall analytical minimum and maximum results and number of samples

Parameter	AWQS	Data Sources/Location	Data Summary	Meets Standard?
Aluminum	100 ug/l (A[C])	RIBS – Byron @ State Route 237 (2000)	N samples = 10 Minimum = 13.9 ug/l Maximum = 301 ug/l Average = 90 ug/l	30% of measurements exceeded standards
Ammonia	Varies with pH and temperature. For this data set, standards range from 0.7 to 1.3 mg/l	RIBS – Byron @ State Route 237 (2000)	N samples = 10 Minimum = 0.01 mg/l Maximum = 0.06 mg/l Average = 0.02 mg/l	Standards met.
Cadmium	0.85 exp (0.7852 [ln (ppm hardness)] - 2.715) (A[C]) *Varies depending on sample hardness.* For this dataset, standards range from 5.11 to 8.32 ug/l.	RIBS – Byron @ State Route 237 (2000)	N samples = 10 Minimum = 0.02 ug/l Maximum = 0.03 ug/l Average = 0.026 ug/l	Standards met.
Coliforms, Total	• The monthly median value of the samples, from a minimum of five examinations, shall not exceed 2,400 cfu/100 ml, and; • more than 20 percent of the samples, from a minimum of five examinations, shall not exceed 5,000 cfu/100ml *Applicable when disinfection is required for SPDES permitted discharges directly into, or affecting the best usage of, the water; or when the department determines it necessary to protect human health.*	SUNY Brockport– Lower (2010)	*N samples per month*: August = 5 September = 4 October = 4 *Monthly Medians (cfu/100 ml)*: August = 14,800 September = 6,100 October = 1,300 *Percent exceeding 5000:* August = 80% September = 75% October = 25%.	August and September exceeded the monthly median standard of 2,400 cfu/100ml. August, September and October exceeded the percent of samples standard of 5,000 cfu/100ml.
Copper	(0.96) exp(0.8545 [ln (ppm hardness)] - 1.702) (A[C]) *Varies depending on sample hardness.* For this dataset, standards range from 23.7 to 40.2 ug/l.	RIBS – Byron @ State Route 237 (2000)	N samples = 10 Minimum = 1.8 ug/l Maximum = 3.1 ug/l Average = 2.4 ug/l	Standards met.
Dissolved Oxygen	For nontrout waters, the minimum daily average shall not be less than 5.0 mg/l, and at no time shall the DO concentration be less than 4.0 mg/l.	RIBS – Byron @ State Route 237 (2000)	N samples = 10 Minimum = 6.6 mg/l Maximum = 14.6 mg/l Average = 9.8 mg/l	Standards met.

Table E-1: Summary of Ambient Water Quality Standards (AWQS) for parameters sampled from Black Creek in recent years from available datasets, with overall analytical minimum and maximum results and number of samples

Parameter	AWQS	Data Sources/Location	Data Summary	Meets Standard?
Fluoride	(0.02) exp(0.907 [ln (ppm hardness)] + 7.394) (A[C]) *Varies depending on sample hardness.* For this dataset, standards range from 5,948 to 10,438 ug/l.	RIBS – Byron @ State Route 237 (2000)	N samples = 10 Minimum = 124 ug/l Maximum = 363 ug/l Average = 226 ug/l	Standards met.
Lead	(1.46203 - [ln (hardness) 0.145712]) exp (1.273 [ln (hardness)] - 4.297) (A[C]) *Varies depending on sample hardness.* For this dataset, standards range from 12.7 to 24 ug/l.	RIBS – Byron @ State Route 237 (2000)	N samples = 10 Minimum = 0.14 ug/l Maximum = 1.4 ug/l Average = 0.573 ug/l	Standards met
Mercury	0.0007 µg/l (H[FC])	RIBS – Byron @ State Route 237 (2000)	N samples = 10 Minimum = <0.01 ug/l Maximum = <0.03 ug/l Average = <0.02 ug/l	Measurements exceeded standards; however, the data were reported as less than the method detection limit.
NIckel	0.997 exp (0.846 [ln (ppm hardness)] + 0.0584) (A[C]) *Varies depending on sample hardness.* For this dataset, standards range from 136 to 230 ug/l.	RIBS – Byron @ State Route 237 (2000)	N samples = 10 Minimum = 0.45 ug/l Maximum = 1.1 ug/l Average = 0.7 ug/l	Standards met.
Nitrite Nitrogen	100 ug/L except 20 ug/L for trout waters (T or TS) (A[C])	RIBS – Byron @ State Route 237 (2000)	N samples = 10 Minimum = 10 ug/l Maximum = 24.5 ug/l Average = 14.8 ug/l	Standards met.
Nitrogen, Total	None in amounts that will result in growths of algae, weeds and slimes that will impair the waters for their best usages.	USGS – Churchville (2005-2009)	N samples = 42 Minimum = 0.042 mg/l Maximum = 694 mg/l Average = 0.117 mg/l	Narrative standards difficult to evaluate with these data.
		SUNY Brockport–Lower (2010)	N samples = 15 Minimum = 0.78 mg/l Maximum = 1.4 mg/l Average = 1.1 mg/l	
pH	Shall not be less than 6.5 nor more than 8.5	RIBS – Byron @ State Route 237 (2000)	N samples = 10 Minimum = 8.02 Maximum = 8.32 Average = 8.19	Standards met.

