Baseline Watershed Assessment
North Branch Park River Watershed

Connecticut Department of Environmental Protection

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FUSS & O'NEILL
Disciplines to Deliver

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In Cooperation With:

Farmington River Watershed Association
Park River Watershed Revitalization Initiative

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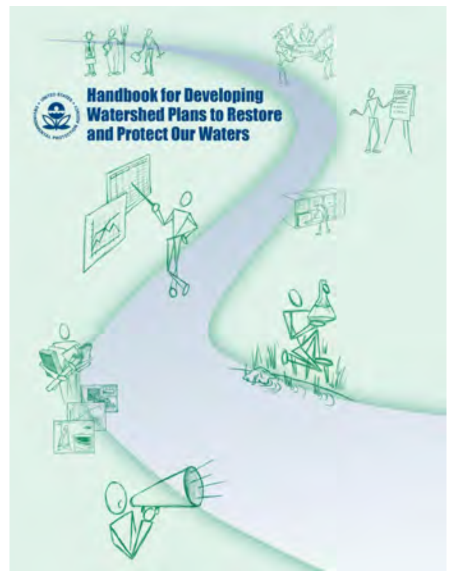
1 Introduction

The Connecticut Department of Environmental Protection (CTDEP) retained a project team led by Fuss & O'Neill, Inc. and including the Farmington River Watershed Association, the Park River Watershed Revitalization Initiative, and New England Environmental, Inc. to prepare a Watershed Management Plan for the North Branch of the Park River in Hartford County, Connecticut. The Watershed Management Plan is being developed in cooperation with the CTDEP, other governmental entities, stakeholder groups, and the general public.

The watershed planning process included the preparation of three documents, including: (1) a baseline assessment report, (2) a detailed subwatershed field assessment report, and (3) a watershed management plan. The *Baseline Watershed Assessment Report*, which is the subject of this document, summarizes existing environmental and land use conditions in the watershed and identifies priority areas in the watershed for subwatershed field inventories. The results of the subwatershed field inventories have been documented in the field assessment report, which include targeted and site-specific opportunities for watershed restoration projects. Finally, the watershed management plan has identified priority action items to protect and improve the ecological integrity of the North Branch Park River and its watershed based on the priorities and issues identified in previous phases of the plan development, with input from the CT DEP and a project steering committee.



The management plan will be developed to satisfy EPA and CTDEP criteria for watershed-based plans.

The watershed management plan is consistent with the U.S. Environmental Protection Agency (EPA) and CTDEP guidance for the development of watershed-based plans. The guidance outlines nine key elements that establish the structure of the plan, including specific goals, objectives, and strategies to protect and restore water quality; methods to build and strengthen working partnerships; a dual focus on addressing existing problems and preventing new ones; a strategy for implementing the plan; and a feedback loop to evaluate progress and revise the plan as necessary. Following this approach will enable implementation projects under this plan to be considered for funding under Section 319 of the Clean Water Act.

The watershed management plan is a comprehensive, scientifically-sound, and practical planning document for the protection and restoration of water resources in the North Branch Park River watershed. The watershed management plan characterizes the watershed conditions, through a process of that has identified the current and emerging issues facing the watershed, and that have the clear potential to affect on-the-ground change within the watershed.

1.1 Development of the Baseline Assessment Report

The following tasks were completed in developing this *Baseline Watershed Assessment Report* for the North Branch Park River watershed:

- Reviewed existing data, studies, and reports on the watershed.
- Compiled and analyzed available Geographic Information System (GIS) data.
- Consulted with the project steering committee, the watershed municipalities, the regional planning agency, and other governmental entities regarding available land use information, mapping, and land use planning regulations.
- Identified and delineated subwatersheds within the overall North Branch Park River watershed.
- Conducted a comparative subwatershed analysis to prioritize watershed field inventories and management plan recommendations.
- Performed a land use regulatory review.

This report documents current watershed conditions for the following topics:

- Study area, including a basic description of the watershed (Section 2).
- Historical and social perspective (Section 3).
- Natural resources including geology and soils, topography, hydrology, wetlands and watercourses, and fish and wildlife resources (Section 4).
- Watershed modifications including dams, water supply, wastewater, stormwater, and regulated sites (Section 5).
- Water quality including classifications and trends based on available monitoring data (Section 6).
- Land use and land cover (Section 7).
- Existing watershed practices (Section 8).
- Pollutant loading (Section 9).
- Comparative subwatershed analysis (Section 10).

1.2 Background

The North Branch Park River watershed, a moderate-sized watershed of slightly less than 30 square miles in area, is the northern sub-basin of the larger (77 square mile) Park River watershed, which also includes the South Branch Park River watershed. The majority of the North Branch Park River watershed (97%) is located within Bloomfield, the adjacent northern suburbs of West Hartford, and the northwestern neighborhoods of Hartford. The remaining 3% of the watershed land area overlaps Avon and Simsbury along the Metacomet Ridge, as well as a few acres in Windsor.

The land uses within the watershed trend from highly urbanized at its underground confluence with the South Branch Park River to undeveloped in portions of its headwater regions, especially along the Metacomet Ridge where open space includes landscapes that protect the MDC Reservoirs and Penwood State Park. Tributaries of Tumbledown Brook, Wash Brook, Beamans Brook and Filley Brook spread out across Bloomfield. Flowing from Reservoir #6, Tumbledown Brook South crosses into West Hartford from Bloomfield, then flows north again. These twisting brooks reveal lost characteristics of the tributaries that have been altered, often straightened by development. The North Branch of the Park River is formed within Bloomfield by the confluence of three brooks (Wash, Filley, and Beamans), flowing into the University of Hartford campus and south through residential neighborhoods. The lower portion of the river disappears completely at Farmington Avenue, pouring into a several-mile long flood control conduit before it discharges to the Connecticut River.

Unseen and often forgotten by many, the North Branch of the Park River flows along the boundaries of Hartford's West End, Asylum Hill and Blue Hills neighborhoods. Tributaries of the North Branch Park River are more prevalent in its upper reaches along the Metacomet Ridge, where considerable amounts of open space and undeveloped land protect the river. In its middle reaches, there are encroachments of urban development interspersed with undeveloped or lightly developed areas adjacent to the river. Flood control reservoirs in the central and upper reaches of the watershed provide some measure of flood protection and open space. Flooding is common along the lower portions of the river due to a combination of development of large parking lots within the floodplain and higher amounts of impervious cover in the southeastern areas of Bloomfield as well as Hartford.

The Park River is formed by the confluence of its north and south branches. Identified as the "Little River" on 17th century maps, the Park River has been shaped by the prevailing economic and political priorities as well as popular cultural aspirations. Hartford landmarks such as the State Capitol, Bushnell Park, Pope Park and the Mark Twain House were originally constructed with respect for the scenic characteristics of these waterways.

Architectural features of the Mark Twain House once enhanced the view of the North Branch Park River.

The historic relationship of the Park River to the urban fabric of Hartford is an indication of the opportunity for improvement – or degradation of the river – through future urban revitalization projects. On-going and future development in the watershed at the municipal boundaries of Bloomfield, Hartford and West Hartford near the University of Hartford could increase flooding downstream if green infrastructure practices are not integrated into the planning and urban design of future development.

Fortunately, the identities of a number of private and public institutions are clearly enhanced by the historic campus landscapes. Many institutions currently front the aboveground portion of the North Branch Park River in Hartford including the University of Hartford, the UConn Law School, Connecticut Historical Society, the Village of Family & Children Services, Saint Francis Hospital and Medical Center, and the Watkinson School. Despite significant development within the watershed and its impaired water quality, the North Branch Park River could serve as a recreational as well as a scenic asset. Property owners have recognized its value as a rare habitat for migratory birds, an urban wild within the city fabric that increases residential property values and provides an unexpected amenity for new development projects, such as the Goodwin Estates residences.

Water quality of urban streams is typically one of many challenges facing urban areas. Stormwater runoff from rooftops, roadways, and parking lots carries pollutants and contributes to flooding, which degrades aquatic habitat. Fortunately, "low impact development" (LID) and broader green infrastructure urban plannng and design strategies can help to improve and restore water quality within high density urban areas. The North Branch Park River also has the potential to serve as a tremendous asset and a focal point for urban/suburban community collaboration. It can be perceived as a natural feature that could help define the character of the urban/suburban nexus. Cities across the United States are beginning to rediscover their connections to rivers and waterways. The success of River Front Recapture in bridging across I-91 to provide pedestrian access from Hartford to the Connecticut River is a prime local example of the benefits that can be reaped from re-connecting people with the river. The North Branch Park River still retains sizeable natural areas along its banks as it flows from its headwaters into Hartford. Naturally regional, watersheds are a comprehensive ecological area that can be measured by a community that values clean water quality within the North Branch Park River. The linear nature of rivers also provides tangible linkages for collaboration among property owners within the watershed's sub-basins.

The North Branch Park River has the potential to serve as a tremendous asset and a focal point for urban/ suburban community collaboration.

The potential exists for a regional vision that provides environmental connectivity and recreational linkages from the Metacomet Ridge to the Connecticut River through the town centers of Bloomfield and West Hartford and downtown Hartford. Such an expansive network of open space can increase public appreciation for smart growth, high-density development that can mitigate sprawl. During the North Branch Park River Watershed Management Plan process, the "iQuilt" evolved as a concept that can enrich the urban experience of downtown Hartford. The iQuilt will enhance the pedestrian experiences with lighting, signage and green infrastructure by weaving together historic parks, cultural landmarks, residences and business properties Over time, the iQuilt concept could unfold across the watershed to restore regional connectivity – and increase cooperative environmental research and management.

Watershed management is especially important given that the aging sewer infrastructure frequently overflows stormwater runoff combined with sanitary sewage into the North and South Branches of the Park River, as well as the buried conduit. These overflows – combined sewer overflows (CSOs) and sanitary sewer overflows (SSOs) – reduce rivers to functioning as open sewers during heavy rain storms. A long-term program to address these issues is being developed by the Metropolitan District Commission (MDC) in cooperation with the CTDEP. For over a decade, the MDC has been working in many ways to reduce CSOs and SSOs, which will significantly improve the quality of the North and South Branches of the Park River as well as the Connecticut River. This historic infrastructure improvement ("Clean Water Project") is an opportunity to raise awareness about the deteriorating conditions of local waterways. Increased public interest can help to motive municipal planning and design decisions towards investments in green infrastructure.

The watershed management plan identifies measures that can be taken to improve the health of the river and have the clear potential to affect on-the-ground change within the watershed.

The CTDEP is seeking to clearly define challenges facing the North Branch Park River. This watershed management plan has identified measures that can be taken to improve the health of the river, including physical on-the-ground improvements, infrastructure improvements including green infrastructure and sustainable design, improved land use decision-making with a shift to the concept of low impact development, river restoration, land or land rights acquisition to further protect the river and allow public access to increase the profile of the river, and public outreach and education programs.

1.3 Ongoing Watershed Conservation and Restoration Efforts

A number of educational, governmental, and neighborhood, organizations are involved in efforts to preserve the existing high-quality natural resources of the North Branch Park River watershed, as well as to restore or improve degraded resources in the watershed. Notable conservation and restoration-related efforts and projects within the North Branch Park River watershed are summarized below.

- The Park River Assessment Program is a project funded by the United States Environmental Protection Agency (EPA) that was initiated in October 2007. The Children's Museum, the Farmington River Watershed Association, and the Park River Watershed Revitalization Initiative are working together on this two-year program, which has recruited family teams and community youth groups to adopt a stream in the watershed and monitor the water quality and habitat along its banks.

- The Park River Watershed Revitalization Initiative (PRWRI) began in 2004 as an online resource (www.parkriver.org) and to form urban watershed stewardship community networks. In 2006 PRWRI became a project of the 501(c)3 Farmington River Watershed Association (FRWA) and continued to build an ad hoc network of advisors and stakeholders who recognized the value of water quality improvements. The Park River and the Farmington River watersheds meet along the Metacomet Ridge. These two watersheds overlap across seven town boundaries and share municipal ordinances that define land use policies. Drinking water for residents of the Park River watershed is drawn from the reservoirs in the Farmington River watershed.

This partnership has organized river clean-ups that have removed over 5 tons of trash and debris from watercourses and waterways within the watershed. In addition, PRWRI coordinated educational workshops that range from the 2007 "Stormwater in the City" conference, invasive species removal projects, green roof planting, building a rain garden and Park Water Arts eco-artist events.

- The Metropolitan District Commission (MDC), which is responsible for the water and sewer systems in the greater Hartford area, is implementing a major infrastructure improvement program known as "The Clean Water Project" to address a federal consent decree and a CTDEP consent order to achieve the Federal Clean Water Act goals. The Clean Water Project includes three basic elements: (1) reduction of combined sewer overflows (CSOs) within the Hartford central sewer system, (2) elimination of sanitary sewer overflows (SSOs) in the sanitary sewers of Wethersfield, West Hartford, Windsor, Rocky Hill and Newington and (3) nitrogen reductions. Projects will range from new sewer and drainage systems to greater wastewater treatment capacity to new tunnel storage and conveyance. These projects will help to eliminate sewage overflows to area waterways during an average year, significantly improving water quality.

The Metropolitan District Commission is embarking on an ambitious program, The Clean Water Project, to address approximately one billion gallons of combined wastewater and stormwater currently released each year to area waterways.

- The EPA promulgated a nation-wide stormwater program in 1990 to regulate stormwater discharges from cities and urbanized areas. Phase I of this program regulated large cities with populations of greater than 100,000 and without combined sewer overflows. Phase II, which began implementation in 1999, applies to small municipal separate storm sewer systems in urbanized areas, which includes the communities in the North Branch Park River watershed. The Phase II stormwater regulations require that regulated communities implement six minimum control measures to reduce levels of pollutants in stormwater discharges. The communities in the North Branch Park River watershed are currently implementing stormwater management plans as required by the Phase II stormwater program.

- The 4-H education center at Auer Farm in Bloomfield, a partner of the University of Connecticut, College of Agriculture, organizes childhood education programs focusing on agriculture within the watershed.

- The Knox Parks Foundation, an organization established to 'green' Hartford's neighborhoods through organizing community gardens, providing horticultural assistance, beautifying the city through horticulture, and reversing the trend of urban deforestation. This organization is now based in the watershed of the South Branch of the Park River, but works within the North Branch watershed as well.

- The North Central Conservation District provides technical services and educational conservation assistance to local nonprofit organizations. The Conservation District serves 30 municipalities, including communities within the North Branch Park River watershed.

- The Connecticut Coalition for Environmental Justice works to protect Connecticut's urban environments from the disproportionate affects of environmental pollution that may be caused by socioeconomic inequality.

- The Eastern Connecticut Resource Conservation and Development Area is a volunteer natural resource advocacy group that focuses on the interdependence of urban, suburban, and rural communities. The Eastern Connecticut RC&D Area includes the North Branch Park River watershed. Their activities include the recent completion of the South Branch Park River Trail and support of the ongoing planning effort in the North Branch Park River watershed.

- Depending upon teacher interests, K-12 schools along the North Branch of the Park River participate in projects that raise awareness about urban watershed stewardship, such as invasive species removal, river clean-ups and nature walks, as well as the design-build learning process of creating a rain garden that can capture stormwater runoff from school parking lots. The Watkinson School, the Montessori School at Annie Fisher, Classical Magnet School, the University of Hartford Magnet School, and the Harris Agri-Science Center at Bloomfield High School have engaged students in water quality learning activities.

- In addition to K-12 schools, there are twelve institutions of higher learning throughout the Park watershed, which have faculty actively engaging students in local research, annual clean-up activities and internships. Considerable assistance has been provided by Trinity College Environmental Science Program (which assisted with background water quality research for the North Branch Park River Watershed Management Plan), and the Watkinson School (which has provided 10 years of CT DEP Project SEARCH data), and the Harris Agri-Science Center at Bloomfield High School. Within the North Branch Park River Watershed there are four institutions of higher education: University of Hartford, University of Connecticut Law School, Hartford Seminary and St. Thomas Seminary. Faculty, student clubs, and facilities maintenance staff at these institutions are increasingly involved in "green campus" initiatives that can raise awareness about water conservation and watershed research.

- Although public parks and golf courses are not necessarily oriented towards watershed stewardship, note that on-going public access and educational programs do contribute to increased public awareness of local environmental conditions.

2 Study Area Description

2.1 North Branch Park River

The North Branch Park River conduit entrance near Farmington Avenue.

The North Branch Park River is formed by four major tributaries - Beamans Brook, Wash Brook, Filley Brook, and Tumbledown Brook (*Figure 2-1*). These tributaries have a total combined length of approximately 13.3 miles, with an additional 28.7 miles of unnamed tributaries. The North Branch Park River begins at the confluence of Beamans Brook and Tumbledown Brook in a wooded area between Routes 218 and 189 in the southern portion of Bloomfield. The North Branch Park River flows in a southerly direction for approximately 5.9 miles through the northern sections of the City of Hartford before entering an underground conduit near Farmington Avenue. The river then flows approximately 0.5 miles in the underground conduit before joining the South Branch Park River and ultimately flowing to the Connecticut River via the Park River conduit. The North Branch Park River and its tributaries are further described in Section 4.3 *Hydrology.*

2.2 Watershed

The North Branch Park River watershed is an approximately 28.6-square mile (18,323 acre) sub-regional basin within the Park River watershed and the Connecticut River basin. The watershed is located within six communities, including Avon, Bloomfield, Hartford, Simsbury, West Hartford, and Windsor. However, Bloomfield, Hartford, and West Hartford comprise greater than 97% of the watershed land area, and approximately 68% of the watershed is within the Town of Bloomfield. *Table 2-1* summarizes the distribution of land area within the watershed by municipality.

Table 2-1. Distribution of Municipalities in the North Branch Park River Watershed

Municipality	Total Acreage of Municipality	Acreage in Watershed	% of Town in Watershed	% of Watershed
Avon	14,989	203	1%	1.1%
Bloomfield	16,872	12,540	74%	68.4%
Hartford	11,553	2,096	18%	11.4%
Simsbury	21,970	192	1%	1.0%
West Hartford	14,336	3,183	22%	17.4%
Windsor	19,868	108	1%	0.6%
Total	**99,587**	**18,323**		**100%**

Figure 2-1

The North Branch Park River watershed is characterized by a distinct mix of developed and undeveloped land uses. The far western portion of the watershed is sparsely developed, with large undeveloped tracts of land in the West Hartford Reservoir subwatershed and Talcott Mountain State Forest area. The northern-most portion of the watershed is moderately developed, characterized by areas of low-density residential development, agricultural areas, golf courses, and flood control reservoirs. The northeast portion of the watershed contains large areas of former agricultural land that has been converted to commercial and industrial/office park land use along Route 187. The central and southern portions of the watershed are more densely developed with residential, institutional, and industrial land uses. Section 7 *Land Use and Land Cover* further describes land uses within the North Branch Park River watershed.

Transportation corridors within the watershed include several heavily-travelled state routes as well as a dense network of local roads, particularly in the center of Bloomfield and in the north end of Hartford. A short segment of Interstate 84 and the West Boulevard Connector Interchange, which is located at the southern limit of the watershed near the confluence of the North and South Branches of the Park River, is the only portion of an interstate highway located within the watershed.

A basic profile of the watershed is provided in *Table 2-2.* Later sections of this document provide more detailed information on these watershed characteristics.