Table E-1: Summary of Ambient Water Quality Standards (AWQS) for parameters sampled from Black Creek in recent years from available datasets, with overall analytical minimum and maximum results and number of samples

Parameter	AWQS	Data Sources/Location	Data Summary	Meets Standard?
Phosphorus, Total	None in amounts that will result in growths of algae, weeds, and slimes that will impair the waters for their best usages.	RIBS – Byron @ State Route 237 (2000)	N Samples = 10 Minimum = 0.021 mg/l Maximum = 0.107 mg/l Average = 0.058 mg/l	Narrative standards difficult to evaluate with these data.
		USGS – Churchville (2005-2009)	N Samples = 42 Minimum = 0.022 mg/l Maximum = 0.618 mg/l Average = 0.117 mg/l	
		SUNY Brockport– Lower (2010)	N Samples = 15 Minimum = 0.037 mg/l Maximum = 0.075 mg/l Average = 0.053 mg/l	
Solids, Total Dissolved	Shall be kept as low as practicable to maintain the best usage of waters but in no case shall it exceed 500 mg/L.	RIBS – Byron @ State Route 237 (2000)	N samples = 10 Minimum = 438 mg/l Maximum = 807 mg/l Average = 612 mg/l	90% of samples exceeded standards.
Solids, Total Suspended	None from sewage, industrial wastes or other wastes that will cause deposition or impair the waters for their best usages.	RIBS – Byron @ State Route 237 (2000)	N samples = Minimum = mg/l Maximum = mg/l Average = mg/l	Narrative standards difficult to evaluate with these data.
		USGS – Churchville (2005-2009)	N Samples = Minimum = mg/l Maximum = mg/l Average = mg/l	
		SUNY Brockport– Lower (2010)	N Samples = Minimum = mg/l Maximum = mg/l Average = mg/l	
Solids, Total	None from sewage, industrial wastes or other wastes that will cause deposition or impair the waters for their best usages.	RIBS – Byron @ State Route 237 (2000)	N Samples = 10 Minimum = 501 mg/l Maximum = 894 mg/l Average =	Narrative standards difficult to evaluate with these data.
Turbidity	None from sewage, industrial wastes or other wastes that will cause deposition or impair the waters for their best usages.	RIBS – Byron @ State Route 237 (2000)	N Samples = 10 Minimum = 0.64 NTU Maximum = 4.7 NTU Average = 1.92 NTU	Narrative standards difficult to evaluate with these data.

Table E-1: Summary of Ambient Water Quality Standards (AWQS) for parameters sampled from Black Creek in recent years from available datasets, with overall analytical minimum and maximum results and number of samples

Parameter	AWQS	Data Sources/Location	Data Summary	Meets Standard?
Zinc	exp (0.85 [ln (ppm hardness)] + 0.50) (A[C]) Varies depending on sample hardness. For this dataset, standards range from 217 to 368 ug/l.	RIBS – Byron @ State Route 237 (2000)	N Samples = 10 Minimum = 0.44 ug/l Maximum = 12.7 ug/l Average = 4.93 ug/l	Standard met.

Notes:
(A[C]) – standard based on aquatic, chronic exposure
(H[FC]) – standard based on human health, fish consumption

Data Sources:
RIBS – Byron @ State Route 237 (2000): BLACK CREEK IN BYRON @ STATE ROUTE 237 – Rotating Intensive Basin Study, conducted in 2000 by the NYSDEC.
SUNY Brockport– Lower (2010): Data collected by for the Genesee River Project by Dr. Joseph C. Makarewicz (SUNY Brockport) during 2010 on Black Creek from a sample location described as “Lower (Black Crk)”, which corresponds to the USGS Churchville location.
USGS – Churchville (2005-2009): • USGS 04231000 BLACK CREEK AT CHURCHVILLE NY. Data available from this station range from 1954 to 2009. For the purposes of this screening, data from 2005 through 2009 were used.
AWQS - 6 NYCRR Part 703 Surface Water and Groundwater Quality Standards and Groundwater Effluent Limitations (Statutory authority: Environmental Conservation Law, §§ 3-0301[2][m], 15-0313, 17-0301, 17-0809)

Table F-1. Rare, Threatened and Endangered Species and Significant Habitats within Black Creek Watershed (NY Natural Heritage Program database).

Common Name[1]	Scientific Name	NY Protection Status[2]				Conservation Ranking[3]
		E	T	R	U	
Reptiles						
Bog Turtle*	*Glyptemys muhlenbergii*	x				S2; G3
Coal Skink	*Eumeces anthracinus*				N[4]	S2S3; G5
Eastern Massasauga	*Sistrurus catenatus catenatus*	x				S1; G3G4T3T4Q
Queen Snake	*Regina septemvittata*	x				S1; G5
Fish						
Blackchin Shiner*	Notropis heterodon				x	S1; G5
Dragonflies and Damselflies						
Black Meadowhawk*	Sympetrum danae				x	S2S3; G5
Vascular Plants						
Big Shellbark Hickory	*Carya laciniosa*		x			S2; G5
Calypso*	*Calypso bulbosa var. americana*	x				SH; G5T5?
Crawe's Sedge	*Carex crawei*		x			S2; G5
Creeping Juniper	*Juniperus horizontalis*	x				S1; G5
Deer's Hair Sedge	*Trichophorum cespitosum ssp. cespitosum*		x			S2; G5T5
Dragon's Mouth Orchid	*Arethusa bulbosa*		x			S2; G4
Handsome Sedge	*Carex formosa*		x			S2; G4
Houghton's Goldenrod	*Oligoneuron houghtonii*	x				S1; G3
Log Fern*	*Dryopteris celsa*	x				S1; G4
Low Nutrush	*Scleria verticillata*	x				S1; G5
Marsh Arrow-grass	*Triglochin palustre*		x			S2; G5
Marsh Valerian	*Valeriana uliginosa*	x				S1S2; G4Q
Mountain Death Camas	*Anticlea elegans ssp. glaucus*		x			S2; G5T4T5
Northern Bog Sedge	*Carex gynocrates*	x				S1; G5
Northern Bog Violet	*Viola nephrophylla*	x				S1; G5
Ohio Goldenrod	*Oligoneuron ohioense*		x			S2; G4
Ovate Spikerush	*Eleocharis ovata*	x				S1S2; G5
Sheathed Sedge	*Carex vaginata*	x				S1; G5
Small White Ladyslipper	*Cypripedium candidum*	x				S1; G4
Sticky False Asphodel	*Triantha glutinosa*	x				S1; G4G5
Swamp Lousewort	*Pedicularis lanceolata*		x			S2; G5
Whorled Mountain-mint*	*Pycnanthemum verticillatum var. verticillatum*		x			S1S2; G5T5
Wiry Panic Grass	*Panicum flexile*		x			S3; G5
Woodland Agrimony*	*Agrimonia rostellata*		x			S2; G5
Communities						
Marl fen					x	S1; G2G3
Northern white cedar swamp					x	S2S3; G4
Rich graminoid fen					x	S1S2; G3
Silver maple-ash swamp					x	S3; G4

[1]Rare plants, rare animals and significant communities documented in the Oatka Creek watershed since 1980, unless marked with an asterisk (*), which indicates last documented in vicinity of the project site before 1980.

[2]NY Protection Status: E = Endangered; T = Threatened; R = Rare; U = Unlisted.

[3]Conservation rankings:

- State Ranking – Rarity in New York as ranked by NY Natural Heritage Program on a 1 to 5 scale.
  S1 = Critically imperiled S2 = Imperiled S3 = Vulnerable S4 = Apparently secure
  S5 = Abundant and secure SH = Historical records only, no recent information available
- Global Ranking – Global rarity as ranked by Nature Serve on a 1 to 5 scale.

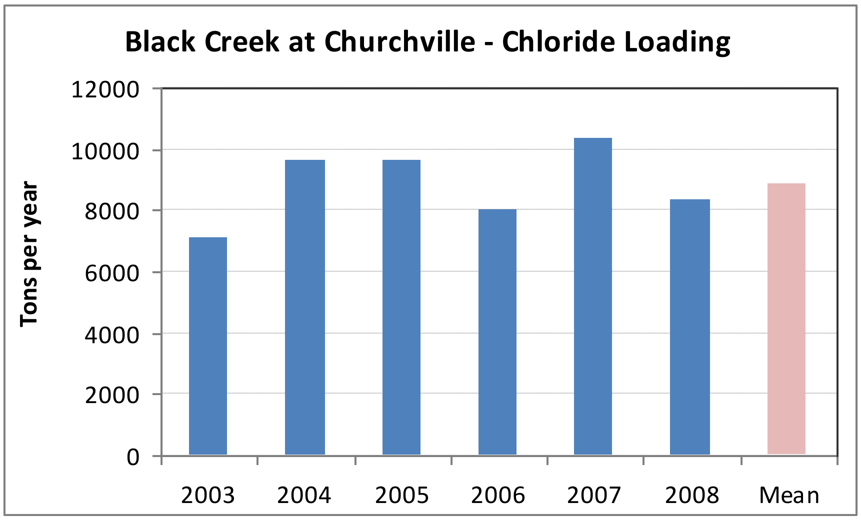
Table F-1. Rare, Threatened and Endangered Species and Significant Habitats within Black Creek Watershed (NY Natural Heritage Program database).