Table 2-2. Profile of the North Branch Park River Watershed

Area	28.6 square mile (18,323 acre)
Stream Length	Approximately 48 miles
Subwatersheds	14
Municipal Jurisdictions	Bloomfield, Hartford, West Hartford, Avon, Simsbury and Windsor
Water Quality	2008 DEP Impaired Waters List for physical substrate habitat alterations due to channelization and *Escherichia* coli due to combined sewer overflows, and unspecified urban stormwater
Current Impervious Cover	15%
Subwatersheds Most Sensitive to Future Development (Section 10)	Wash Brook North Beamans Brook East Wintonbury Reservoir Blue Hills Reservoir Filley Brook
Subwatersheds with the Highest Restoration Potential (Section 10)	Beamans Brook West Tumbledown Brook Filley Brook North Branch Park River Wash Brook South
Major Transportation Routes	Interstate 84 State Route 44 (Albany Avenue) State Route 189 State Route 178 State Route 218 State Route 173 State Route 187 (Blue Hills Avenue)
Significant Natural and Historic Features	Mark Twain House, Harriet Beecher Stowe House, Connecticut Governor's Residence, Heublien Tower, Penwood State Park (portion), Talcott Mountain State Park, Elizabeth Park, Auer Farm

Table 2-2. Profile of the North Branch Park River Watershed

Significant Institutions and Land Use Features	University of Hartford, UConn Law School, St, Francis Hospital, Watkinson School, University High School of Science & Engineering, Weaver High School, Hartford Public High School, Hartford Classical Magnet School, Wintonbury Hills Golf Course, Tumble Brook Country Club, Gillette Ridge Golf Course, Hartford Golf Club, Wampanoag Country Club, COPACO Shopping Center, Bloomfield Shopping Center, The Center of Bloomfield Shopping Center, Tunxis Plaza Shopping Center, Kaman Corporation Complex, Blue Hills Industrial Park, Griffin Center, CIGNA Campus, Wintonbury Reservoir, Blue Hills Reservoir, Tunxis Reservoir, Cold Spring, West Hartford Reservoir

2.3 Subwatersheds

For the purpose of this report, the North Branch Park River watershed is divided into 14 subwatersheds, from which surface runoff potentially enters the river or its tributaries. The subwatershed delineations are based on basin delineations by the CTDEP and the U.S. Geological Survey, with modifications based on updated land use mapping, topographic mapping, flood control structures, and field observations. Subwatersheds were also delineated to facilitate assessment and development of watershed management plan recommendations.

Five of the subwatersheds are delineated based on flood control structures and are named by the impounded reservoir, including the West Hartford Reservoir, Cold Spring Reservoir, Bloomfield (Tunxis) Reservoir, Wintonbury Reservoir, and Blue Hills Reservoir subwatersheds. The remaining nine subwatersheds are catchments associated with the major tributaries to the North Branch, including Wash Brook North, West, and South; Beamans Brook East and West; Tumbledown Brook and Tumbledown Brook South; Filley Brook; and the remaining area that discharges directly to the main stem of the North Branch Park River. General characteristics of these subwatersheds are presented in *Table 2-3*, and their locations and boundaries are shown in *Figure 2-2*.

Table 2-3. Subwatersheds

Subwatershed	Acronym	Area (acres)	Area (square miles)
Beamans Brook East	BBE	163	0.25
Beamans Brook West	BBW	1,185	1.85
Blue Hills Reservoir	BHR	1,035	1.62
Cold Spring Reservoir	CSR	1,155	1.80
Filley Brook	FYB	404	0.63
North Branch Park River	NBP	4,033	6.30
Tumbledown Brook	TDB	1,561	2.44
Tumbledown Brook South	TBS	1,622	2.53
Tunxis Reservoir	TUX	874	1.37
Wash Brook North	WBN	762	1.19
Wash Brook South	WBS	1,559	2.44
Wash Brook West	WBW	1,029	1.61
West Hartford Reservoir	WHR	2,048	3.20
Wintonbury Reservoir	WTR	894	1.40

3 Historical and Social Perspective

3.1 History of the Watershed

The North Branch Park River and its watershed, as it exists today, reflect the rich cultural history of the Hartford metropolitan area as well as many dramatic changes since the 1600s that have altered the development patterns along the river and within its watershed, the physical characteristics of the river, and even the name of the river itself. The following sections provide a brief history of the North Branch Park River watershed.

The Sukiaug and other Native American tribes populated areas along the Connecticut and Park Rivers, which became known to European settlers as the Great and Little Rivers. Dutch traders established a trading post near the mouth of the Little River in 1633. English settlers arrived two years later, following Reverend Thomas Hooker's parish and settled near the Dutch trading post along the Little River. To their north and south, other settlements were being established in the areas that are now Windsor and Wethersfield.

The Park River, circa 1895 (Taylor Collection, Connecticut State Library).

By 1640, the first mills were built and required the damming of the Little River. During this time the Little River began to be known as the Mill River. Hartford continued to grow through the 1780s with the expansion of industry along the river, which included a rum distillery and a large woolen mill, from which George Washington ordered a suit. By the 19th century, tanneries, a dye house, pigsties and slaughterhouses, brickyards, and tenements were built along the banks of the Mill River. The city's residents may have began calling the Mill River the "Hog River" because the river was used as an open sewer by industries - including pigsties and slaughterhouses - that dumped waste into the river. Conditions along the Hog River continued to deteriorate as the city grew; problems included crowded tenements, poverty, poor sanitation, polluted water and air.

Nevertheless, by the mid-19th century, Hartford had become a very prosperous culture within the American Industrial Revolution. Reverend Horace Bushnell advocated the creation of a public park to be financed with public funding, which was an entirely new strategy. This proposal focused on an industrial dump between the river and a railroad spur. Bushnell and other civic leaders noticed that the removal of the railroad tracks would create an opportunity for a park within the increasingly crowded city. Moreover the park could provide a scenic landscape for a new, permanent state Capitol building, which would greatly benefit the growing city. This small "central park" became a place for all urban residents to step away from the urban environment, into the tranquility of nature. Bushnell Park was opened in 1865, and the Hog River was renamed to the Park River in reference to Bushnell Park.

Despite the success of this first public park, now named after Bushnell, the Park River water quality continued to suffer from direct, untreated discharge of human and animal sewage and industrial waste. A joint committee was formed on what was called the "Park River Nuisance" that proposed initiatives to prevent waste from entering the river and to flush the waste more quickly down the river by pumping water into the Park River during low flow. Eventually, the city wastewater system expanded to collect sewage and other wastes, treat the wastewater, and discharge it to the Connecticut River.

However, the early 19th century sewer systems were designed to carry both stormwater runoff and sanitary sewage in the same pipes. During smaller storms, wastewater treatment facilities receive and treat the flow from these combined sewers before discharging it to the Connecticut River. Today, the combined sewer system – parts of which are over 100 years old – can become overwhelmed by stormwater runoff, discharging untreated wastewater directly to the North Branch Park River. Several outfalls for combined sewers still exist within the North Branch Park River watershed, resulting in numerous combined sewer overflows (CSOs) each year. The MDC is currently implementing a major infrastructure improvement program known as "The Clean Water Project" that could eliminate CSOs in the North Branch Park River.

Concerns related to the North Branch Park River are not limited to water quality; flood control is also a significant challenge that became prominent in the 20th century. Two large storms occurred in the 1930s that resulted in major floods in Hartford and other areas of Connecticut, in 1936 and 1938. In response to these floods, the Hartford Department of Engineers and the U.S. War Department developed plans for dikes to protect the city from the Connecticut River and for twin underground conduits to control flooding along the Park River.

The Park River conduits during construction, circa 1942. (Hartford Collection, Hartford Public Library).

This flood control project began along the Park River in September 1940 and was completed three years later. The first phase of the conduit was just over a mile long and ended between the Capitol and Armory buildings. The majority of the flood control system was completed in 1943, although additional changes were constructed following flooding caused by Hurricane Diane in 1955, including construction of a section of the conduit from the Armory to Farmington Avenue in the early 1960s (Normen, 2008), which combined the construction of I-84 along the former stream corridor of the South Branch, with the underground conduit and flood storage system 40' – 100' below grade. This flood control system remains intact today. The system of underground conduits conveys both the North and South branches of the Park River below Hartford to an outfall on the Connecticut River. Burial of the North Branch between Capitol and Farmington Avenues was the last segment of river to be buried to accommodate an athletic field for Hartford High School and a parking lot for the Mark Twain House and Museum.

While the flood control projects of the last century have protected the City of Hartford from the type of catastrophic floods that occurred in the 1930s and 1950s, channelization and burial of portions of the North Branch Park River dramatically altered the physical and habitat characteristics of the river and the land development patterns along the river and within its watershed. These changes have disconnected the river from the surrounding communities and have contributed to the river's deteriorated water quality and degraded habitat conditions that exist today.

In many respects, the history of the Park River has overshadowed the history of the North Branch Park River watershed. The watershed history includes the history of land use and residential development. Hartford's West End neighborhood was established after the construction of a reliable bridge over the North Branch of the Park River. As wealthy families moved away from the crowded conditions of downtown Hartford, the North Branch (or "Woods" river) became a scenic feature at the cultivated edge of large estates. Over time, a number of the 19th century estates became the campus grounds for institutions and schools, such as The Hartford Seminary, The Watkinson School, The Connecticut Historical Society, The Hartford College for Women, which has become a part of the University of Hartford, and St. Thomas Seminary. In West Hartford and Bloomfield, estates became private golf courses that preserved open space and provided a popular recreational activity, yet altered the ecosystem.

With the automobile, trends towards suburban living extended further north into Bloomfield, which had been an agricultural area beyond the reach of urban development. The design of modern corporations began to combine the automobile experience with access to naturalistic open space, as in the 450 acres of Connecticut General ("the Wilde Building") built in 1957. Integral to the development of Bloomfield are the flood storage reservoirs, which were built to prevent the conduits from being overwhelmed by stormwater that drains from the North Branch Park River watershed.

With increased focus on urban water resource management and the relationships between land use planning and environmental quality, the history of the watershed will become more significant. Throughout the late 20th century, open space has been lost to the sprawling patterns of suburban residential and commercial development projects that have impacted open space, water quality, and hydrology of the watercourses. The next chapter of watershed history will depend on a more complex mosaic of land use and conservation planning decisions that must balance density needed for economic development, yet preserve the healthy "ecosystem services" – the functions of nature can reduce the hidden costs of sprawl. The positive outcome of "greener" development priorities will offer the aesthetic values and vision embedded within the history of Bushnell Park.

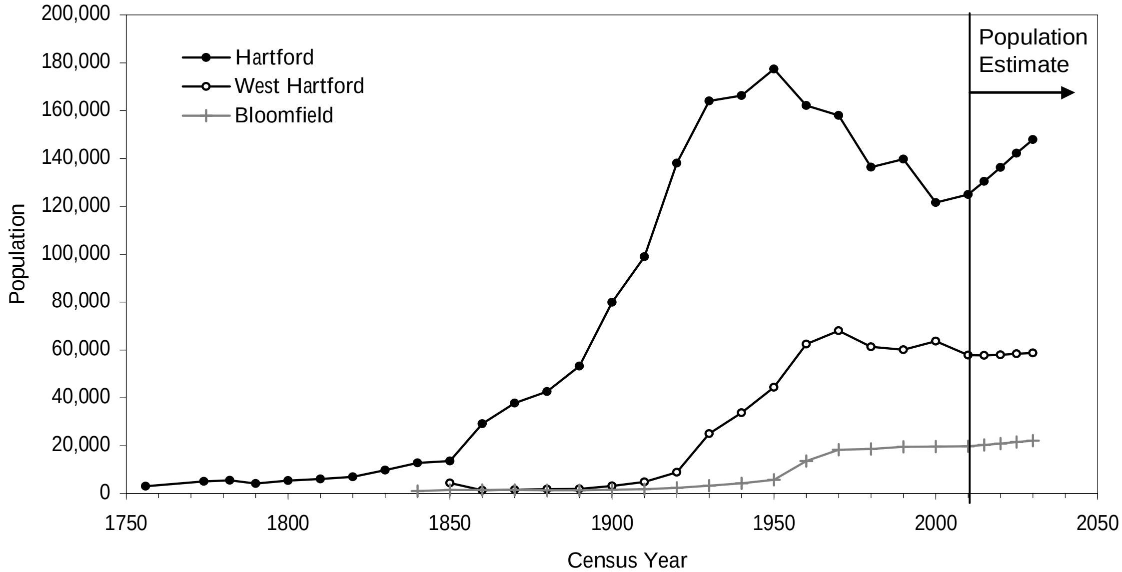
3.2 Population and Demographics

Although the North Branch Park River watershed is located within portions of six communities, the majority of the watershed's population resides in Bloomfield, Hartford, and West Hartford. The following sections provide a summary of overall population trends in these three communities, as well as population and demographic information for the North Branch Park River watershed.

> The total watershed population is estimated at approximately 48,000 residents, with 41% of the population residing in the City of Hartford, 21% in West Hartford, and 38% in Bloomfield.

The city of Hartford reached a peak population in 1950 of approximately 180,000 residents. Hartford's population began to decline in the late 1950s as city residents began to seek a higher quality of life in the suburbs. The decline in Hartford's population continued through the 1990s although has reversed since the most recent 2000 census (*Figure 3-1*). The most recent three-year estimated household population in Hartford (2005-2007) is 110,774 (U.S Census Bureau, 2008). Future population estimates by the Connecticut State Data Center predict an increase in population in the City of Hartford in the next 20 years. West Hartford continued to grow until 1970 as a result of the migration out of the urban core and reached a maximum population of approximately 68,000, with an estimated 2005-2007 household population of 61,165 (U.S Census Bureau, 2008). Bloomfield also experienced a large population increase between 1950 and 1970, but has remained stable since then with a population of 19,587 based on the 2000 census. The populations of West Hartford and Bloomfield are predicted to be stable between 2010 and 2030.

According to the Capital Region's Census Data Profile Report (Capitol Region Council of Governments, 2003) , the pattern of housing unit increase over the 1960 to 2000 period reflects the shift in the Region's population from city to suburbs. In 2000, there were 294,092 housing units in the Capitol Region. The number of housing units in the Capitol Region increased more rapidly than population over this forty-year period, increasing by 72% as compared to the 32% increase in population. This is due both to declining household sizes and the movement of households from older, urbanized communities to new housing in the suburbs.



Source: US Census and Connecticut State Data Center

Figure 3-1. Population Trends

While the trend of increasing suburbanization may be tempered by the recent economic downtown in Connecticut and nationally, this recent trend of movement away from the urban center raises concerns about the loss of open space and development pressure on nearby suburban and rural communities. Such a trend within the North Branch Park River watershed could result in further development pressure in the headwater areas of Bloomfield, West Hartford, and Avon. Initiatives that protect open space and reinforce sustainable development within the urban center where infrastructure already exists are intended to address these concerns.

Population and demographic information within the North Branch Park River watershed was analyzed using 2000 U.S. Census data. There are 39 census blockgroups and 497 blocks located wholly or mostly within the watershed. From this data, the total watershed population is estimated at approximately 48,000, with approximately 41% of the population residing in the City of Hartford, 21% in West Hartford, 38% in Bloomfield, and less than 1% in Simsbury, Avon, and Windsor combined. *Figure 3-2* summarizes the racial and ethnic composition of the watershed's population. The majority of the watershed population is white (86.7%), 4.3% are Hispanic, 3.4% are Asian, 2.0% are Black, and 3.7% are reported as Multi-race or Other.

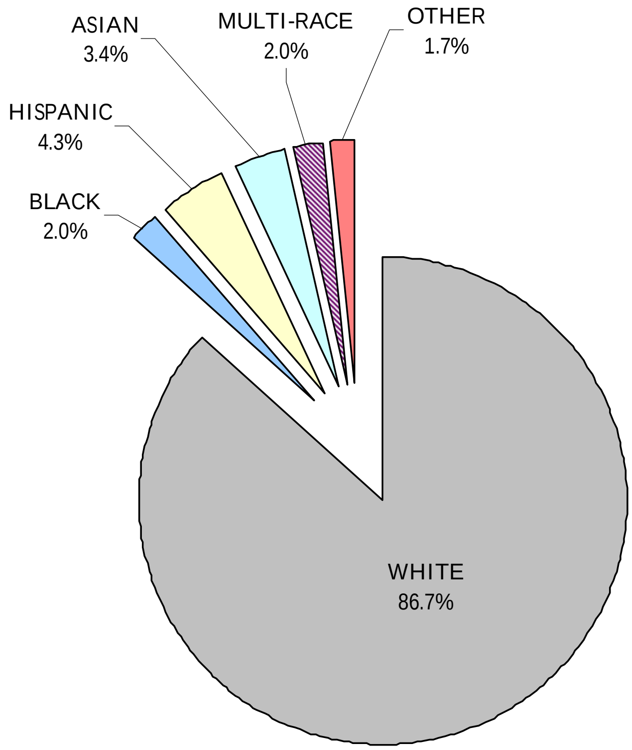


Figure 3-2. Demographics in the North Branch Park River Watershed

3.3 Historical Resources

The North Branch Park River watershed has a rich cultural history and is home to numerous sites and buildings that are on the State or National Register of Historic Places. Existing State or National-registered historic places in the watershed are listed in *Table 3-1*. Several of the notable cultural resources in the watershed include:

- The Harriet Beecher Stowe House, which served as the residence of this well-known abolitionist from 1873 through her death in 1896. This residence is located in the Nook Farm grounds, a former compound of artists and writers.
- The Mark Twain House, neighboring the Harriet Beecher Stowe House on the Nook Farm grounds.
- The Connecticut Governor's Residence, located on Prospect Avenue in Hartford is a 19-room Georgian Revival Colonial home.
- The 22-room Goodwin Mansion and Estate was restored as part of a larger new development of condominiums. The property was originally built in 1903 for Walter L. Goodwin, a descendant of a family that had been influential in developing the city.
- Elizabeth Park, a public park with recreational areas and a 2.5-acre rose garden with 800 varieties of roses, which was the first public rose garden in America.
- Heublein Tower, a six-story observation structure built atop the Metacomet Ridge by Gilbert F. Heublien, a hotelier and restaurateur in Hartford, which is now open to the public.

- There are four historic districts within the watershed (listed in *Table 3-1*), including
    - Little Hollywood Historic District
    - Nook Farm and Woodland Street District (the Nook Farm grounds being the location of the Mark Twain and Harriet Beecher Stowe houses)
    - West End North Historic District
    - West End South Historic District

In December 2006, the Hartford City Council adopted an ordinance that protects properties designated on the State or National Register of Historic Places from unauthorized demolition or alteration. The ordinance states that all work requiring a building permit being performed on properties that are individually listed or within a historic district must gain the approval of the Historic Preservation Commission before they may receive a permit. Building permit applicants who are subject to this requirement must fill out an Application for Historic Review in the City's Department of Licenses & Inspections.