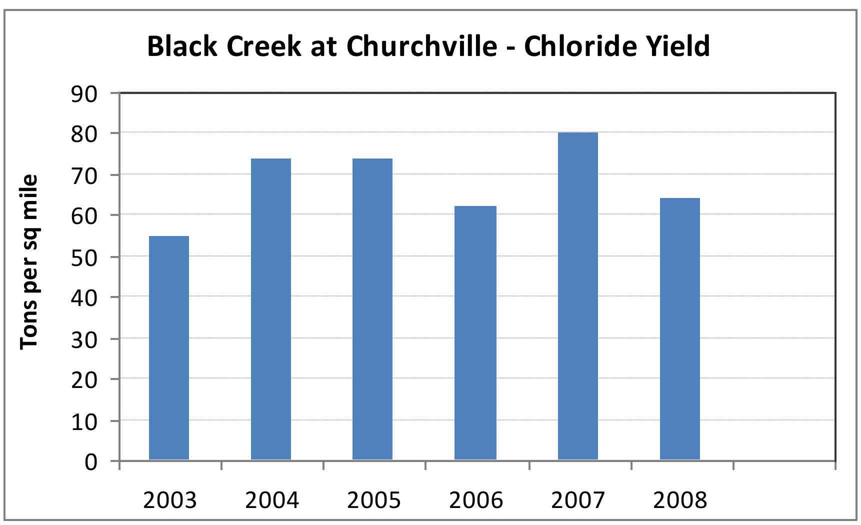
G1 = Critically imperiled G2 = Imperiled G3 = Vulnerable
G4 = Apparently secure G5 = Secure GNR = Not ranked;

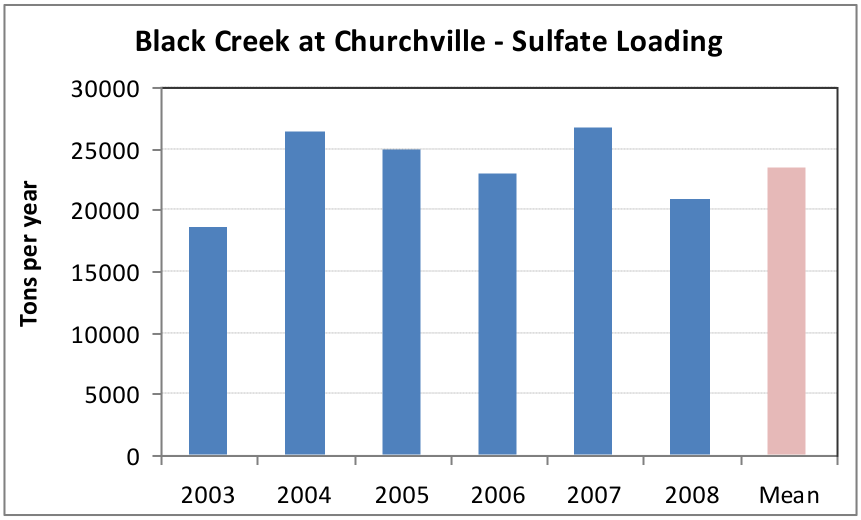
- T-ranks (T1-T5) are defined the same as the G-ranks (G1-G5), but T-rank refers only to the rarity of the subspecies or variety.
- Q = a question exists whether or not the species or variety is a good taxonomic entity.
- ? = a question exists about the rank.

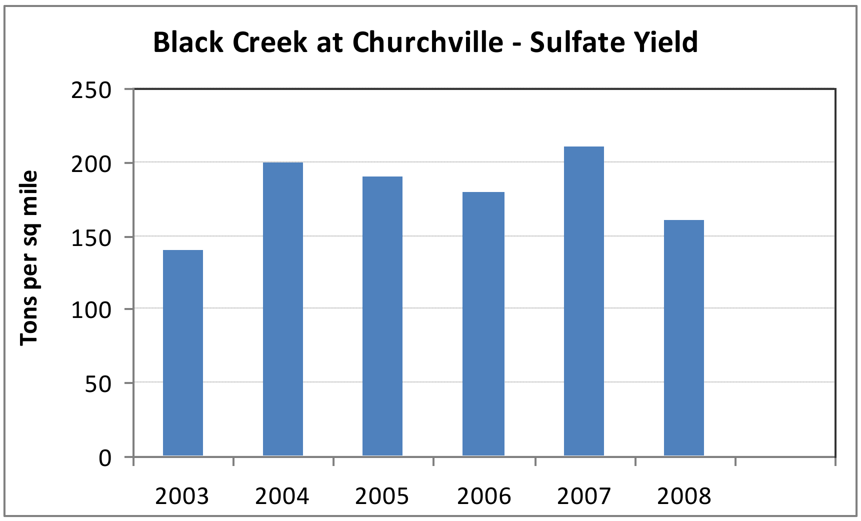
[4]N = No open season

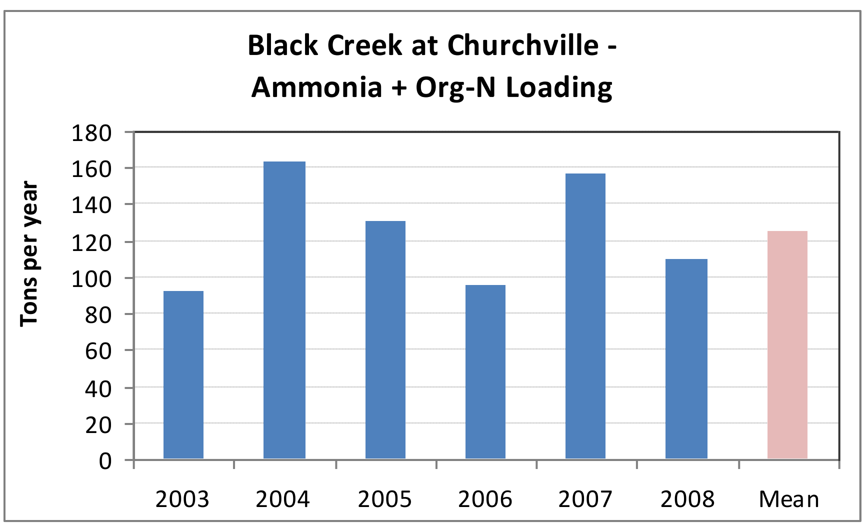
Charts referenced under Section 5.3: Constituent Loads