Table 3-1. National Register of Historic Places

Town/City	Date Listed	Resource Name	Address
Bloomfield	5/15/2007	Filley, Capt. Oliver, House	130 Mountain Ave.
Bloomfield	3/25/1982	Gillette, Francis, House	545 Bloomfield Ave.
Bloomfield	10/18/1972	Old Farm Schoolhouse	Jct. of Park Ave. and School St.
Bloomfield	7/24/1992	Southwest District School	430 Simsbury Rd.
Hartford	4/19/1994	Austin, A. Everett, House	130 Scarborough St.
Hartford	7/31/1994	Barlow, Boce W., Jr., House	31 Canterbury St.
Hartford	6/28/1982	Children's Village of the Hartford Orphan Asylum	1680 Albany Ave.
Hartford	4/16/1971	Day House	77 Forest St.
Hartford	3/10/1983	Elizabeth Park	Asylum Ave.
Hartford	3/2/1989	Engine Company 16 Fire Station	636 Blue Hills Ave.
Hartford	6/26/1986	Hartford Golf Club Historic District	Roughly bounded by Simsbury Rd. and Bloomfield Ave., Northmoor Rd., Albany Ave., and Mohegan Dr.
Hartford	6/22/1982	Hartford Seminary Foundation	55 Elizabeth St. and 72-120 Sherman St.
Hartford	11/29/1979	Hooker, John and Isabella, House	140 Hawthorn St.
Hartford	2/24/1983	House at 36 Forest Street	36 Forest St.
Hartford	4/29/1982	Little Hollywood Historic District	Farmington Ave., Owen, Frederick and Denison Sts.
Hartford	10/31/1975	Lyman House	22 Woodland St.
Hartford	11/29/1979	Nook Farm and Woodland Street District	Woodland, Gillett, and Forest Sts., and Farmington Ave.
Hartford	12/14/1978	Perkins-Clark House	49 Woodland St.
Hartford	8/29/1985	Prospect Avenue Historic District	Roughly bounded by Albany Ave., N. Branch Park River, Elizabeth & Fern Sts., Prospect & Asylum Aves. & Sycamore Rd.
Hartford	2/24/1983	Spencer House	1039 Asylum Ave.
Hartford	10/6/1970	Stowe, Harriet Beecher, House	73 Forest St.
Hartford	12/1/1978	Temple Beth Israel	21 Charter Oak Ave.

Table 3-1. National Register of Historic Places

Town/City	Date Listed	Resource Name	Address
Hartford	10/15/1966	Twain, Mark, House	351 Farmington Ave.
Hartford	3/23/1995	Watkinson Juvenile Asylum and Farm School	140, 180 and 190 Bloomfield Ave.
Hartford	7/25/1985	West End North Historic District	Roughly bounded by Farmington Ave., Lorraine, Elizabeth, and Highland Sts.
Hartford and West Hartford	4/11/1985	West End South Historic District	Roughly bounded by Farmington Ave., Whitney and S. Whitney Sts., West Blvd. and Prospect Ave.
Simsbury	6/30/1983	Heublein Tower	Talcott Mountain State Park
West Hartford	12/22/1983	Mount St. Joseph Academy	235 Fern St.
West Hartford	6/14/1979	Spanish House, The	46 Fernwood Rd.

3.4 Recreation and Community Resources

Across the North Branch Park River watershed there are a variety of recreational activities, such as fishing, boating, cross-country skiing, picnicking, golf, and hiking. The oldest designated open space area near the North Branch Park River is Bushnell Park in Hartford, designated in 1865. Talcott Mountain State Park and the Penwood State Park are located in or near the watershed.West Hartford Reservoir, the Metacomet Hiking Trail, the Metacomet, Monadnock and Mattabesett National Scenic Trail, and Heublein Tower are prominent recreational features in the watershed.

The watershed is also home to the Greater Hartford Urban Outdoor Classroom and Nature Trail, a facility developed with assistance from the Eastern Connecticut Resource Conservation and Development Area, a nonprofit organization, working with community, educational, and government partners. There is a teachers' guide available for this area which assists the teacher and students in learning about habitats and wildlife found in the watershed.

Several golf courses are located throughout the watershed including the Wintonbury Hills Golf Course, Tumble Brook Country Club, Gillette Ridge Golf Course in Bloomfield, Hartford Golf Club, and Wampanoag Country Club in West Hartford. Many of the municipal parks and schools located within the watershed provide public recreational opportunities.

Although fishing opportunities exist along the North Branch Park River tributaries as well as lakes and ponds within the watershed, fishing opportunities along the mainstem of the North Branch Park River are severely limited due to impaired water quality, degraded aquatic habitat, and limited river access. As discussed in Section 6 *Water Quality*, the North Branch Park River is designated by the CTDEP as impaired for fish habitat, other aquatic life and wildlife, and recreation due to nonpoint source pollution and channel modifications. Furthermore, the Park River is not included in the CTDEP Angler's Guide.

4 Natural Resources

4.1 Geology and Soils

The State of Connecticut is composed of three distinct geologic units divided longitudinally across the state. These three units are known as the Western Uplands, the Central Valley, and the Eastern Uplands. The Western and Eastern Uplands are comprised of metamorphic rocks – rocks subjected to intense heat and pressure of the Earth's interior – while the Central Valley is a younger unit comprised of sedimentary rocks. The Central Valley began forming about 225 million years ago when the super-continent Pangaea began to break apart. A large rift formed a long, narrow valley through the middle of the state, eventually filling with sediments from the eroding hills to the east and west (presently known as the Eastern and Western Uplands). The sediments were compacted into soft, easily eroded, red and brown sandstones through which the Connecticut Rivers flows.

The North Branch Park River watershed is entirely within the Central Valley geologic region, which is separated from the Eastern Uplands by the Eastern Border Fault and the Western Uplands by the Cameron's Line Fault. The Central Valley is composed of Connecticut's youngest rocks (190 million years) and is primarily Brownstone (a sand-stone-like sedimentary rock) and Traprock (lava flows and intrusive rock). Talcott Mountain and the Metacomet Ridge form the western limit of the watershed. The Metacomet Ridge is a ridge of traprock that cuts across Connecticut from Branford to West Suffield and continues into western Massachusetts.

Drastic changes in the surficial geology have occurred within Connecticut since the formation of these geologic regions. Above the sandstone of the Central Valley lie extensive glacial deposits, or "glacial till," left as the large glaciers receded. Advancing glaciers left a moraine, or pile of glacial till, at Rocky Hill, Connecticut approximately 15,000 years ago. The moraine impounded the Connecticut River, forming Glacial Lake Hitchcock. Sediment settling out within the glacial lake laid down flat, fine deposits that result in high quality farmland in towns surrounding the Connecticut River north of Rocky Hill. Melting glacier ice formed rivers which sorted glacial till into layers of sand and gravel, or "stratified drift" (Bell, 1985).

The Natural Resources Conservation Service Soil Survey Geographic (SSURGO) database for the State of Connecticut indentifies five predominant surficial materials in the North Branch Park River watershed. Till is the predominant surficial material in the upland areas of the western portion of the watershed. The surficial material transitions to finer material moving east toward the Connecticut River. The northeast area of the watershed around Blue Hills Avenue is predominantly sand and fines. Smaller non-contiguous areas of surficial material include alluvial fines and thick till, which are found interspersed throughout the watershed.

The soil parent material in the watershed is predominantly bedrock in the western uplands west of the West Hartford Reservoir. The parent material gradually changes from bedrock to Ledgemont Till, then Glaciofluvial, Glaciolacustrine, and eventually Alluvial Floodplain moving east from the uplands toward the Connecticut River floodplain. The majority of the soil parent material in Hartford and the western portion of West Hartford is composed of Urban Influenced material.

4.2 Topography

The topography of the North Branch Park River watershed is generally characterized by steep hills along the Metacomet Ridge to the west, leading to a gently sloping valley on the eastern portion of the watershed near the Connecticut River. Based on U.S. Geological Survey topographic mapping of the area, elevations in the westernmost, upper portions of the watershed on Talcott Mountain are as high as 920 feet above mean sea level (MSL) sloping steeply (5-10% slope) eastward. The eastern portion of the watershed is gently sloped (less than 5%) with typical elevations of 130 feet above MSL. The elevation at the watershed outlet at the confluence with the South Branch Park River is less than 60 feet above MSL in an underground conduit. The Park River conduit discharges to the Connecticut River approximately 1 mile from the confluence of the North and South Branches at an elevation of approximately 10 feet above MSL. *Figure 4-1* presents a shaded relief map of the North Branch Park River watershed showing the variation in topography across the watershed.

4.3 Hydrology

The North Branch Park River is a 28.6-square mile (18,323 acre) sub-regional basin within the Park River basin (*Figure 2-1*). The watershed is located within the municipal boundaries of Avon, Bloomfield, Hartford, Simsbury, West Hartford, and Windsor, although greater than 97% of the watershed lies within the communities of Bloomfield, Hartford and West Hartford. The North Branch Park River has four named tributaries (listed upstream to downstream) – Tumbledown Brook, Wash Brook, Filley Brook, and Beamans Brook – that are fed by smaller tributaries in the upper portions of the watershed. Overall, there are approximately 48 miles of mapped perennial and intermittent streams within the North Branch Park River watershed. *Table 4-1* summarizes the miles of mapped streams within each subwatershed.

Table 4-1.Miles of Mapped Streams Within Each Subwatershed

Subwatershed	Length of Stream (miles)
Beamans Brook East	0.51
Beamans Brook West	2.59
Blue Hills Reservoir	1.70
Cold Spring Reservoir	3.96
Filley Brook	1.11
North Branch Park River	7.27
Tumbledown Brook	5.91
Tumbledown Brook South	5.15
Tunxis Reservoir	1.75
Wash Brook North	3.33
Wash Brook South	5.79
Wash Brook West	3.31
West Hartford Reservoir	4.30
Wintonbury Reservoir	1.35

Figure 4-1

Wash Brook begins north of Bloomfield Center and flows in a southerly direction to its confluence with Beamans Brook near the northwest corner of Hartford. Tumbledown Brook (also known as Tumble Brook), with its headwaters on the eastern slopes of Talcott Mountain, flows south, then east, and then north to its confluence with Wash Brook. Beamans Brook begins in the northeastern portion of the watershed and flows south to join Wash Brook. The junction of Wash and Beamans Brooks (just north of the Bloomfield-West Hartford town line) forms the North Branch Park River, which then flows in the southeastern direction through Hartford to its confluence with the South Branch.

The northern portion of the watershed drains to Wash Brook, which is located almost entirely in Bloomfield. The Wash Brook subwatershed is characterized by a commercial and industrial corridor along State Route 187 and moderate residential development, forested open space, golf courses, and some commercial and industrial facilities. The general patterns of natural drainage have not been significantly altered in this portion of the watershed. However, small impoundments and flood control reservoirs (that generally do not impound water during dry weather) are located throughout the upper portion of the watershed.

Drainage from the western portion of the watershed, a portion of the Tumbledown Brook watershed, is conveyed from the upland portions of the Talcott Mountain reservation area to the West Hartford Reservoir No. 6, controlled by the Metropolitan District Commission (MDC). Water from the Nepaug River, a tributary of the Farmington River, and Barkhamsted Reservoir is also diverted to West Hartford Reservoir No. 6. Water from West Hartford Reservoir No. 6 is treated at a facility located at the reservoir. Water may also be diverted from West Hartford Reservoir No. 6 to West Hartford Reservoir No. 5, which is located in the South Branch Park River watershed.

Filley Brook is a small intermittent stream that flows in a southerly direction through the center of Bloomfield. Filley Brook joins Wash Brook south of Cottage Grove Road (State Route 218), less than a quarter-mile upstream from the confluence of Wash Brook and Beamans Brook where the North Branch Park River begins.

The mainstem of the North Branch Park River flows through the southern and eastern portions of the watershed. The majority of the North Branch Park River subwatershed is located in Hartford and West Hartford and is characterized by high-density urban development, including primarily residential, institutional, and commercial land use. The channel of the North Branch Park River and significant portions of the drainage in this section of the watershed have been significantly altered from natural conditions as a result of urban development. An approximately half-mile section of the North Branch flows underground through a conduit system before reaching the confluence with the South Branch and ultimately flowing to the Connecticut River via the Park River conduit.

Figure 4-2 shows the seasonal pattern of mean monthly streamflow in the North Branch Park River measured at the stream gage 60 feet downstream from the stone-arch bridge on Albany Avenue in Hartford and 3 miles upstream from the confluence with the South Branch (United States Geological Survey Stream Gage 01191000, at Hartford, CT [Latitude 41°47'03", Longitude 72°42'31" NAD27]) for the period of record (11/1/36 to 9/30/86). Note that stream flow measurements have been discontinued at this stream gage. Normalized by drainage area, the streamflow data in *Figure 4-2* are presented in units of cubic feet per second per square mile (CFSM). The highest streamflow generally occurs during March and April, while seasonal low-flows typically occur during late summer or early fall.

The United States Geological Survey (USGS) has also estimated peak-flow magnitudes for 1.5-, 2-, 10-, 25-, 50-, 100- and 500-year recurrence intervals (corresponding to exceedance probabilities of 0.67, 0.50, 0.10, 0.04, 0.02, 0.01, and 0.002, respectively) based on historical streamflow measurements at the North Branch Park River stream gage location near Albany Avenue (Ahearn, 2003). *Table 4-2* summarizes peak flow frequency estimates for given recurrence intervals and the maximum known peak flow for the North Branch Park River. Beginning in 1963, flows in the North Branch Park River watershed were affected by flood control regulation resulting from the construction of the Cold Spring, Bloomfield (Tunxis), Wintonbury, and Blue Hills flood control reservoirs. Details of these flood control reservoirs are presented in Section 5.1.

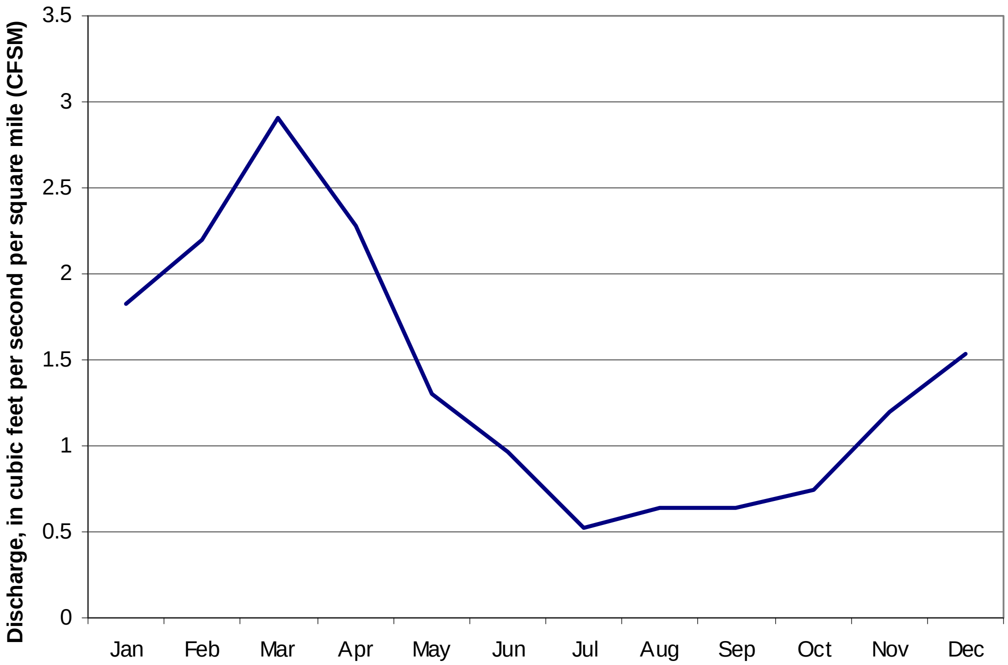


Figure 4-2. Mean Monthly Streamflow of North Branch Park River

Table 4-2.Peak Flow Frequency Estimates and Maximum Peak Flow	
Parameter	**Peak Flow (cubic feet per second)**
Peak-flow frequency estimates for given recurrence interval	
1.5 years	943
2 years	1,150
10 years	2,460
25 years	3,430
50 years	4,330
100 years	5,400
500 years	8,760
Maximum Known Peak Flow	
August 19, 1955	10,000

Source: Based on stream flow data from USGS Gage Station 01191000, North Branch Park River at Hartford, period of record 1936-1962 and 1963-1996 (regulated) (Ahearn, 2003).

4.4 Flood Hazard Areas

Figure 4-3 depicts flood hazard areas within the North Branch Park River watershed, including the 100-year and 500-year flood zones and CTDEP Stream Channel Encroachment Lines (SCELs). Flood zones are defined by the Federal Emergency Management Agency (FEMA) as the area below the high water level that occurs during a flood of a specified size. FEMA also defines a "floodway" as the stream channel and adjacent areas that carry the majority of the flood flow at a significant velocity, whereas "floodplain" also includes the flood fringe or areas that are flooded without a strong current. SCELs are regulatory boundaries associated with selected rivers and streams in Connecticut that define the jurisdiction of CGS Sections 22a-342 through 22a-349a. These areas are similar to floodways and delineate the portion of the waterway that is considered necessary for passage of flood flows. SCELs are mapped for the North Branch Park River upstream of Albany Avenue; Tumbledown Brook between its confluence with Wash Brook and Cold Spring Reservoir; Beamans Brook between its confluence with Wash Brook and the Blue Hills and Wintonbury Reservoirs, and Wash Brook to the Tunxis Reservoir. All of the SCELs in the North Branch Park River Watershed were established in 1965.

An example of flooding that is common along the lower portion of the North Branch Park River during a January 2006 storm.

The September 2008 Hartford County Flood Insurance Study (FIS) prepared by FEMA indicates that much of the 100-year flood zone in the watershed is free of development. However, low-lying areas along the lower portions of the North Branch Park River routinely experience flooding, including buildings along Woodland Drive, Dillon Road, and Woodside Circle as well as other areas.

Figure 4-3

The upper segment of the North Branch Park River from the confluence of Wash and Beamans Brooks to the Bloomfield/West Hartford boundary is another large flood-prone area, including residences on the east side of Kenwood Circle.

Based on the floodway information included in the 2008 FEMA FIS, the widest portion of the floodway along the North Branch Park River is approximately 1,000 feet downstream of the University of Hartford Road Dam (551 feet wide), while the narrowest portion of the floodway occurs near the conduit entrance (53 feet wide). The FIS reports the highest estimated water velocity within the North Branch Park River occurs near the University of Connecticut Road (10.1 feet per second) and the lowest is approximately 1,000 feet downstream of the confluence of Wash and Beamans Brooks (1.2 feet per second).

4.5 Climate

The North Branch Park River watershed is located in an area with a temperate and humid climate. The annual average precipitation in the Hartford area is 44.29 inches. Rainfall is fairly evenly distributed throughout the year. The wettest month of the year is May with an average rainfall of 3.99 inches, while the driest month is February. During a normal winter, snow cover can accumulate the equivalent of 5 inches of precipitation (average snowfall is 49 inches). On average, the Hartford area experiences approximately 128 days per year with 0.01 inches or more of precipitation. Typical air temperatures in the watershed are relatively mild with 19 days per year on average when temperatures are above 90° F and six days per year when temperatures are below 0°F.

Changes in climate are anticipated to occur over the next century. The magnitude of changes in temperature, sea level, and the timing and intensity of rainfall will depend upon future emissions of carbon dioxide and other greenhouse gases driving climate change. However, using different emissions scenarios, climate modelers have predicted the following changes to the climate in the Northeast United States as summarized below (Ashton et al., 2007; Fogarty et al., 2007; Frumhoff et al., 2007; Hayhoe et al., 2008; Kirshen et al., 2008).

> Changes in climate are anticipated to occur over the next century. The magnitude of changes in temperature, sea level, and the timing and intensity of rainfall will depend upon future emissions of carbon dioxide and other greenhouse gases. In the Northeast, the anticipated hydrologic response will be higher winter and lower summer streamflow.

Over the next several decades, temperatures are anticipated to rise 2.5-4°F in winter and 1.5-3.5°F in summer. By the end of the century, winter temperatures are predicted to rise 5-12°F and summer temperatures 3-14°F compared to current conditions. As a result, days over 90°F will be more frequent, there will be a longer growing season, less winter precipitation falling as snow and more as rain, a reduced snowpack, and an earlier spring snowmelt. In addition, regional sea surface temperatures are expected to rise 4-8°F by 2100.