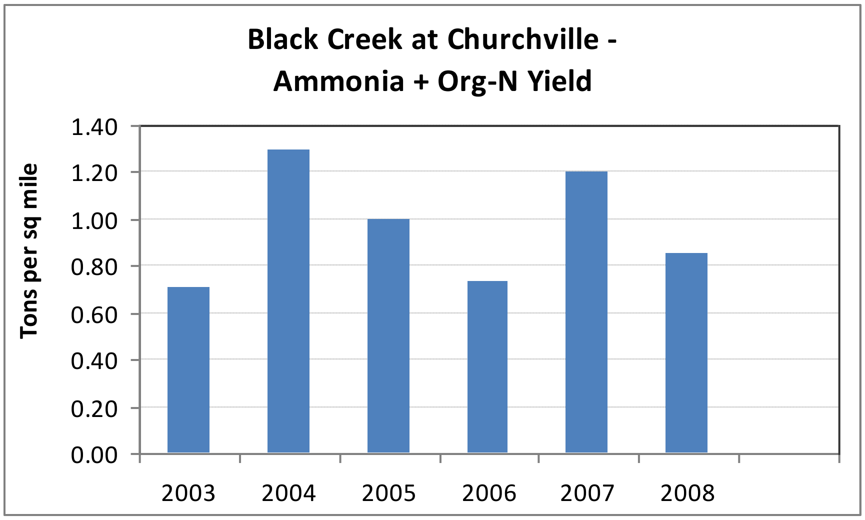


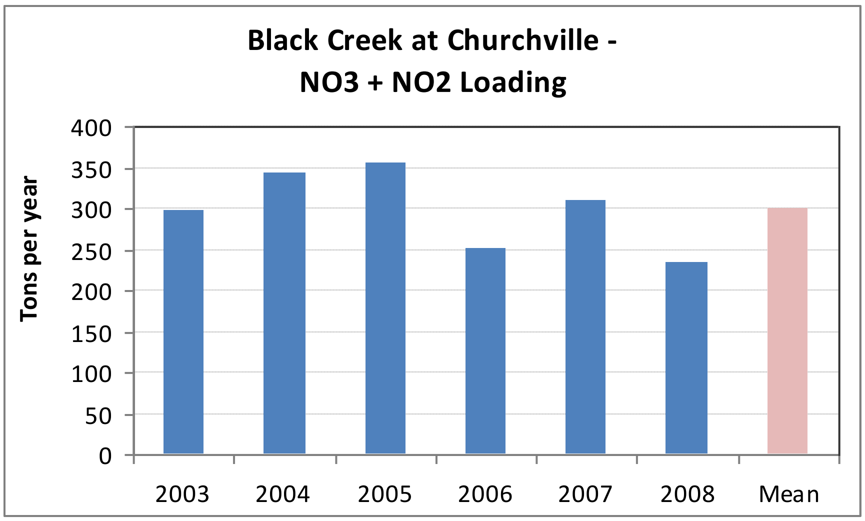


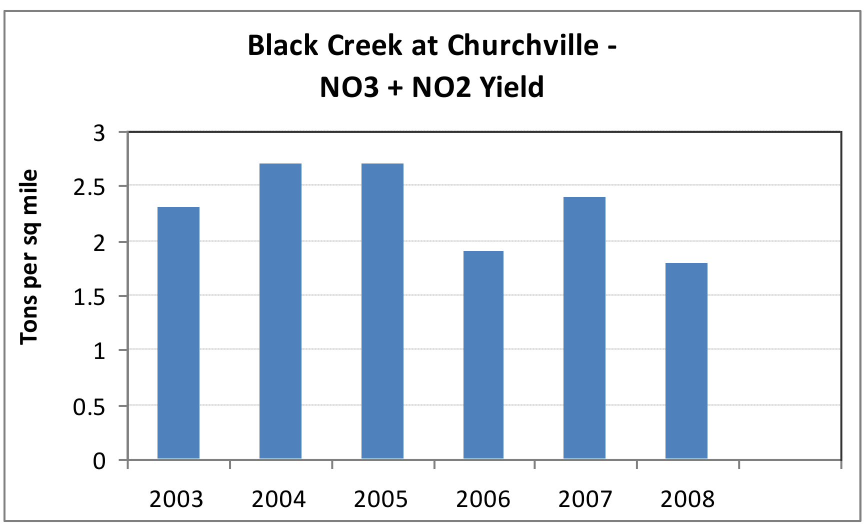

Black Creek at Churchville - Sulfate Loading
Tons per year
30000
25000
20000
15000
10000
5000
0
2003
2004
2005
2006
2007
2008
Mean

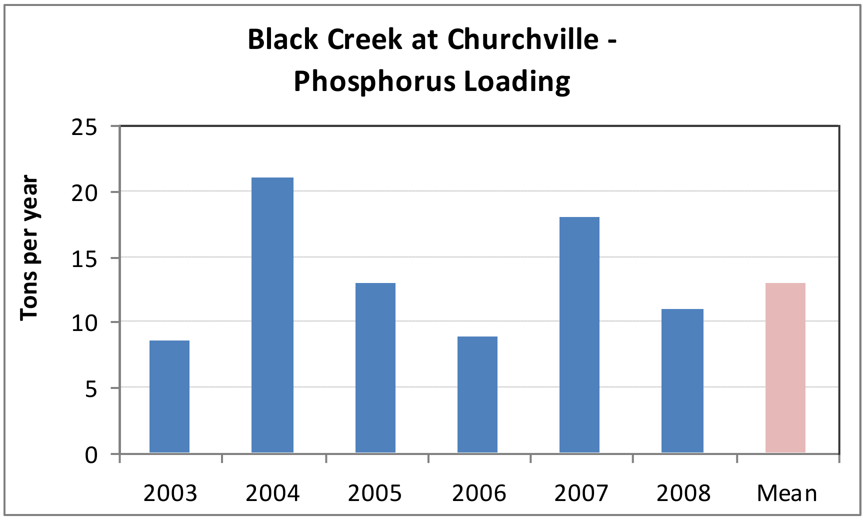

Black Creek at Churchville - Sulfate Yield
Tons per sq mile
250
200
150
100
50
0
2003
2004
2005
2006
2007
2008


Black Creek at Churchville -
Ammonia + Org-N Loading
Tons per year
180
160
140
120
100
80
60
40
20
0
2003
2004
2005
2006
2007
2008
Mean


Black Creek at Churchville -
Ammonia + Org-N Yield
Tons per sq mile
1.40
1.20
1.00
0.80
0.60
0.40
0.20
0.00
2003
2004
2005
2006
2007
2008


Black Creek at Churchville -
NO3 + NO2 Loading
Tons per year
400
350
300
250
200
150
100
50
0
2003
2004
2005
2006
2007
2008
Mean