The Northeast is anticipated to experience an increase in total precipitation of about 10% or 4 inches on an annual basis by the end of the century. Seasonally, winter precipitation is predicted to increase 20-30%, while summer precipitation amounts will remain relatively unchanged. In addition to increased precipitation amounts, more extreme precipitation is expected. Current model predictions include an increase in the precipitation intensity, i.e., the average amount of rain falling on a rainy day, and the number of heavy precipitation events. Precipitation intensity is predicted to increase 8-9% by mid-century and 10-15% by the end of the century. An 8% increase in the number of heavy precipitation events is expected by mid-century, with a 12-13% increase by the end of the century. The anticipated hydrologic response will be higher winter and lower summer streamflow.

4.6 Wetlands

4.6.1 Resource Description

Generally, 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. Wetlands vary widely because of regional and local differences in soils, topography, climate, hydrology, water chemistry, vegetation, and other factors, including human disturbance. Wetlands and buffer zones between watercourses and developed areas help to preserve stream water quality by filtering pollutants, encouraging infiltration of stormwater runoff, and protecting against stream bank erosion.

> Wetlands are considered valuable because they clean surface waters, recharge water supplies, reduce flood risks, and provide fish and wildlife habitat. In addition, wetlands provide recreational opportunities, aesthetic benefits, and sites for research and education.

Differing definitions of wetlands are used in Connecticut depending on the legal jurisdiction being considered. The State of Connecticut designates wetlands by soil classification since certain soils can cause groundwater to linger near the ground surface and since, conversely, groundwater lingering near the ground surface tends to transform soil characteristics. Wetland soils can also be defined by landscape position. The following classes of soils are defined by the Connecticut Inland Wetland and Watercourses Act (CTDEP, 2009).

- *Poorly drained soils*. These soils occur in places where the groundwater level is near or at the ground surface during at least part of most years. These soils generally occur in areas that are flat or gently sloping.

- *Very poorly drained soils.* These soils are typically characterized by groundwater levels at or above the ground surface during the majority of most years, especially during the spring and summer months. These areas are generally located on flat land and in depressions.

- *Alluvial and floodplain soils.* These soils form where sediments are deposited by flowing water, and thus typically occur along rivers and streams that are flooded periodically. The drainage characteristics of these soils vary significantly based on the characteristics of the flowing water, ranging from excessively drained where a stream tends to deposit sands and gravel to very poorly drained where a stream deposits silts or clays.

Connecticut's definition of inland wetlands is based on soil characteristics. In contrast, the Federal Clean Water Act definition for wetlands is based on a three-part criterion: 1) soil characteristics; 2) hydrophytic vegetation; and 3) hydrology. The federal wetland designation, established by Cowardin *et al.* (1979) defines wetlands as:

> "Lands transitional between terrestrial and aquatic systems where the water table is usually at or near the surface or the land is covered by shallow water. Wetlands must have one or more of the following three attributes: (1) at least periodically, the land supports predominately hydrophytes, (2) the substrate is predominantly undrained hydric soil, and (3) the substrate is nonsoil and is saturated with water or covered by shallow water as some time during the growing season of each year."

Vernal pools are a unique category of wetlands. A vernal pool is an isolated land depression which lacks a permanent aboveground outlet. Vernal pools vary in size and may be the size of a small puddle or shallow lake. In the Hartford area, as is true for much of the Northeast, a vernal pool fills with freshwater in the fall and winter due to the rising water table and/or in the spring due to the meltwater from winter snow and runoff from spring rains. Many vernal pools in the Northeast are covered with ice in the winter months. They contain water for a few months in the spring and early summer but by late summer, are generally dry.

As vernal pools usually dry up during a period of most years, species tend to use the area for specific portions but not all of their life cycle. "Obligate" vernal pool species (typically reptiles and amphibians) are those that must use a vernal pool for a portion of their life cycle. Common obligate species in Connecticut include spotted, Jefferson's, and marbled salamanders, wood frogs, eastern spadefoot toads, and fairy shrimp.

Vernal pools are unique and very fragile, containing significant biodiversity, frequently including endangered plants and animals. They are typically threatened by adjacent land uses and development including changes to the natural topography. Given the importance of these microhabitats, the EPA, CTDEP, and the U.S. Army Corps of Engineers regulate their protection.

4.6.2 Existing Wetlands Information

Figure 4-4 depicts the extent and distribution of wetland soils in the North Branch Park River watershed based on Natural Resources Conservation Service soil classifications, following the State of Connecticut definition. *Figure 4-4* also shows wetland classifications available from the U.S. Fish & Wildlife Service National Wetlands Inventory. State-designated wetlands and surface waters comprise nearly 20% of the overall watershed (approximately 3,600 acres), while approximately 8% of the watershed area (approximately 1,500 acres) is mapped as freshwater emergent wetlands or freshwater forested/shrub wetlands following the Federal definition or as surface waters.

Mapped wetland soils are generally located in riparian and floodplain areas along the North Branch Park River and its tributaries. The concentration of wetland soils is generally higher in the less developed northern portions of the watershed such as Bloomfield, and significantly lower in the southern, more densely-developed areas of the watershed such as Hartford and West Hartford. *Table 4-3* summarizes wetland soils coverage by subwatershed.

Table 4-3. Wetlands in the North Branch Park River Watershed

Subwatershed	Area of Mapped State Wetlands & Surface Waters (ac)	% of Subwatershed	Area of Mapped Federal (NWI) Wetlands & Surface Waters (ac)	% of Subwatershed
Beamans Brook East	50.7	31.2%	19.3	11.8%
Beamans Brook West	320.6	27.1%	57.9	4.9%
Blue Hills Reservoir	259.1	25.0%	83.8	8.1%
Cold Spring Reservoir	225.3	19.5%	145.9	12.6%
Filley Brook	39.2	9.7%	14.0	3.5%
North Branch Park River	447.2	11.1%	115.3	2.9%
Tumbledown Brook	344.7	22.1%	101.5	6.5%
Tumbledown Brook South	336.3	20.7%	116.5	7.2%
Tunxis Reservoir	240.6	27.5%	141.0	16.1%
Wash Brook North	123.1	16.2%	55.5	7.3%
Wash Brook South	280	18.0%	117.2	7.5%
Wash Brook West	350.7	34.1%	170.5	16.6%
West Hartford Reservoir	337.4	16.5%	255.5	12.5%
Wintonbury Reservoir	239.5	26.8%	67.7	7.6%
North Branch Park River Watershed	**3,594.6**	**19.6%**	**1,461.7**	**8.0%**

The Town of Bloomfield completed a town-wide wetlands inventory in 1985 (Inwoods Environmental Consultants, 1985). The inventory identified and mapped wetland areas within the Town and evaluated these areas for their hydrologic, biological, and cultural functions using a common rating scale to allow for relative comparisons between wetlands. The Bloomfield inventory identified a number of priority wetlands for preservation and protection because of their importance in maintaining water quality, providing open space and wildlife habitats, and

Figure 4-4

providing flood protection. The 1985 inventory concluded that relatively few wetlands are providing significant water quality protection functions, but many of Bloomfield's wetlands are providing valuable wildlife habitat, recreational sites, and flood protection.

The Town of Bloomfield has also identified numerous vernal pools within the North Branch Park River watershed, which are shown on the Town's inland wetlands and watercourses maps (http://www.bloomfieldct.org/adminonline/upload/1223961542_Wetlands_Index_Web_DialUp.pdf) but were unavailable digitally for incorporation into the mapping for this report. Inland wetlands and watercourses mapping is also available for the other watershed municipalities.

4.6.3 Wetlands Field Assessment

A field assessment of selected wetlands throughout the North Branch Park River watershed was performed to augment the existing wetland information and mapping. The purpose of the field assessment was to evaluate the current functions and values of representative wetlands in the watershed and to compare current wetland conditions to those identified in the 1985 Bloomfield wetland inventory. Details of this assessment are presented in the following sections.

4.6.3.1 Selection of Study Areas

As indicated in *Table 4-3,* areas classified as State-designated wetland soils account for more than 3,500 acres (more than 5.5 square miles) of land in the North Branch Park River watershed. Given the limited resources available for this baseline watershed assessment, a desktop analysis was performed to identify a priority list of wetlands for field assessment, which are representative of wetlands throughout the entire watershed. Several wetlands were selected for field assessment from the categories listed below. Additionally, some of the wetlands that were previously assessed in the 1985 Bloomfield wetland inventory were selected for comparison purposes. The selected wetlands are shown in *Figure 4-5*.

- *Baseline Wetlands.* These are large, high-quality wetlands located in protected open space areas with little development in their contributing drainage areas. These baseline wetlands can provide a basis for comparison to wetlands in more developed areas. Wetlands in the vicinity of the Blue Hills Reservoir in Bloomfield and Hoe Pond in West Hartford were selected as baseline wetlands. The Blue Hills Reservoir was also assessed in 1985 (referred to as wetland #34 in the 1985 inventory).

- *Headwater Wetlands.* These wetlands are located at or near headwater areas of mapped streams, but may be at risk for impacts from future development. Hoe Pond and the associated wetlands were identified as representative of this category, since it is located on private land in the Reservoir No. 6 watershed. Several other wetlands listed below are also located in headwater areas with future development potential, including Dudley Town Pond and Adams Road to Duncaster Hollow.

Figure 4-5

- *Potentially Impacted Wetlands.* These wetlands are located near more urbanized areas of where wetland impacts are more likely. Wetlands near several different land uses were assessed, including residential, commercial, and industrial development, agriculture, and unsewered areas. The wetland areas assessed in this category include:
  - Croydon Drive, North Branch Park River subwatershed – This wetland, identified as Wetland #5 in the 1985 inventory, is located in the North Branch Park River subwatershed near the municipal boundaries of Bloomfield, Hartford, and West Hartford and is located adjacent to an older residential neighborhood.
  - School Street/Wheeler Park, Beamans Brook West subwatershed – This area includes wetlands assessed in 1985 as Wetland #30 and a portion of Wetland #26, and is located near former agricultural land west of School Street in Bloomfield.
  - COPACO Shopping Mall, North Branch Park River subwatershed – The wetland assessed in this location consists of a portion of wetland #4 in the 1985 inventory, and is located west of Goodman Street in Bloomfield, adjacent to commercial land use.
  - Cliffmont Open Space, Tumbledown Brook subwatershed – This wetland, assessed in 1985 as wetland #20, is adjacent to residential land uses between Burnwood and Cliffmont Drives in Bloomfield.
  - Sunset Lane and Valley View Drive, Wash Brook South subwatershed – This wetland is adjacent to residential and agricultural land uses and was assessed as Wetland #23 in 1985.
  - Adams Road to Duncaster Hollow, Wash Brook West subwatershed – This headwaters portion of previously-assessed Wetland #38 is adjacent to agricultural land use areas.
  - Dudley Town Pond, Wintonbury Brook subwatershed – This wetland, near the headwaters of Beamans Brook and located south of Route 187, is adjacent to commercial/industrial land uses.

4.6.3.2 Assessment Methods

The selected wetlands were assessed by New England Environmental, Inc. (NEE) on September 14, 2009 using the "Highway Methodology" developed by the U.S. Army Corps of Engineers. This is a descriptive methodology in which a standard set of criteria are evaluated for each wetland. These criteria indicate the degree to which a particular function or process is present in a wetland, and ultimately allow an assessment of the "principal" functions associated with the wetland.

4.6.3.3 Assessment Results

The assessed wetlands range from completely isolated to fully integrated with watercourses, from small to large, from degraded to relatively pristine, and include the full range of wetland types, often in combination. Below is a summary of the assessment results for the selected wetlands. The complete letter report, functions and values forms, and hand sketches of the wetland locations are included in *Appendix A*.

Blue Hills Reservoir

The assessment was performed in the southwestern portion of the Blue Hills Reservoir, which lies within the Beamans Brook East subwatershed. The assessment transect passed through wet meadow and marsh in the open, southern end of the site, shrub habitat and a small stream walking north, a recreational field which contains large patches of mown wet meadow, a Red Maple swamp adjacent to another stream north of the field, mixed shrub/herbaceous and wetland/upland along a power line easement, and exited along the reservoir dike. The reservoir (which is not normally flooded) contains a mosaic of uplands as well as wetlands.

As noted in the 1985 report, this is a diverse and rich habitat, protected as open space. Aside from ongoing maintenance of the recreational field and the power line corridors, and its function as flood control in extreme storm and meltwater events, it will remain a large unit of undisturbed habitat. The site contains multiple circles on the CTDEP Natural Diversity Data Base (NDDB) map. Although the transect did not run through any potential vernal pools, vernal pools could be potentially present in wooded areas north and east of the transect route.

School Street – Wheeler Park

Wheeler Park is located in a former agricultural field west of School Street. It is maintained in an open condition by seasonal mowing. It incorporates both wetland #30 and a portion of wetland #26 from the 1985 inventory. It was mown in late summer 2009, and periodic mowing may be a consistent policy to preserve grassland bird breeding capacity. The mowing practices noted in 1985 are now limited, and grazing, and agricultural practices noted then now appear to be eliminated, improving the habitat functions and reducing erosion potential. Its park status and location adjacent to Bloomfield Middle School enhance its capacity to provide educational and recreational functions. Its groundwater and surface water quality functions remain important.

COPACO Shopping Center

Although much of this area was altered in the past and continues to be impacted by stormwater runoff from the shopping center and other nearby impervious areas, a square-shaped wooded portion in the southeast corner of the assessment area remains relatively undisturbed. Open water and marsh dominate the northern end of this wetland. Four distinct vernal pools (breeding habitat not confirmed) are evident within the undisturbed woods. One of them held a small amount of water on the date of the assessment, while the other three were dry. Because of the large amount of water directed to these wetlands from developed areas, they provide important water quality functions.

Wooded wetland near the COPACO Shopping Center (NEE, 2009).

Croydon Drive

Much or all of the forested swamp designated as wetland #5 in the 1985 inventory is hydrologically isolated on the surface, and contains potential vernal pool habitat in isolated depressions. The 1985 assessment classified this area with low wildlife habitat function, due to the assessment matrix used, which did not take into account important connectivity and contextual qualities. The area is connected to a long stretch of the North Branch Park River by relatively undisturbed forest, and contains tightly interspersed wetlands and uplands.

Hoe Pond

Hoe Pond is impounded by a dam at the south end, and its outlet flows though an extremely rocky channel to the east, ultimately discharging to West Hartford Reservoir #6. It occupies an unusual place in the landscape for a pond, near the top of a stony ridge with steep slopes nearby on the west and east. Emergent wetlands along the shore are narrow. The pond and its shoreline are on private land, but this land is surrounded on three sides by Talcott Mountain State Park. The south end is covered by a habitat circle on the NDDB map.

Cliffmont Open Space

This small isolated wetland is within a pocket of open space in the middle of a mature residential development, and appears to have changed very little since its assessment in 1985. It is in a wooded depression with no outlet, and does not apparently hold standing water for an extended period. It has a groundwater recharge function, and provides limited wildlife habitat and educational/recreational opportunities within its residential setting.

Outlet stream from Hoe Pond (NEE, 2009).

Sunset Lane and Valley View Drive

This is a wetland fragmented and altered by agricultural use (now reduced to a single corn field) and residential development. While the corn field and surrounding residential neighborhoods continue to exert pressure on this wetland corridor, it remains a diverse system providing important functions, especially with respect to water quality. The main stream running through the middle of the corridor drains east to Wash Brook. A marsh south of Sharon Lane, identified as a cat-tail marsh in 1985, is now dominated by Common Reed (*Phragmites australis*). The wetland north of Sharon Lane is a patchwork of Red Maple swamp, marsh, and shrub/scrub habitat.

West of the end of Ryefield Hollow Drive on the west side of the stream, an area of extensive wetland vegetation is present in the bottom of the plowed field. The resource area also includes open water at a small pond west of Countryview Drive, with a wet meadow covered with Reed

Canary-grass and an open stream channel bordered by Alders and other shrubs nearby. From the end of Valley View Drive, the transect accessed the wooded swamp adjacent to the main stream as it turns east. There are some shallow potential vernal pools in this area, and also some trash and abandoned vehicles and equipment, as noted in the 1985 report. The northernmost section of woods, extending to Terry Plains Road, is within a circle on the NDDB map.

Adams Road to Duncaster Hollow

Ground-pine on former farmland (NEE, 2009).

The wetland complex assessed in 2009 is within the northern, headwaters portion of a large wetland system, #38 in the 1985 inventory. A portion of this wetland north of Adams Road and south of Duncaster Hollow was assessed. The area is a patchwork of old farmland in various stages of regeneration, from second growth forest to recently abandoned fields. Varieties of habitat observed included wet meadow, shallow marsh, and shrub/scrub patches. Among the diverse wetland vegetation, Swamp Lousewort (*Pedicularis lanceolata*), a rare plant (listed as Threatened in Connecticut) was observed. A circle on the NDDB map touches the southwestern corner of the wetlands assessed where the plant was found. A second area of this wetland complex was also assessed. The transect followed an old farm road extending from Duncaster Road to Harvest Lane, running along the northern edge of a large open field that appeared to have been farmed recently but was fallow or abandoned at the time of assessment. The eastern end of the field is dominated by wetland vegetation, and beyond the edge of the field is a wooded swamp. North of the old farm road is a dammed farm pond, surrounded by woods on three sides. As noted in 1985, this is a diverse, functionally-rich wetland system.

Dudley Town Pond

Commercial and industrial development along Dudley Town Road borders this pond to the east. A very large warehouse complex was recently built to the northwest, and a large area which was previously forested to the west has now been cleared and was in the process of being regarded at the time of the assessment. Emergent wetlands extend out from the pond to the north and northwest. The pond and these wetlands are generally protected by a forested buffer in most places, but the pond is suffering from eutrophication. On the date of assessment, it was almost completely covered with a thick, green, foul-smelling scum. Ducks were landing in the water at the northern end of the pond despite the algae, but the southern end was covered in a solid mat of thick algae. A wooded swamp and open cat-tail marsh are present along a northwest branch of the pond. With the exception of the wetlands along the stream corridors to the north and northwest, the wetland fringe around the pond is narrow.

The 1985 inventory lists under upstream impacts, "direct runoff from surrounding industries into the pond." However, it does not mention eutrophication, and specifically mentions diverse wildlife use around the pond. It appears that there has been significant degradation of this pond and wetlands since 1985.

4.7 Fish and Wildlife Resources

Portions of the North Branch Park River have abundant habitats supportive of a variety of fish and wildlife. Various waterbodies, wetlands, and upland areas provide habitat for fish, mammals, amphibians, and birds. Ecological assets in the Park River include common species such as the great blue heron, mallard, wood ducks, white-tailed deer, coyote, and fox. A 1988 fish survey by the CTDEP Fisheries Division found pickerel, abundant blacknosed dace, large-mouth bass, and other varieties of fish (Normen, 2008).

A number of relatively large areas of open space are present within the North Branch Park River watershed. These areas, which are generally located in the upper reaches of the watershed, vary in their level of protection and quality of their habitats. See Section 7.1 for a discussion of open space in the watershed.

4.7.1 Fish

The North Branch Park River and its tributaries support a variety of fish species despite the significant level of development within the watershed and historical modification of the rivers and streams including channel modifications, road crossings, flood control dams, and other impoundments.

The CTDEP Ambient Monitoring Program conducted ambient fish community sampling in 2000 in the North Branch Park River at Albany Avenue and in 2008 in Wash Brook at Cottage Grove Road. The fish species observed in Wash Brook were all native, including plentiful numbers of Blacknose dace, Longnose dace, Tesselated darter and White sucker. A combination of native and exotic species was identified in the North Branch Park River, including the exotic species Bluegill sunfish, Carp, Largemouth Bass, and Rock Bass. *Table 4-4* summarizes the fish species identified during these surveys.