Black Creek at Churchville -
NO3 + NO2 Yield
Tons per sq mile
3
2.5
2
1.5
1
0.5
0
2003
2004
2005
2006
2007
2008



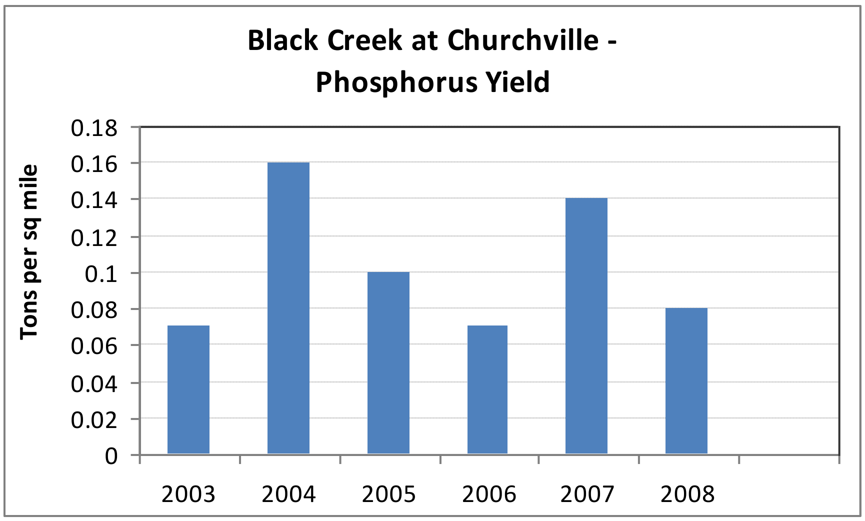


Table F-2: Black Creek Macroinvertebrate Samples Collected by NYSDEC on 9-14-2004 (Preliminary Analysis provided by NYSDEC-Stream Biomonitoring Unit and Formatted Spreadsheet; Notes provided by Peter Lent, BCWC volunteer)

Phylum	Class (For Common Names See Notes)	Order (For Common Names See Notes)	Family or Subfamily-Tribe	Genus/species (Tolerance Value) *	9/14/04 Black Creek North of Byron 200m Upstream Rt 237 Bridge	9/14/04 Black Creek Below Churchville 80 m Downstream Burnt Mill Rd Bridge	9/14/04 Spring Creek North of Byron 20 m Downstream RT 237 Bridge	9/14/04 Mill Creek Chili Center Immediately Above Stottle Rd Bridge
PLATYHELMINTHES	TURBELLARIA			Undetermined Turbellaria (6)			2	
ANNELIDA	OLIGOCHAETA		Tubificidae	Undet. Tubicidae w/o cap. Setae (10)				1
	HIRUDINEA							
MOLLUSCA	GASTROPODA	BASOMMATOPHORA	Physidae					

Table F-2: Black Creek Macroinvertebrate Samples Collected by NYSDEC on 9-14-2004 (Preliminary Analysis provided by NYSDEC-Stream Biomonitoring Unit and Formatted Spreadsheet; Notes provided by Peter Lent, BCWC volunteer)

Phylum	Class (For Common Names See Notes)	Order (For Common Names See Notes)	Family or Subfamily-Tribe	Genus/species (Tolerance Value) *	9/14/04 Black Creek North of Byron 200m Upstream Rt 237 Bridge	9/14/04 Black Creek Below Churchville 80 m Downstream Burnt Mill Rd Bridge	9/14/04 Spring Creek North of Byron 20 m Downstream RT 237 Bridge	9/14/04 Mill Creek Chili Center Immediately Above Stottle Rd Bridge
	PELECYPODA	VENEROIDEA	Sphaeriidae	Sphaerium sp. (6)	9	18	6	
ARTHROPODA	CRUSTACEA	ISOPODA	Asellidae	Caecidotea sp. (8)	1			
		AMPHIPODA	Gammaridae	Gammarus sp. (6)	13	35	17	2
	INSECTA	EPHEMEROPTERA	Baetidae	Baetis intercalaris (5)	1			
			Heptageniidae	Stenonema femoratum (7)	1			
				Stenonema vicarium (2)	8			
				Stenacron interpunctatum (7)		4		2
			Leptophlebiidae					
			Ephemerellidae					
			Leptohyphidae					
			Caenidae					
		ODONATA	Coenagrionidae	Argia sp. (6)		1		
		PLECOPTERA						
		COLEOPTERA	Psephenidae	Psephenus herricki (4)	1	2		
			Elmidae	Optioservus fastiditus (4)	3			
				Optioservus sp. (4)				1
				Promoresia elegans (2)				9
				Stenelmis crenata (5)	22	20	32	24
		MEGALOPTERA	Corydalidae	Nigronia serricornis (4)	4			3
		TRICHOPTERA	Philopotamidae	Chimarra obscura (4)		8		
				Chimarra alterima? (4)				3
			Hydropsychidae	Cheumatopsyche sp. (5)	6	2	26	23
				Hydropsyche betteni (7)	3	3	8	23
				Hydropsyche scalaris (2)	2			
				Hydropsyche sparna (6)	3		3	5
			Helicopsychidae					
			Brachycentridae					
			Rhyacophilidae					
		DIPTERA	Simuliidae	Simulium aureum (7)	1			1