Table 4-4. Fish Species Surveyed in the North Branch Park River Watershed

Fish Species	North Branch Park River (8/22/00 Survey)	Wash Brook (6/13/08 Survey)
American eel	15	2
Banded killifish	1	--
Blacknose dace	4	46
Bluegill sunfish	3	--
Carp	8	--
Common shiner	1	--
Fallfish	--	6
Largemouth Bass	3	--
Longnose dace	3	34
Pumpkinseed	15	--

Table 4-4. Fish Species Surveyed in the North Branch Park River Watershed

Fish Species	North Branch Park River (8/22/00 Survey)	Wash Brook (6/13/08 Survey)
Pumpkinseed X Red breast	1	--
Redbreast sunfish	9	1
Rock Bass	8	--
Tesselated darter	69	28
White sucker	23	26

4.7.2 Birds

As noted in the Eastern Connecticut Environmental Review Team Report (2000), blue heron, mallards, wood ducks, belted kingfisher, American robin, blue jay, northern flicker, mourning dove, American goldfinch, catbird, black-capped chickadee, tufted titmouse, and American crow have been observed along the North Branch Park River.

The Atlas of Breeding Birds of Connecticut (1994) collected information from 1982 to 1986 and found approximately 97 confirmed or probable species in the watershed. A complete species list is provided in *Appendix B*.

Mr. Jay Kaplan of the Roaring Brook Nature Center has organized summer bird counts (second weekend in June) along the North Branch Park River from Route 44 north to the University of Hartford Magnet School over the past two years (2008-2009). During these counts 32 species were observed including red-tailed hawk, barn swallow, and Baltimore oriole. It should be noted that the count only indicates birds which were observed, it does not indicate if the bird witnessed is confirmed as a breeder at the location. A complete species list is provided in *Appendix B*.

Additionally, Mr. Kaplan has organized Christmas Bird Counts (CBC) every December for approximately the past 20 years. The study area covers a 7.5-mile radius from the Old State House in downtown Hartford. Within the North Branch Park River portion of the study area, approximately 44 species of birds have been observed over the approximate 20 years of data collection, with 5 of the species including bald eagle, peregrine falcon, and ruby-crowned kinglet witnessed on a few occasions. Other notable species witnessed over the period of data collection include the great horned owl, yellow-rumped warbler, and fox sparrow. The birds witnessed during the CBC are considered permanent residents, winter visitors, or lingering migrants that may have not yet moved southward for a variety of reasons. A complete species list is provided in *Appendix B*.

4.7.3 Amphibians & Reptiles

Documentation is not readily available regarding the extent and population of amphibians and reptiles within the North Branch Park River watershed. However, the extent of available habitats (e.g., wetlands, watercourses, sandy upland areas, old field, etc.) within the watershed suggests that it likely supports a broad range of amphibians and reptiles. For example, suburban areas with medium to small wetlands, intermittent or small perennial streams, or moist woodland areas can support species such as the American toad, northern spring peeper, wood frog, redback salamander, and garter snake. Any of the numerous ponds and lakes either associated with water supply reservoirs, farms, or golf courses can support species such as bullfrogs, green frogs, spring peepers, painted turtles, spotted turtles, and snapping turtles. Finally, upland areas may support snakes including garter, northern ringneck, black racer and black rat snake. The presence of these common species within the watershed was confirmed by Mr. Hank Gruner of the Connecticut Science Center. A listing of the reptiles and amphibians he has observed in the various North Branch Park River subwatersheds is also included in *Appendix B*.

Mr. Brian Kleinman of Riverside Reptiles, a wildlife education company specializing in reptiles, has completed many bioinventories in the North Branch Park River watershed. He reports having observed within the watershed all of the common amphibians and reptiles found in Connecticut as well as less common species, including the eastern box turtle, the Jefferson/blue-spotted complex spotted salamander, the black rat snake and northern copperhead. Similar to the rest of Connecticut, the populations of these species within the watershed are threatened by development and potential additional fragmentation of their habitats.

4.7.4 Threatened and Endangered Species

The CTDEP Natural Diversity Data Base (NDDB) maintains information on the location and status of endangered, threatened, and special concern species in Connecticut. The Connecticut Endangered Species Act defines "Endangered" as any native species documented by biological research and inventory to be in danger of extirpation (local extinction) throughout all or a significant portion of its range within Connecticut and to have no more than five occurrences in the state. The Act defines "Threatened Species" as any native species documented by biological research and inventory to be likely to become an endangered species within the foreseeable future throughout all or a significant portion of its range within Connecticut and to have no more than nine occurrences in the state. "Species of Special Concern" means any native plant or any native non-harvested wildlife species documented to have a naturally restricted range or habitat in the state, to be at a low population level, to be in such high economic demand that its unregulated taking would be detrimental to the conservation of its population, or has become locally extinct in Connecticut.

Figure 4-6 displays the generalized areas of endangered, threatened, and special concern species in the North Branch Park River watershed. *Table 4-5* presents a list of species known to exist within the watershed. The areas represent a buffered zone around known species or community locations.

The locations of species and natural community occurrences depicted on the NDDB mapping are based on data collected over the years by the Environmental and Geographic Information Center's Geologic and Natural History Survey, other units of the CTDEP, conservation groups, and the scientific community. Approximately fourteen such areas were identified throughout

Figure 4-6

the watershed. Because new information is continually being added to the Natural Diversity Database and existing information updated, the areas are reviewed on an annual basis by the CTDEP. Areas can be removed or added based upon the results of the review.

Table 4-5. Endangered, Threatened, and Special Concern Species

Common Name	Scientific Name	Status
Flora		
Sedge	*Carex squarrosa*	Special Concern
Goldie's Fern	*Dryopteris goldiana*	Special Concern
Swamp Lousewort	*Pedicularis lanceolata*	Threatened
Fauna		
Jefferson Salamander	*Ambystoma jeffersonianum*	Special Concern
Upland Sandpiper	*Bartramia longicauda*	Endangered
Bobolink	*Dolichonyx oryzivorus*	Special Concern
Peregrine Falcon	*Falco peregrinus*	Endangered
American Kestrel	*Falco sparverius*	Threatened
Atlantis Fritillary	*Speyeria atlantis*	Special Concern
Eastern Meadowlark	*Sturnella magna*	Special Concern
Eastern box turtle	*Terrapene c. carolina*	Special Concern
Brown thrasher	*Toxostoma rufum*	Special Concern
Habitats		
Subacidic rocky summit/outcrop	--	--

Source: CTDEP Natural Diversity Data Base, 2009.

The 2009 wetland field assessment described in Section 4.6.3 of this report identified the presence of one "threatened" species, Swamp Lousewort (*Pedicularis lanceolata*) within the wetland complex between Adams Road and Duncaster Hollow.

5 Watershed Modifications

5.1 Dams and Impoundments

The North Branch Park River watershed includes a number of dams and reservoirs that were constructed for flood control, water supply, industrial power, and recreation. Some of the existing dams and reservoirs retain their original uses, while others now primarily provide recreation, habitat, and open space. The major flood control reservoirs in the watershed, several of which only impound water during large storms, are largely undeveloped and therefore provide valuable wildlife habitat and open space. Other impoundments in the watershed provide aquatic and wildlife habitat and recreational opportunities, but may also limit or impede fish migration. *Table 5-1* lists the flood control reservoirs in the watershed, while *Table 5-2* lists state-registered dams in the watershed. *Figure 5-1* depicts the locations of the various dams and impoundments in the watershed.

Monument at Blue Hills Reservoir (NEE, 2009).

Table 5-1. Flood Control Reservoirs in the North Branch Park River Watershed

Name/ Year Completed	CTDEP Flood Control ID No.	Location	Drainage Area (square miles)	Flood Control Pool Volume (acre-feet)	Pool Surface Area (acres)
Wintonbury Reservoir/ 1963 *dam only	1	Westerly branch of Beamans Brook, 1.2 miles northeast of Bloomfield Town Hall	1.42	850	165
Blue Hills Reservoir/1964 *dam only	2	Easterly branch of Beamans Brook, 1.3 miles northeast of Bloomfield Town Hall	1.9	700	175
Bloomfield (Tunxis) Reservoir/1962 *dam w/dike structure	3	Wash Brook, 1.5 miles north of Bloomfield Town Hall, adjacent to Tunxis Avenue (Rt. 189)	3.05	1,750	245
Cold Spring Reservoir/1968 *dam only	9	Northerly branch of Tumbledown Brook, 1.7 miles southwest of Bloomfield Town Hall	1.94	1,100	137

Figure 5-1

The flood control reservoirs listed in *Table 5-1* were constructed by the State of Connecticut in the early 1960s in response to the severe flooding that occurred in 1955. The reservoirs are designed to be primarily dry (no permanent pool) during non-flood events but have a total combined flood storage capacity of 1.44 billion gallons (4,408 acre-feet). These reservoirs are also designed to control approximately 12 inches of runoff from the contributing drainage area with allowances for approximately 50 years of sediment accumulation. A 1959 report to the Greater Hartford Flood Commission (Metcalf & Eddy, 1959) estimated the construction cost of these reservoirs at $2,200,000 (based on 1955 prices).

Figure 5-1 shows the location and hazard classification of state-registered dams within the North Branch Park River watershed. According to the CTDEP Dam Safety Regulations, the hazard classification of a dam is based on the damage potential from failure of the structure. For example, a Class C dam is a high hazard potential dam which, if it were to fail, would result in probable loss of life; major damage to habitable structures, residences, hospitals, and other inhabited and public gathering places; damage to main highways with greater than 1,500 average daily trips; and great economic loss.

Table 5-2. Hazard Classification of State-Registered Dams

Dam Name	Hazard Class	Town
Brainard Pond Dam #1	A	West Hartford
Brainard Pond Dam #2	A	West Hartford
Tobacco Pond Dam #3	A	Bloomfield
Wash Brook Pond Dam	A	Bloomfield
Park Pond Dam	A	Bloomfield
Detention Basin Dam	A	Bloomfield
Dudley Town Pond Dam	A	Bloomfield
Filley Park Pond Dam	A	Bloomfield
Old Mill Pond Dam	A	Bloomfield
Natural Pond Dam	A	Bloomfield
Emerick Pond Dam	B	Bloomfield
Sinnot Pond Dam	B	Bloomfield
Serbin Dam	B	Bloomfield
Gale Pond Dam	BB	Bloomfield
Bloomfield Site 3A Dam	BB	Bloomfield
Schweitzer Pond Dam	BB	Bloomfield
University Of Hartford Dam	BB	Hartford
Cold Spring Dam	C	Bloomfield
Hartford Reservoir Dam #6	C	West Hartford
Talcott Reservoir Dam #1	C	West Hartford
Bloomfield Dam	C	Bloomfield
Wintonbury Site #1 Dam	C	Bloomfield
Blue Hills Reservoir Site #2 Dam	C	Bloomfield

Dams that have changed use or ownership often degrade in condition and fall into a state of disrepair, increasing the likelihood of dam failure. The CTDEP Dam Safety Section is required to inspect dams periodically, with increased inspection frequency for dams with higher hazard potential.

5.2 Park River Conduit System

Prior to the construction of the flood control reservoirs in the 1950s, a major flood control system was designed and constructed in Hartford in response to the devastating floods that occurred in the 1930s. The flood control system, much of which is intact today, consists of dikes to protect the city from the Connecticut River and twin underground conduits to control flooding along the Park River. Construction of the Park River conduits began in 1940, and was later modified in the 1950s following the 1955 flood. The Park River conduit system conveys flows from Hartford's interior drainage system, both artificial and natural, including the north and south branches of the Park River, into the Connecticut River. The Park River conduit system consists of tunnels that carry the north and south branches of the Park River separately to their confluence, and then join to form a twin-barreled conduit that carries the entire main branch of the Park River to its mouth at the Connecticut River. The North Branch Park River enters this conduit system near Farmington Avenue in Hartford. Each of the two conduits that comprise the main branch of the conduit system is 36 feet wide and 27.5 feet high. Under typical conditions, the conduits flow by gravity with a free water surface. However, during large flood events, the conduit inlets can become submerged, causing the conduits to flow under pressure. The conduit system also includes an additional siphon conduit that augments the capacity of the main conduits.

The confluence of the Park River conduit with the Connecticut River in Hartford.

> While the flood control projects of the last century have protected the City of Hartford from the type of catastrophic floods that occurred in the 1930s and 1950s, these changes have also disconnected the river from the surrounding communities and have contributed to the river's deteriorated water quality and degraded habitat conditions that exist today.

The Park River conduit system is designed to manage flows associated with localized storm events (i.e., limited to the Park River watershed) much larger than the 100-year storm, which is the design standard for flood control. The selected design storm for the Park River conduit system was the "storm of record" in New England (18.3 inches of rain in a 24-hour period as recorded at Westfield, Massachusetts in 1955). By comparison, a 100-year storm in Hartford is estimated to be approximately 6.7 inches of rain in

24 hours. The conduit system is designed to accommodate these flood flows even while the Connecticut River is peaking at its 100-year flood elevation. A drainage analysis of the City of Hartford's Levee and Flood Control System was completed in June 2009 as part of the City's effort to obtain FEMA accreditation for the system. Based on this analysis, the capacity of the main branch of the Park River conduit system is approximately 24,000 cubic feet per second (cfs) and the capacity of the Auxiliary Conduit is approximately 6,700 cfs.

The flood control projects of the last century have protected the City of Hartford from the type of catastrophic floods that occurred in the 1930s and 1950s. However, as indicated in Section 3.1 *History of the Watershed*, channelization and burial of portions of the North Branch Park River dramatically altered the physical and habitat characteristics of the river and the land development patterns along the river and within its watershed, which have disconnected the river from the surrounding communities and have contributed to the river's deteriorated water quality and degraded habitat conditions that exist today.

5.3 Water Supply

The Metropolitan District Commission (MDC), chartered by the Connecticut General Assembly in 1929, provides potable water to approximately 90,000 customers and 400,000 people in its eight member communities, which include Bloomfield, East Hartford, Hartford, Newington, Rocky Hill, West Hartford, Wethersfield and Windsor; as well as portions of East Granby, Farmington, Glastonbury, South Windsor, Manchester and Windsor Locks. As of 2000, 95% of Bloomfield's and 100% of West Hartford's and Hartford's populations were supplied water by the MDC. Avon and Simsbury, small areas of which are located within the North Branch Park River watershed, are served by Connecticut Water Company and Aquarion Water Company, respectively.

Drinking water supplied to the North Branch Park River watershed originates from surface waters located outside of the watershed boundaries, including the East Branch of the Farmington River and the Nepaug River, a tributary of the Farmington River. The associated drinking water reservoirs are located in the northwest hills of Connecticut – the 30.3 billion gallon Barkhamsted Reservoir and the 9.5 billion gallon Nepaug Reservoir. Water from these sources flows by gravity to two treatment facilities, including a slow sand filtration plant located off Farmington Avenue in West Hartford and a rapid sand filtration facility located at the MDC-operated West Hartford Reservoir No. 6, which is located in the southwest portion of the North Branch Park River watershed. West Hartford Reservoir No. 6 typically receives water from Barkhamsted

Drinking water supplied to the North Branch Park River watershed originates from surface waters located outside of the watershed boundaries, including the East Branch of the Farmington River and the Nepaug River, a tributary of the Farmington River.

Reservoir and may receive water from Nepaug Reservoir depending on the positioning of flow control valves along the transmission main (MDC, 2008).

Portions of the watersheds of two other MDC reservoirs, West Hartford Reservoirs No. 2 and No. 3, are located within the North Branch Park River watershed. Although active, West Hartford Reservoirs No. 2 and No. 3 are rarely used at this time. *Table 5-3* provides additional information on the three MDC reservoirs that are located within the North Branch Park River watershed.

Table 5-3. MDC Drinking Water Reservoirs
in the North Branch Park River Watershed

West Hartford Reservoir	Location	Use	Built	Capacity (million gallons)		Watershed Area (sq.mi.)
				Total	Usable	
No. 2	West Hartford	Water supply (active, rarely used)	1867-1868	284	277	1.1
No. 3	West Hartford	Water supply (active, rarely used)	1875	144	96	0.6
No. 6	West Hartford & Bloomfield	Water supply (active)	1891-1895	809	796	2

Source: The Metropolitan District Individual Water Supply Plan, 2008.

The MDC water supply system is largely protected by its undeveloped watershed land. The West Hartford Reservoir system watershed is predominantly rural, with few commercial or industrial facilities. A large percentage of the watershed land is owned by the MDC or the State of Connecticut. Of the over 2,300 acres of watershed area associated with the West Hartford Reservoir system (Reservoirs No. 2, 3, 5, and 6), approximately 91 percent of the land in the watershed is preserved including all watershed land owned by the MDC, state forest and parklands, and municipally or privately held land designated as open space (CTDPH, 2003). However, the MDC implements a number of source water protection programs to further protect the quality of its drinking water supplies, including:

- Watershed inspection
- Water quality monitoring
- Land use monitoring
- Land use planning and zoning
- Technical assistance and education
- Emergency spill response
- Watershed forest management
- Land acquisition

The State of Connecticut Department of Public Health, Drinking Water Section completed an assessment of public drinking water sources to identify and document potential sources of contamination that could adversely impact drinking water quality. The assessments found that the West Hartford Reservoir system has a low susceptibility to potential sources of contamination (CTDPH, 2003).

Less than 10 percent of the residents of the North Branch Park River watershed obtain their drinking water from private groundwater wells and other water supplies sources. Private water supplies are regulated by the local health departments.

5.4 Wastewater

In addition to water supply, the MDC also provides sewerage services on a regional basis to its member communities. The MDC owns and operates a combined sewer system within Hartford and a small portion of West Hartford. These sewers date back to the 19th century, when it was believed that dual-purpose pipes for sewage and storm water conveyance would result in more manageable and cost-effective collection systems. While the pipes were originally sized to carry both sewage and stormwater, intense storm events and expansion of the collection system due to development have historically taxed the capacity of the MDC's interceptor sewers and the wastewater treatment facility, which cannot handle the large wet weather flows from the combined sewer system (CTDEP, 2007). During rain events, basements may fill with sewage, streets may flood, and untreated wastewater may discharge from the sewer system at combined sewer overflow (CSO) and sanitary sewer overflow (SSO) locations.

A combined sewer system uses a single pipe to carry both sewage and stormwater. When it rains, stormwater enters the pipe with the sewage. As these sewers become overloaded, they can back up onto streets, into yards and into basements. Combined Sewer Overflows or CSOs are used to alleviate pipe surcharging, spilling sewage into open waters.

Six of the eight member communities contribute flow to the Hartford collection system for conveyance to the Hartford Water Pollution Control Facility, including all of Hartford, all of West Hartford, and portions of Bloomfield, Newington, Wethersfield and Windsor. Hartford and West Hartford are the only member communities with any combined sewers. The MDC's CSOs are ultimately discharged to the Connecticut River having a direct effect on multiple downstream communities (CTDEP, 2007). *Figure 5-2* depicts the sewer service area within the North Branch Park River watershed. There are currently four CSO discharges directly to the free flowing portion of the North Branch Park River (and several other CSO discharges to the river within the Conduit) (*Figure 5-3*). The partially and fully combined portions of the sewer system are located within the West Hartford and Hartford portions of the watershed.

The MDC is implementing a major infrastructure improvement program known as "The Clean Water Project" to address a federal consent decree and a CTDEP consent order to achieve the Federal Clean Water Act goals by 2020. The Clean Water Project includes three basic elements: (1) reduction of combined sewer overflows (CSOs) within the Hartford central sewer system, (2) elimination of sanitary sewer overflows (SSOs) in the sanitary sewers of Wethersfield, West Hartford, Windsor, Rocky Hill and Newington and (3) nitrogen reductions. The MDC

Figure 5-2

Figure 5-3

abatement plan would eliminate all discharge from CSOs/SSOs during storms up to and including the typical one-year frequency event. The District plans to address the SSO and CSO issues by implementing one or more of the following strategies:

- Separating the combined sewer systems
- Correcting illegal connections including roof drains and sump pumps and groundwater infiltration locations
- Installing new, larger sewer pipes
- Installing storage pipes to hold storm flows and prevent storm event related discharges
- Increasing sewer treatment plant capacities

These projects will help to eliminate sewage overflows to area waterways during an average year, significantly improving water quality. In addition to CSO and SSO abatement program, the "Clean Water Project" also includes plans to upgrade District water pollution control facilities (WPCFs) to meet nitrogen removal requirements. However, none of the MDC WPCFs discharge into the North Branch Park River watershed.

The MDC and the City of Hartford are also evaluating the use of green infrastructure approaches and low impact development (LID) to further manage wet weather flows, including storm runoff volume and quality. Such practices include the installation of rain gardens, open channels/swales, and pervious pavements which promote the infiltration of runoff into the soil instead of directing it into the storm and/or combined sewer system. Green infrastructure concepts are being implemented in and around the State Capitol in Hartford including the removal of impervious cover (reduction of paved areas) and the installation of stormwater swales and rain gardens.

The Towns of Avon and Simsbury are not served by MDC sewer system. Alternately, all private septic systems in these Towns are regulated under the Farmington Valley Health District. This District is responsible for the enforcement of the Connecticut Public Health Code requirements governing the disposal of sewage through septic systems including the installation of new systems as well as the repair and replacement of existing septic systems.

5.5 Regulated Sites

Historical and current industrial and commercial development within the North Branch Park River watershed poses a potential threat to surface water and groundwater supplies in the watershed. Wastewater discharges, illegal waste disposal, improper use and disposal of chemicals such as used oil, pesticides, and herbicides, chemical spills, and historical site contamination are potential sources of contaminants from industrial and commercial facilities.

Table 5-4 summarizes the facilities in the North Branch Park River watershed with surface water discharges regulated under the National Pollutant Discharge Elimination System (NPDES) permit program, which is administered by the CTDEP. The facilities listed in *Table 5-4* have permits for discharges of wastewater or stormwater discharges either directly to surface waters or indirectly via stormwater drainage systems. The majority of these facilities are located in Bloomfield, although a number are also located in Hartford and West Hartford.

Table 5-4. Facilities with NPDES Discharge Permits in the North Branch Park River Watershed

Type of Discharge Permit	Permit ID Prefix	Number of Facilities in the Watershed		
		Bloomfield	Hartford	West Hartford
Surface Water Discharge	CT	3	0	1
General Permit for Cooling Water	GCW	4	1	0
General Permit for Domestic Sewage	GDS	1	1	1
General Permit for Food Processing	GFP	2	0	0
General Permit for Groundwater Remediation	GGR	2	2	1
General Permit for Miscellaneous Discharges to Sewer	GMI	2	0	0
General Permit for Photographic System	GPH	3	6	1
General Permit for Swimming Pool Filters	GPL	7	4	5
General Permit for Printing & Publishing	GPP	4	0	0
General Permit for Commercial Stormwater	GSC	4	1	0
General Permit Industrial Stormwater	GSI	15	0	0
General Permit for Municipal Separate Storm Sewer Systems (MS4s)	GSM	1	1	1
General Permit for Construction Stormwater	GSN	26	8	6
General Permit for Parts Tumbling and Cleaning	GTC	3	0	0
General Permit for Vehicle Maintenance	GVM	5	2	0
General Permit for Potable Water Filtration	GWT	5	0	0
Pretreated Sewer Discharge	SP	2	0	0
	Total:	**89**	**25**	**15**

Source: CTDEP, December 2007.

Table 5-5 summarizes hazardous waste generators and other regulated industrial facilities within the watershed. These facilities are located in the upper portion of the watershed primarily along the Route 187 corridor in Bloomfield and in the lower portion of the watershed clustered along Homestead Avenue in Hartford. Hazardous waste facilities are regulated under the Resource Conservation and Recovery Act (RCRA), including Large Quantity Generators (i.e., facilities that generate 1,000 kilograms per month or more of hazardous waste, more than 1 kilogram per month of acutely hazardous waste, or more than 100 kilograms per month of acute spill residue or soil) and facilities registered with the CTDEP Corrective Action Program. Small Quantity Generators are not included in *Table 5-5.* The Toxics Release Inventory (TRI) is a database containing detailed information on chemicals that industrial facilities manage through disposal or other releases, or recycling, energy recovery, or treatment. This inventory was established under the Emergency Planning and Community Right-to-Know Act of 1986 (EPCRA) and expanded by the Pollution Prevention Act of 1990. Certain facilities are required to report to the TRI Program annually.

There are no sites in the watershed that are listed as potential hazardous waste sites under the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA), otherwise known as "Superfund." Additionally, there are no facilities in the watershed requiring a Federal Title V permit for major emitters of air pollutants.

Table 5-5. Summary of Regulated Waste Facilities

Facility Name	Address	Town	Resource Conservation and Recovery Act	Toxic Release Inventory
Birken Manufacturing Company, Inc.	3 Old Windsor Road	Bloomfield	Corrective Action	Reporter
Connecticut Printers, Inc.	55 Granby Street	Bloomfield	-	Reporter
Kamatics Corporation	1330 Blue Hills Ave.	Bloomfield	Large Quantity Generators	Reporter
Lesro Industries, Inc.	55 Peters Rd	Bloomfield	Large Quantity Generators	--
New England Dairies, Inc.	255 Homestead Avenue	Hartford	--	Reporter
Otis Service Center	212 W. Newberry Rd.	Bloomfield	--	Reporter
Philbrick-Booth & Spencer	367 Homestead Avenue	Hartford	--	Reporter
Rollprint Packaging Prod, Inc	16 Southwood Rd.	Bloomfield	--	Reporter
St Francis Hospital & Med Ctr	114 Woodland Street	Hartford	Large Quantity Generators	--
Stanley P Rockwell Company	296 Homestead Avenue	Hartford	--	Reporter
Tilcon Connecticut, Inc	301 Hartford Avenue	Newington	--	Reporter
Turbine Controls Inc	2 Old Windsor Rd	Bloomfield	Large Quantity Generators	Reporter
Turbotec Products Incorporated	125 Old Iron Ore Rd.	Bloomfield	--	Reporter
Ultra Vac Metallizing Corporation	195 W. Newberry Rd.	Bloomfield	--	Reporter
Wood Group Pratt & Whitney Industrial Turbine Service LLC	1460 Blue Hills Ave	Bloomfield	Large Quantity Generators	--

Sources: EPA Geospatial Data Access Project. Featured Environmental Interests. http://www.epa.gov/enviro/geo_data.html. Updated January 1, 2009 and Department of Environmental Protection. Commercial Hazardous Waste and Connecticut Regulated Waste Facilities In Connecticut. http://www.ct.gov/dep/cwp/view.asp?a=2718&q=325490&depNav_GID=1646. Updated October 21, 2008.

A former municipal landfill is located immediately adjacent to the western boundary of the West Hartford Reservoir subwatershed. The closed landfill, which is now a leaf compost facility operated by the Town of West Hartford, is located off of Route 44 on the southwest side of West Hartford Reservoir No. 6. The facility is identified as a significant potential contamination source in the MDC Water Supply Plan (2008).

6 Water Quality

6.1 Classifications, Standards, and Impairments

> The North Branch Park River is impaired for recreational uses and habitat for fish, other aquatic life, and wildlife due to physical alteration and elevated levels of indicator bacteria.

The Federal Clean Water Act (CWA) was developed to protect the nation's surface waters. Through authorization of the CWA, the United States Congress declared as a national goal "water quality which provides for the protection and propagation of fish, shellfish, and wildlife, and recreation in and on the water wherever attainable." The CWA requires states to:

1. Adopt Water Quality Standards,
2. Assess surface waters to evaluate compliance with Water Quality Standards,
3. Identify those waters not currently meeting Water Quality Standards, and
4. Develop Total Maximum Daily Load (TMDL) analysis and other management plans to bring water bodies into compliance with Water Quality Standards.

Connecticut Water Quality Standards are established in accordance with Section 22a-426 of the Connecticut General Statutes and Section 303 of the CWA. The Water Quality Standards are used to establish priorities for pollution abatement efforts. Based on the Water Quality Standards, Water Quality Classifications establish designated uses for surface and ground waters and identify the criteria necessary to support these uses. The Water Quality Classification system classifies inland surface waters into four different categories ranging from Class AA to D. *Table 6-1* summarizes the Connecticut Surface Water Quality Classifications.

Table 6-1. Connecticut Inland Surface Water Quality Classifications

<table>
<tr><th>Designated Use</th><th>Class AA</th><th>Class A</th><th>Class B</th><th>Class C</th><th>Class D</th></tr>
<tr><td>Existing/proposed drinking water supply</td><td>•</td><td></td><td></td><td></td><td></td></tr>
<tr><td>Potential drinking water supply</td><td>•</td><td>•</td><td></td><td></td><td></td></tr>
<tr><td>Fish and wildlife habitat</td><td>•</td><td>•</td><td>•</td><td colspan="2" rowspan="3">Class C and D waters may be suitable for certain fish and wildlife habitat, certain recreational activities, industrial use, and navigation</td></tr>
<tr><td>Recreational use</td><td>•</td><td>•</td><td>•</td></tr>
<tr><td>Agricultural and industrial use</td><td>•</td><td>•</td><td>•</td></tr>
</table>

Figure 6-1 depicts the Water Quality Classifications of surface waters in the North Branch Park River watershed. The North Branch Park River is classified as C/A meaning that the river is currently only meeting Class C criteria or designated uses but has a goal of Class A. The North Branch Park River is also listed as impaired for recreational uses and habitat for fish, other aquatic life, and wildlife in the *2008 List of Connecticut Waterbodies Not Meeting Water Quality Standards. Table 6-2* summarizes the location and nature of the impairment. Multiple factors are identified as responsible for the impairment, including physical habitat alteration and elevated levels of *Escherichia coli* (*E.Coli*). The potential source of the *E. Coli* contamination is combined sewer overflows and urban stormwater.

Table 6-2. North Branch Park River Watershed Impaired Waters

Waterbody Name/ Segment ID	Location Description	Waterbody Segment Length	Impaired Designated Use	Cause	TMDL Priority/ Category	Potential Source
North Branch Park River-01/ CT4404-00_01	From mouth at confluence with Park River just downstream of I84 crossing, upstream to entrance of conduit (entire segment in pipe) near Farmington Avenue, Hartford	0.51 miles	Habitat for Fish, Other Aquatic Life and Wildlife	Physical substrate habitat alterations	N/4C	Channelization
			Recreation	Physical substrate habitat alterations	N/4C	Channelization
			Recreation	Escherichia coli	L/5	Combined Sewer Overflows
North Branch Park River-02/ CT4404-00_02	From downstream side of Farmington Avenue (at entrance of conduit), upstream to confluence with Wash Brook (just downstream of confluence of Wash Brook and Beamans Brook), Bloomfield	5.39 miles	Habitat for Fish, Other Aquatic Life and Wildlife	Unknown	L/5	Unspecified Urban Stormwater, Combined Sewer Overflows
			Recreation	Escherichia coli	L/5	Unspecified Urban Stormwater, Combined Sewer Overflows

Source: CTDEP, 2008
[1] TMDL Priority Definitions (i.e., Potential for TMDL Development within 3 Years):
H – high priority for which there is assessment information that suggests that a TMDL may be needed to restore the water quality impairment; TMDLs may be developed within 3 years.
M – medium priority indicates that there may be insufficient information to assess the impairment or that other programs are likely to remedy the water quality impairment; TMDLs may be developed within 3-7 years.
L – low priority; may be reassigned to another EPA category or TMDLs may be developed in 7-11 years.
N – not applicable; the impact to the stream is not being caused by a pollutant.
[2] TMDL Category Definitions for Waterbodies Not Meeting State Water Quality Standards:
4A – A TMDL to address a specific pollutant combination has been approved or established by EPA.
4B – A use impairment caused by a pollutant is being addressed by the State through pollution control requirements other than a TMDL.
4C – A use is impaired, but the impairment is not caused by a pollutant.
5 – Available data and/or information indicate that at least one designated use is not being supported and a TMDL is needed.

Figure 6-1

Total Maximum Daily Loads (TMDLs) provide the framework to restore impaired waters by establishing the maximum amount of a pollutant that a water body can assimilate without adverse impact to aquatic life, recreation, or other public uses. The *2008 List of Connecticut Waterbodies Not Meeting Water Quality Standards* includes a priority ranking system for development of a TMDL specific to the contaminants in each impaired segment: high (H), medium (M), low (L), under study (T), or Not Applicable (N). CTDEP has identified the need for a TMDL to address the impairment for Escherichia coli, although the priority is low at this time.

Other tributaries, lakes and ponds throughout the North Branch Park River watershed are classified as Class A with the exception of Tumbledown Brook, Beamans Brook, and Wash Brook, which are classified as Class B/A; the West Hartford Reservoir No. 6, which is classified as B/AA; and Hoe Pond in the upper northwest portion of the watershed, which is classified as AA since it feeds West Hartford Reservoir No. 6.

Currently, there is a statewide advisory that recommends limiting the consumption of freshwater fish due to elevated levels of mercury in some species. However, only those designated uses specifically identified in the Connecticut Water Quality Standards are assessed. In making water quality assessments, each designated use of a waterbody is assigned a level of support (e.g., full support, not supporting, or not assessed), which characterizes the degree to which the water is suitable for that use. The North Branch Park River is designated full support for fish consumption, although this designation is superseded by the statewide advisory.

6.2 Water Quality Monitoring

Water quality monitoring within the North Branch Park River watershed is conducted by the CTDEP and by the Trinity College Environmental Science program. Both water quality monitoring programs are described in the following sections, followed by a discussion of the monitoring results.

6.2.1 CTDEP Monitoring Program

The CWA requires each state to monitor, assess and report on the quality of its waters relative to attainment of designated uses established by the State's Water Quality Standards. For assessing statewide water quality conditions and complying with the CWA monitoring requirements, the CTDEP relies on monitoring data collected by two programs, the Ambient Monitoring Program and the Rapid Bioassessment in Wadeable Streams & Rivers by Volunteer Monitors (RBV) Program.

The determination of the supported uses in rivers across the state relies on the collection of physical, chemical and biological monitoring data of stream water quality. In 2005 a new Comprehensive Ambient Water Quality Monitoring Strategy was adopted. The strategy incorporates a composite of targeted and probabilistic sampling designs to assess aquatic life use support. The monitoring includes a mix of sites visited on five-year, two-year and annual basis.

The RBV program is a citizen-based water quality-monitoring program developed by the CTDEP ambient monitoring program. The RBV program is a standardized screening bioassessment method that identifies sections of streams with pollution sensitive organisms. Organisms are categorized as Least Sensitive, Moderately Sensitive, or Most Sensitive, which together with chemical monitoring data can serve as an indicator of overall stream health.

Table 6-3 provides a summary of the CTDEP water quality monitoring programs within the North Branch Park River watershed. The monitoring locations are depicted in *Figure 6-1.* The Ambient Monitoring Program conducted water quality monitoring of the North Branch Park River at Albany Avenue and a second location at Upper Campus Road (on the University of Hartford campus) in the winter, spring and summer of 1999. Additional water quality samples were collected and analyzed from a monitoring location on the North Branch Park River at Farmington Avenue (behind 19 Woodland Street) in June, July, August, and September of 2008. Sampling was not coordinated with wet or dry weather. Ambient monitoring results are also available for other locations within the watershed. Bioassessments in the North Branch Park River were performed by the RBV program in September of 2008.

Table 6-3. Summary of DEP Ambient Water Quality Monitoring Program

Stream	Location	Program	Parameters Monitored	Dates
North Branch Park River	Farmington Avenue behind 19 Woodland Street	AMP1	Temperature, DO, ORP, BOD5, pH, TDS, TSS, Turbidity, Alkalinity, Hardness, Total P, Total N, NO3, NO2, Org-C, TKN, Ca, Mg, E. coli	6/13/2008 6/16/2008 7/1/2008 7/10/2008 8/28/2008 9/2/2008 9/22/2008 10/8/2008
		RBV2	Macroinvertebrates	9/20/2008
	Watkinson School	RBV2	Macroinvertebrates	9/20/2008
	Albany Avenue	AMP1 - Quarterly Monitoring	Temperature, DO, ORP, BOD5, pH, TSS, Turbidity, Alkalinity, Hardness Total N, NO3, NO2, Ammonia, Org N, TKN, PO43- Cd, Cl, Cr, Cu, Pb, Ni, Zn, Fe Total Coliform, Enterococci, E. coli	3/30/1999 6/16/1999 9/27/1999
		AMP1 – Ambient Fish Community Sampling	Fish Species	8/22/2000
	Sunny Reach Drive	AMP1	DO, pH, TDS, water depth, Temperature	9/17/2008
	Upper Campus Road at University of Hartford	AMP1 - Quarterly Monitoring	Temperature, DO, ORP, BOD5, pH, TSS, Turbidity, Alkalinity, Hardness, Total N, NO3, NO2, Ammonia, Org N, TKN, PO43, Cd, Cl, Cr, Cu, Pb, Ni, Zn, Fe, Total Coliform, Enterococci, E. coli	3/30/1999 6/16/1999 9/27/1999
Wash Brook	US Cottage Grove Road (Route 218)	AMP1 - Ambient Fish Community Sampling	Fish Species Ammonia, NO3, NO2, pH, TSS, TKN, Total Solids, Turbidity, NOX, Org N, Ca, Mg, PO4-3, Alkalinity, Cl, PO4-2, K, Na, Total N, Hardness, SO4	6/13/2008

6.2.2 Trinity College Monitoring Program

Dr. Jonathan Gourley of the Trinity College Environmental Science Program is conducting an ongoing water quality monitoring project in the North and South Branches of the Park River. During the summer of 2008 a team of five undergraduate research students collected water quality samples at twelve locations from the headwaters of the North Branch Park River watershed through the main stem of the North Branch Park River (*Figure 6-1*). The samples were analyzed for temperature, pH, conductivity, total dissolved solids (TDS), salinity, dissolved oxygen (DO), hardness, major anions (chloride, nitrates and sulfates), fecal coliform, and macroinvertebrates. Sampling was not coordinated with wet or dry weather.

6.3 CTDEP Monitoring Results

The following sections summarize the CTDEP water quality monitoring results for the North Branch Park River watershed. Water quality monitoring results for additional parameters that were analyzed during the 1999 and 2008 sampling events are summarized in *Appendix C*.

6.3.1 Turbidity

Turbidity, a measure of the scattering of light through water, is a common indicator of suspended particulate and colloidal material and is typically included in ambient water quality monitoring programs (EPA, 2000). Turbidity can be caused by any small, undissolved material in water such as suspended algal cells or by inorganic suspended soils. Turbidity is typically reported in either Nephelometric Turbidity Units (NTUs) or Formazin Turbidity Units (FTUs) (although the NTU and FTU units are not necessarily synonymous, for the purposes of this report they are used interchangeably).

Turbidity levels can vary significantly in the environment and may depend on the surficial soils, level of development, nutrient loadings, and other watershed characteristics as well as rainfall conditions prior to sampling. EPA suggests a reference criteria level of 3.04 FTU for the Eastern Coastal Plain Ecoregion (Ecoregion XIV), which includes the majority of Connecticut (EPA, 2000b). The Connecticut Water Quality Standards turbidity criteria for waters in Class AA through B do not allow an increase in turbidity of more than 5 NTU above ambient conditions. Elevated turbidity can be symptomatic of excessive nutrients loads, resulting in algal growth, or sediment loads from soil erosion.