Table F-2: Black Creek Macroinvertebrate Samples Collected by NYSDEC on 9-14-2004 (Preliminary Analysis provided by NYSDEC-Stream Biomonitoring Unit and Formatted Spreadsheet; Notes provided by Peter Lent, BCWC volunteer)

Phylum	Class (For Common Names See Notes)	Order (For Common Names See Notes)	Family or Subfamily-Tribe	Genus/species (Tolerance Value) *	9/14/04 Black Creek North of Byron 200m Upstream Rt 237 Bridge	9/14/04 Black Creek Below Churchville 80 m Downstream Burnt Mill Rd Bridge	9/14/04 Spring Creek North of Byron 20 m Downstream RT 237 Bridge	9/14/04 Mill Creek Chili Center Immediately Above Stottle Rd Bridge
				Simulium vittatum (7)		6		2
				Simulium sp. (5)	13			
			Empididae	Hemerodromia sp. (6)		1		
			Athericidae	Atherix sp. (4)	1			
			Tipulidae	Antocha sp. (3)			1	1
			Chironomidae	**(Total of Below)**	**9**	**0**	**5**	**0**
			Tanypodinae					
			Diamesinae					
			Orthcladiinae	Parametriocnemus lundbecki (5)	3			
				Cricotopus sp. (7)			1	
				Tvetenia bavarica gr. (4)			1	
			Chironominae-Chironomini	Microtendipes pedellus gr. (6)	3		1	
				Polypedilum flavum (6)	1		2	
				Stictochironomus sp. (9)	2			
			Chironominae-Tanytarsini					
				Total Number in Sample	101	100	100	100
				No Species in Sample	21	11	12	14
				Biological Assessment Profile (BAP)**	5.9	3.8	3.9	4.2
				Overall Rating	SLIGHT	MODERATE	MODERATE	MODERATE

NOTES

Tolerance Value - Hilsenhoff's Biotic Index tolerance value (HBI) found in Appendix 18.10 of Standard Operating Procedure: Biological Monitoring of Surface Waters in New York State, NYSDEC, 2009

Each species is an assigned number from 0-10 based on its tolerance to pollution, 0 being very intolerant and 10 being very tolerant. See http://www.dec.ny.gov/docs/water_pdf/sbusop2009.pdf

** BAP (Biological Assessment Profile) - The BAP score is a multimetric index of water quality, which is calculated by combining several measurements describing the macroinvertebrates in the sample.

For riffle habitats, the indices used in calculating the BAP are: SPP (Species Richness), HBI (Hilsenhoff Biotic Index), EPT (Mayfly-Stonefly-Caddisfly richness), and PMA (Percent Model Affinity).

NYS categorizes water quality assessed by biomonitoring into four impact categories based on BAP scores: Non-Impact 10-7.5; Slight Impact 7.5-5; Moderate Impact 5-2.5; and Severe Impact 2.5-0.

The impact category considered the decision threshold for designated use impairment based on biological data is the boundary between Slight and Moderate Impact.

See http://www.dec.ny.gov/docs/water_pdf/sbusop2009.pdf for further descriptions of how biomonitoring isused to assess water quality in New York.

Common Names of Macroinvertebrate Groups

NON-INSECTS

Flatworms= Platyhelminthes
Aquatic Earthworms =Oligochaeta
Leeches = Hirudinea
Snails = Gastropoda
Clams = Pelecypoda
Fingernail Clams = Sphaeriidae
Aquatic Sow Bugs = Isopoda
Scuds or Sideswimmers = Amphipoda

INSECTS

Mayflies = Emphemeroptera
Dragonflies & Damselflies = Odonata
Stoneflies = Plecoptera
Caddisflies = Trichoptera
Dobsonflies, Hellgrammites, Fishflies & Alderflies = Megaloptera
Beetles = Coleoptera
Water Penny Beetle = Psephenidae
Riffle Beetles = Elmidae
True Flies = Diptera
Black Flies = Simuliidae
Dance Flies = Empididae
Aquatic Snipe Flies = Athericidae
Crane Flies = Tipulidae
Non-Biting Midges or Midges = Chironomidae

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