Figure 6-3 presents turbidity results for the CTDEP Ambient Monitoring Program data within the watershed. Turbidity levels measured in 1999 generally ranged from 1 to 3 NTU, with one measurement approaching 4.5 NTU at Albany Avenue. In 2008, measured turbidity levels varied from 1.6 to 6.7 NTU.

6.3.2 Total Suspended Solids

Similar to turbidity, Total Suspended Solids (TSS) describes the quantity of particulate matter suspended in the water column. TSS attenuates light and reduces transparency, whether the source is algae, algal detritus or inorganic sediment. Unlike turbidity, TSS is directly measured; water is filtered directly to remove the suspended material, and then the material is weighed. Solids that pass the filter are assumed to be dissolved.

During high streamflow, the concentration of suspended solids (and water clarity) is more strongly influenced by inputs of inorganic sediment or channel erosion in streams than by algae, especially in urbanized and agricultural watersheds. As shown in *Figure 6-4*, the Albany Avenue sampling location had the highest average TSS levels of the four sampling locations. However, the sample with the single highest measured TSS concentration was collected at the Farmington Avenue sample location.

There are no numerical state or federal water quality criteria for TSS. The Connecticut Water Quality Standards require that suspended and settleable solids not be present in concentrations or combinations that would impair designated uses, alter the composition of the water body substrate, or impact aquatic organisms.

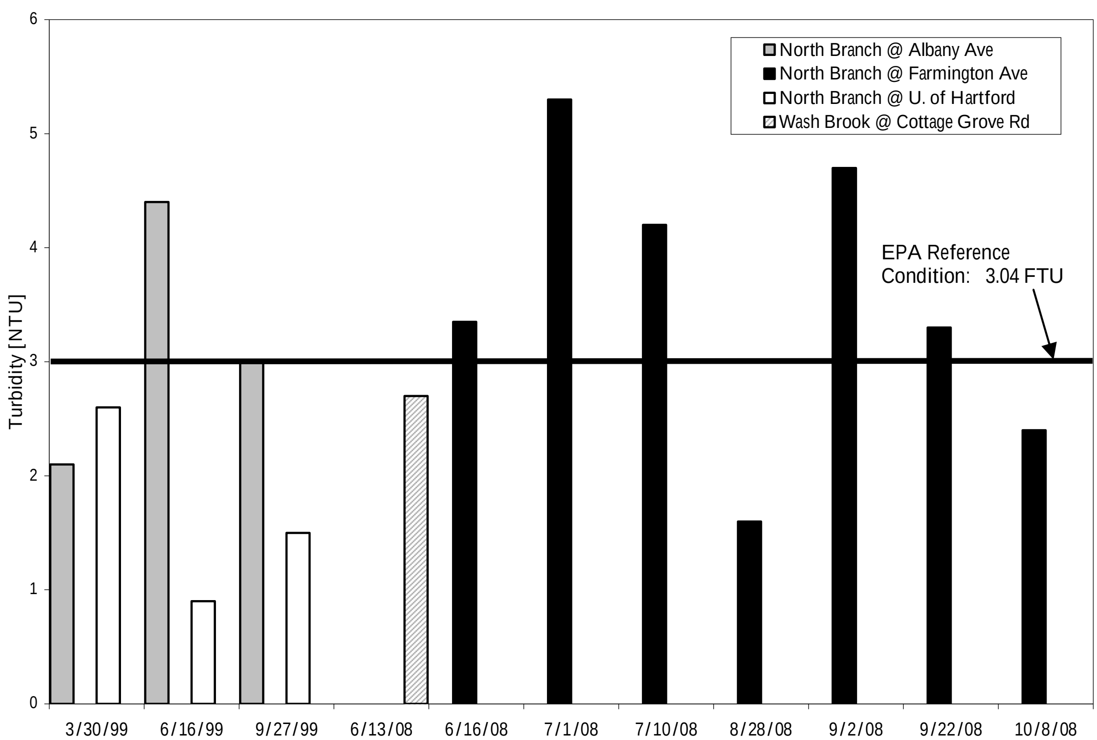


Figure 6-3. Turbidity – North Branch Park River Watershed

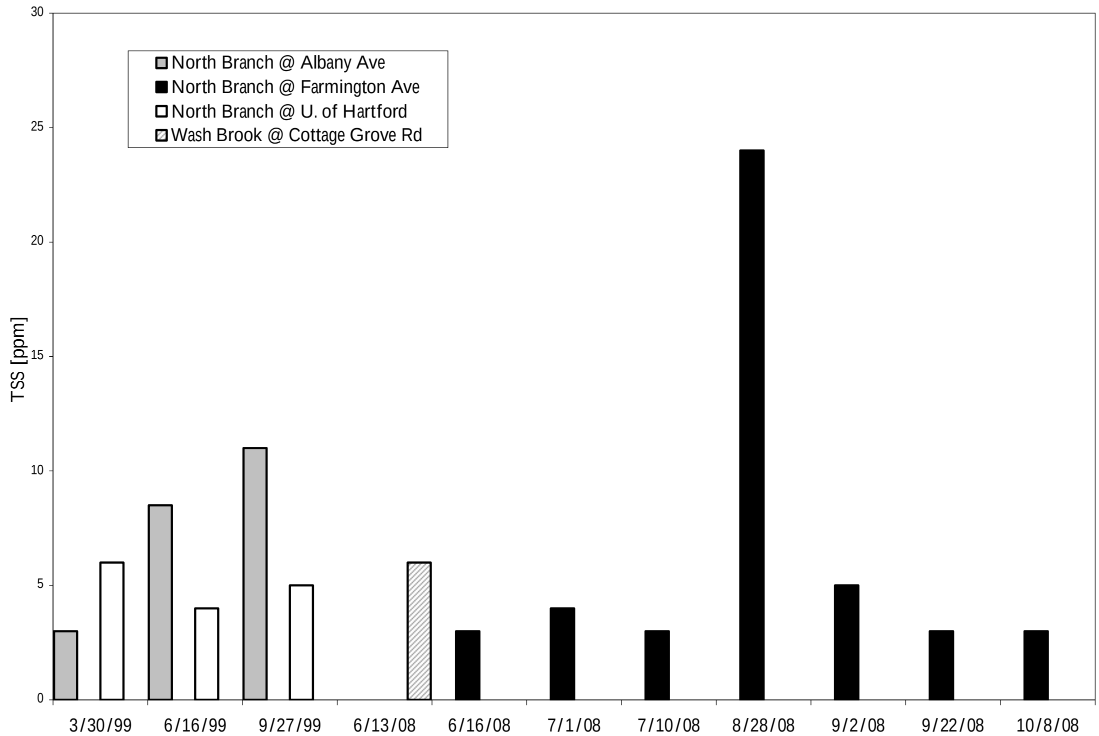


Figure 6-4. Total Suspended Solids (TSS) – North Branch Park River Watershed

6.3.3 Metals

Metals occur naturally in the environment, but human activities can alter their distribution. When metals are released into the environment in higher than natural concentrations they can be toxic and disrupt aquatic ecosystems. Metals in their dissolved form are typically more harmful (i.e., bioavailable) to aquatic organisms.

Dissolved copper was measured at two locations within the watershed on three occasions in 1999, and has not been sampled since. Both locations, at Albany Avenue and the University of Hartford, were found to have levels above the Connecticut Water Quality Standards freshwater chronic aquatic life limit of 4.8 micrograms per liter (*Figures 6-5*) during two of the three monitoring events. Biological integrity can be impaired when the ambient concentration of dissolved copper exceeds this value on more than 50 percent of days in any year (Connecticut Water Quality Standards, 2002). These elevated copper levels may result from stormwater runoff and combined sewer overflows.

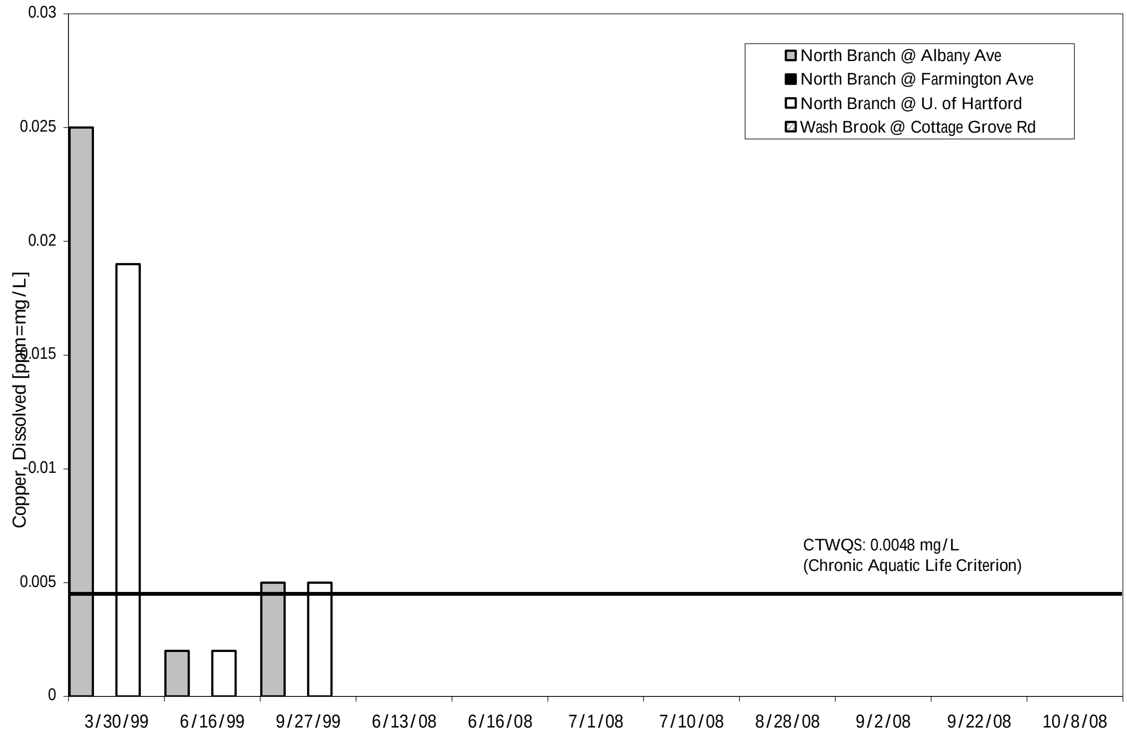


Figure 6-5. Dissolved Copper – North Branch Park River Watershed

Figure 6-6 summarizes dissolved lead concentrations at watershed sampling locations relative to the freshwater chronic aquatic life criterion of 1.2 micrograms per liter. None of the measured dissolved lead concentrations exceeded the criterion. Dissolved zinc concentrations were measured on three dates at two locations (Albany Avenue and University of Hartford) in 1999 (*Figure 6-7*). Of the six samples, two (one at each location) exceeded the freshwater chronic aquatic life criterion of 6.5 micrograms per liter.

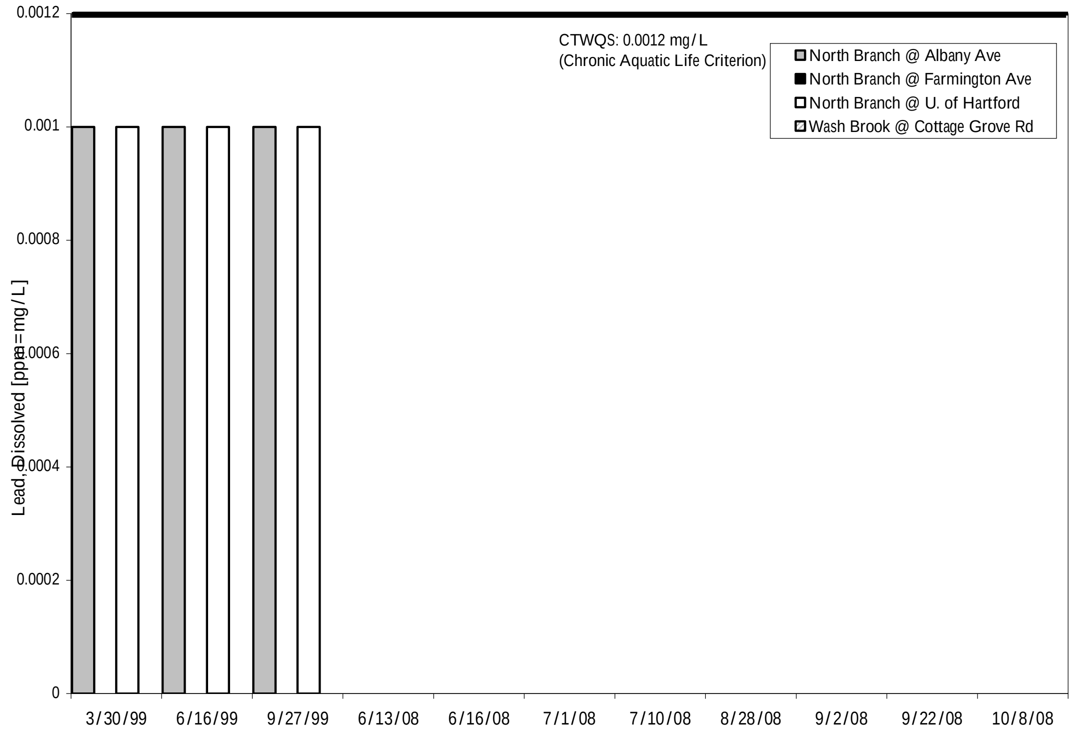


Figure 6-6. Dissolved Lead – North Branch Park River Watershed

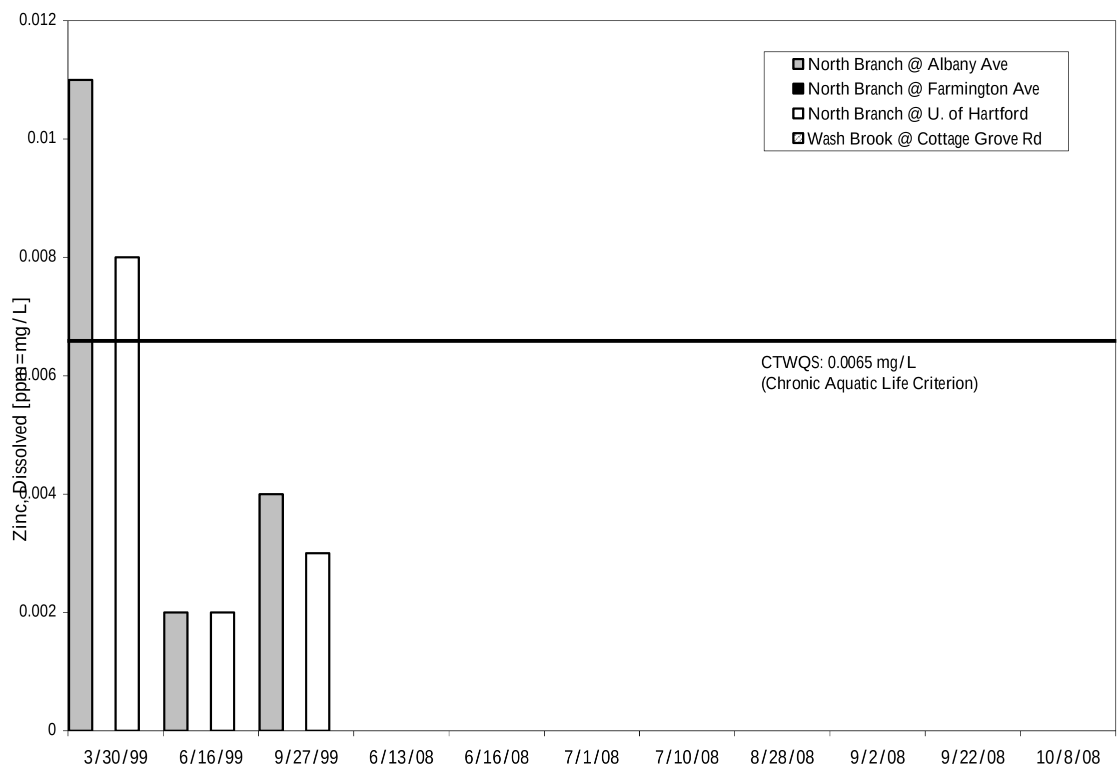


Figure 6-7. Dissolved Zinc – North Branch Park River Watershed

6.3.4 Nitrogen

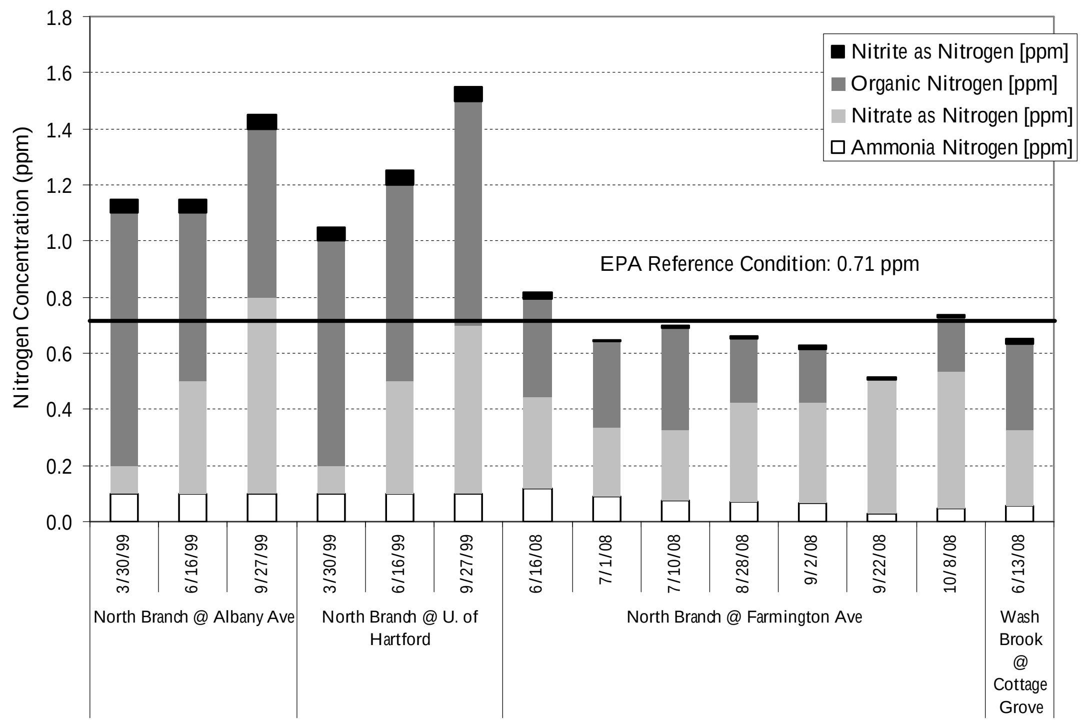
Nitrogen and phosphorus are the primary nutrients that enrich streams and rivers and cause nuisance levels of algae. Nutrients, especially phosphorus, are frequently the key stimulus to increased and excess algal biomass in many freshwaters. Nitrogen is more of a concern in marine systems and estuaries, such as the Lower Connecticut River and Long Island Sound to which the North Branch Park River eventually discharges.

The nitrogen species monitored within the watershed include ammonia, nitrate, nitrite, total nitrogen, nitrate and nitrite, and organic nitrogen. Total nitrogen can be calculated as the sum of ammonia, nitrate, and organic nitrogen, in addition to nitrite, which is rapidly converted to nitrate in surface waters. Total nitrogen levels measured at many of the monitoring locations exceeded the EPA reference criterion for rivers in Ecoregion XIV of 0.71 mg/L. This may reflect the significant contribution of nitrogen from sources in the watershed such as precipitation and atmospheric deposition, urban stormwater runoff, septic system effluent, and sewer overflows. *Figure 6-8* presents a subset of the total nitrogen data set for comparison with the EPA reference condition.

Organic nitrogen was the dominant nitrogen species at the Albany Avenue and University of Hartford sampling locations in 1999, although nitrate levels were similar to or greater than organic nitrogen levels at the Farmington River sampling location and in Wash Brook in 2008. However, organic nitrogen generally accounted for up to approximately 50% of all nitrogen in the collected samples.

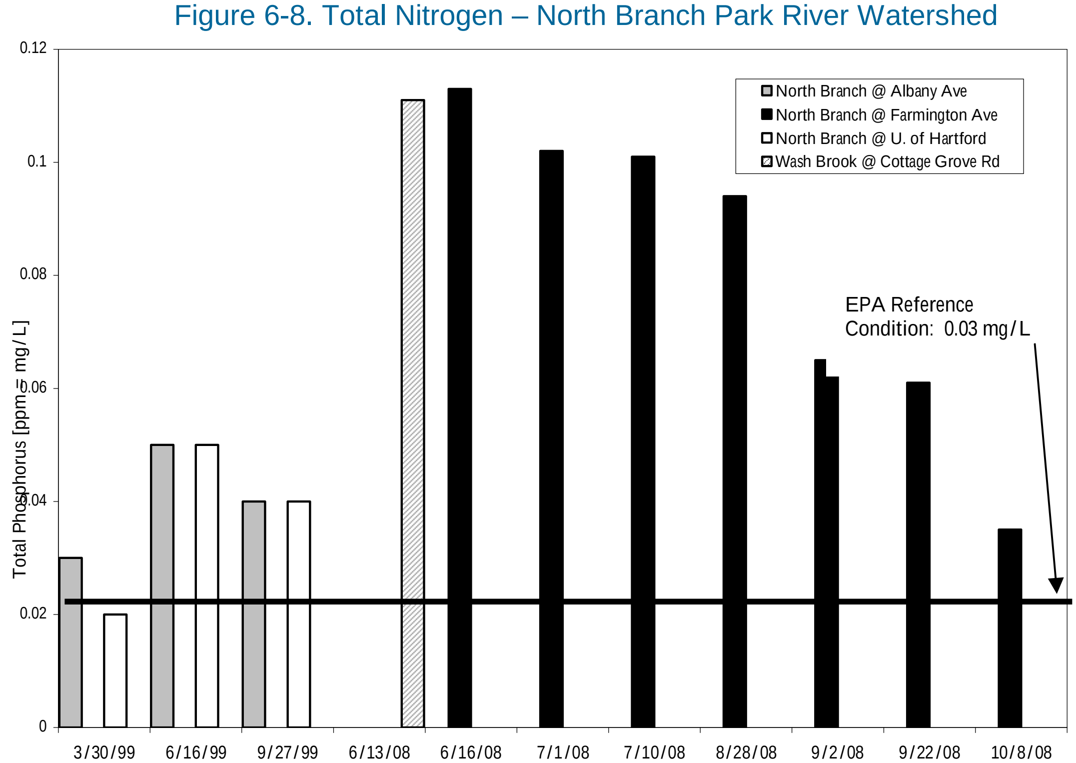
6.3.5 Phosphorus

Elevated phosphorus levels are an indicator of potential organic enrichment, which can enhance algal growth and impair aquatic life support and contact recreation under certain conditions. Total phosphorus concentrations measured at the four sampling locations (*Figure 6-9*) consistently exceeded the EPA reference criterion of 0.03 mg/L, which is also the Connecticut Water Quality Standards summer phosphorus concentration for lakes that would be expected to fully support contact recreational uses.



Note: Organic nitrogen data were unavailable for 9/22/08 at the Farmington Avenue sampling site.

Figure 6-8. Total Nitrogen – North Branch Park River Watershed



*Note: Samples dated 3/30/99-9/27/99 were analyzed using EPA Method 365.1 (Determination of Phosphorus by Semi-Automated Colorimetry), samples collected 6/13/08-10/8/08 we analyzed using EPA Method 365.4 (Phosphorous, Total (Colorimetric, Automated, Block Digester AA II)), both for Total Phosphorus

Figure 6-9. Total Phosphorus – North Branch Park River Watershed

6.3.6 Indicator Bacteria

Elevated levels of indicator bacteria (*Escherichia coli*) were measured at all monitoring locations sampled by the CTDEP (Wash Brook at Cottage Grove Road was not sampled for *Escherichia coli*). *Figure 6-10* presents *Escherichia coli* monitoring results. According to the Connecticut Water Quality Standards, Class AA, A, or B waters designated for freshwater recreational use have a single sample maximum criterion of 235 Colony Forming Units or CFU/100 ml of *Escherichia coli* for designated bathing areas, 410 CFU/100 ml for non-designated swimming areas, and 576 CFU/100 ml for other recreational uses. Since the North Branch Park River is not considered a bathing area (designated or non-designated), sample results are compared against the latter criterion (576 CFU/100 ml). Additionally, the maximum geometric mean criterion is 126 CFU/100 ml.

Determining the potential sources of indicator bacteria is difficult, especially since precipitation conditions prior to and during the sampling events are not known. Elevated bacteria levels during wet weather suggest stormwater runoff and other non-point sources (sewer overflows, pet waste, waterfowl, septic systems, etc.) as likely contributors of pathogens in the North Branch Park River and its tributaries. Alternately, elevated dry weather concentrations may be related to illicit discharges, septic system failures, or natural sources of bacteria such as waterfowl or wildlife. Samples collected at the Farmington Avenue (6/16/08) and University of Hartford (6/16/99) monitoring locations exceeded the single sample water quality standard of 576 CFU/100 ml.

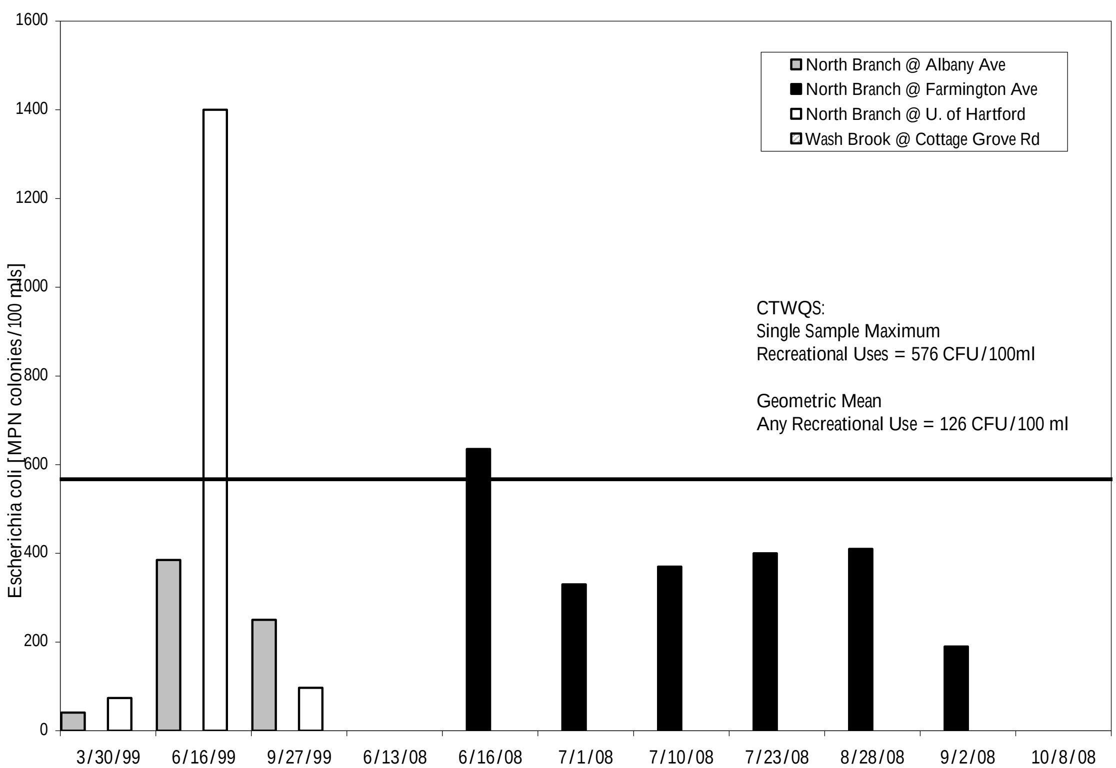


Figure 6-10. *Escherichia coli* – North Branch Park River Watershed

6.3.7 Bioassessments

The September 2008 RBV data generally indicate impacted water quality at the North Branch Park River monitoring locations, which suggests that the river is not fully supporting the state water quality standard for aquatic life. This finding is consistent with the impaired status of the North Branch Park River. No "most wanted" and a total of six "moderately wanted" macroinvertebrate types were found at the two assessment sites located on the North Branch Park River (Farmington Avenue and Watkinson School), while a total of nine "least wanted" types were noted. The CTDEP considers those locations where samples document 4 or more types of organisms in the "most wanted" category as fully supporting the state water quality standard for aquatic life.

6.4 Trinity College Monitoring Results

The results of the 2008 water quality monitoring project conducted by the Trinity College Environmental Science program (*Appendix D*) indicate relatively good water quality throughout most of the North Branch Park River watershed, except for Filley Brook where degraded water quality was observed (elevated chemical parameters, low dissolved oxygen, and physical observations of turbid water and a pungent odor). Chloride, nitrate and sulfate levels generally increased from the headwaters to the main stem of the North Branch Park River. Anion concentrations were elevated in Tumbledown Brook just downstream of the Wampanoag Golf Course, which may reflect impacts from golf course fertilizer runoff.

The Trinity College bioassessment results indicate fair to good water quality throughout the watershed. There was also little variability in the number (e.g., biotic index) or diversity of species (e.g., taxa richness) throughout the length of the river or over the duration of the monitoring event. Findings indicated that Wash Brook was the healthiest section of the watershed for both the number and diversity of aquatic macroinvertebrates. In general, the Beamans Brook and Tumbledown Brook tributaries were observed to have the greatest impacts. The Trinity College findings also indicate that the water quality in the North Branch Park River compared favorably to water quality measured by the program in the South Branch Park River (Gourley et al., 2008).

7 Land Use and Land Cover

The type and distribution of land use and land cover within a watershed has a direct impact on nonpoint sources of pollution and water quality. This section describes the current and potential future land use and land cover patterns in the watershed, and the implications for water quality and stream health.

7.1 Current Conditions

7.1.1 Land Use

Figure 7-1 depicts the generalized land use in the North Branch Park River watershed. The data in *Figure 7-1* are parcel-based land use categories for the watershed communities, provided by the Capital Region Council of Governments (CRCOG). The data include 20 land use categories, 14 of which are found in the watershed (*Table 7-1*). Approximately 63% of the watershed consists of developed land uses, with single-family residential comprising the largest percentage (27.3%). Highways and roads comprise approximately 8.2% of the watershed area. Commercial land use accounts for approximately 11% of the watershed area, with the majority of the commercial areas concentrated in the central and northern portions of the watershed along the Route 187/305 and Route 218 corridors in Bloomfield. Approximately 14% of the watershed is classified as undeveloped, while another 22.9% is classified as resource/recreation land use, including golf courses, conservation land, and other protected and unprotected open space. Large portions of the riparian areas adjacent to the North Branch Park River are located within resource/recreation areas.

Approximately 63% of the watershed consists of developed land uses, with single-family residential comprising the largest percentage (27.3%)

Development patterns and densities in the watershed are highly varied. The far western portion of the watershed is sparsely developed, with large undeveloped tracts of land in the West Hartford Reservoir subwatershed and Talcott Mountain State Forest area. The northern portions of the watershed are moderately developed, characterized by areas of low-density residential development, agricultural areas, golf courses, and flood control reservoirs. The northeast portion of the watershed contains large areas of former agricultural land that has been converted to commercial and industrial/office park land use along Route 187. The central and southern portions of the watershed are more densely developed with residential, institutional, and industrial land uses.

Figure 7-1

Table 7-1. Watershed Land Use

Land Use Category	Acres	Percent of Watershed
Agriculture	408	2.2%
Cemetery	27	0.1%
Commercial	1,947	10.6%
Government/Non-Profit	1,302	7.1%
Group Quarters	14	0.1%
Health/Medical	96	0.5%
Mixed Use	20	0.1%
Right-of-Way (ROW)	1,495	8.2%
Residential Multi-Family	1,132	6.2%
Residential Single-Family	5,010	27.3%
Resource/Recreation	4,192	22.9%
Undeveloped	2,600	14.2%
Unknown	7	0.0%
Water	71	0.4%

Source: Capitol Region Council of Governments (CRCOG), 2003

7.1.2 Zoning

Figure 7-2 depicts the existing zoning in the North Branch Park River watershed, which is based on a generalized compilation, prepared by the Capitol Region Council of Governments, of zoning districts and designations established by the watershed municipalities. The specific zoning districts across the watershed are highly variable because they are defined at the city or town level. The pattern of existing zoning largely reflects the existing pattern of residential, commercial, office, and industrial uses in the watershed. The majority of the watershed (76.7%) is zoned as residential (*Table 7-2).*

Table 7-2. Watershed Zoning

Zoning Category	Acres	Percent of Watershed
1-3 Unit Residential, Low Density	4,567	24.9%
1-3 Unit Residential, Medium Density	4,589	25.1%
1-3 Unit Residential, Medium-Low Density	4,895	26.7%
General Mixed Use	760	4.1%
Industrial	2,290	12.5%
Multi-Family	255	1.4%
Neighborhood Scale Commercial	63	0.3%
Planned Area Development Including Residential	55	0.3%
Planned Residential	487	2.7%
Public Land	1	<0.1%
Recreation	84	0.5%
Town Scale Commercial	265	1.4%

Source: Capitol Region Council of Governments (CRCOG), 2003

Figure 7-2

7.1.3 Land Cover

Figure 7-3 depicts the generalized land cover in the watershed. The data shown in *Figure 7-3* are land cover types derived from 2006 Landsat satellite imagery with a ground resolution of 30 meters. The land cover data in the watershed are classified into eleven categories (*Table 7-3*), which are used in the Connecticut Land Cover Map Series and described following the table (University of Connecticut Center for Land Use Education and Research).

Table 7-3. Watershed Land Cover

Land Cover Type	1985		2006		Relative Change in Percent of Watershed (%)[1]	Relative Change in Acreage (%)[2]
	Acres	Percent of Watershed	Acres	Percent of Watershed		
Developed	5,118	28%	5,966	33%	5%	17%
Turf & Grass	3,046	17%	3,361	18%	1%	10%
Other Grasses	413	2%	790	4%	2%	91%
Agriculture	2,261	12%	1,292	7%	-5%	-43%
Deciduous Forest	5,757	31%	5,200	28%	-3%	-10%
Coniferous Forest	861	5%	813	4%	-1%	-6%
Water	280	2%	255	1%	-1%	-9%
Non-forested Wetland	19	0%	20	0%	0%	6%
Forested Wetland	395	2%	364	2%	0%	-8%
Tidal Wetland	0	0%	0	0%	0%	0%
Barren Land	85	0%	174	1%	1%	105%
Utility ROWs	87	0%	88	0%	0%	1%

[1]Calculation = % land cover 2006 - % land cover 1985
[2]Calculation = (acres land cover 2006 - acres land cover 1985) / acres land cover 1985
Source: University of Connecticut Center for Land Use Education and Research (CLEAR)

The characteristics of each of these land cover types include the following:

- Barren Land– Mostly non-agricultural areas free from vegetation, such as sand, sand and gravel operations, bare exposed rock, mines, and quarries. Also includes some urban areas where the composition of construction materials spectrally resembles more natural materials. Also includes some bare soil agricultural fields.

- Coniferous Forest – Includes Southern New England mixed softwood forests. May include isolated low density residential areas.

- Deciduous Forest – Includes Southern New England mixed hardwood forests. Also includes scrub areas characterized by patches of dense woody vegetation. May include isolated low density residential areas.

Figure 7-3

- Developed – High density built-up areas typically associated with commercial, industrial and residential activities and transportation routes. These areas contain a significant amount of impervious surfaces, roofs, roads, and other concrete and asphalt surfaces.

- Forested Wetland – Includes areas depicted as wetland, but with forested cover. Also includes some small watercourses due to spectral characteristics of mixed pixels that include both water and vegetation.

- Non-forested Wetland – Includes areas that predominantly are wet throughout most of the year and that have a detectable vegetative cover (therefore not open water). Also includes some small watercourses due to spectral characteristics of mixed pixels that include both water and vegetation.

- Other Grasses – Includes non-maintained grassy areas commonly found along transportation routes and other developed areas and also agricultural fields used for both crop production and pasture.

- Turf & Grass – A compound category of undifferentiated maintained grasses associated mostly with developed areas. This class contains cultivated lawns typical of residential neighborhoods, parks, cemeteries, golf courses, turf farms, and other maintained grassy areas. Also includes some agricultural fields due to similar spectral reflectance properties.

- Utility ROWs – Includes utility rights-of-way. This category was manually digitized on-screen from rights-of-way visible in the Landsat satellite imagery. The class was digitized within the deciduous and coniferous categories only.

- Water – Open water bodies and watercourses with relatively deep water.

> Between 1985 and 2006, the watershed experienced a 5% increase in developed land cover and a corresponding loss of agricultural land and forest.

A comparison of watershed land cover between 1985 and 2006 (*Table 7-2*) shows a moderate increase in watershed development during this period (9% increase in developed cover types) and a corresponding loss of agriculture (5% decrease) and forest (4% decrease). There was a significant percentage loss of barren land cover and percentage increase in other grasses; however these land cover categories comprise a very small percentage of the watershed area and could reflect construction or agricultural activity at the time the satellite data was obtained.

The North Branch Park River watershed is characterized by roughly equal amounts of forested and developed land cover. These land cover types are described below.

7.1.4 Forest Cover

Approximately 35% of the watershed consists of deciduous and coniferous forest cover, which is associated with open space, wooded portions of low-density residential properties, and forested wetlands. *Table 7-4* compares the total acreage and percentage of forest cover by subwatershed. The percent forest cover in each subwatershed ranges from a low of approximately 13% in the Filley Brook subwatershed to a high of approximately 80% in the West Hartford Reservoir subwatershed.

Table 7-4. Forest Cover - North Branch Park River Watershed

Subwatershed Name	Forest Cover in Subwatershed (acres)	Percent Forest Cover in Subwatershed	Developable Forest Cover in Subwatershed (acres)	Percent of Forest Cover that is Developable
Beamans Brook East	51	31%	20	39%
Beamans Brook West	195	16%	31	16%
Blue Hills Reservoir	411	40%	94	23%
Cold Spring Reservoir	646	56%	168	26%
Filley Brook	54	13%	15	28%
North Branch Park River	792	20%	166	21%
Tumbledown Brook	330	21%	68	21%
Tumbledown Brook South	486	30%	61	13%
Tunxis Reservoir	376	43%	67	18%
Wash Brook North	257	34%	102	40%
Wash Brook South	360	23%	93	26%
Wash Brook West	448	44%	79	18%
West Hartford Reservoir	1,645	80%	203	12%
Wintonbury Reservoir	326	37%	129	40%
Watershed (total)	**6,377**	**35%**	**1,297**	**20%**

Source: University of Connecticut's Center for Land Use Education and Research (CLEAR)

Based on literature threshold values documented in several studies (CLEAR, 2007), watershed forest cover of 65% or greater is typically associated with a healthy aquatic invertebrate community. Only one of the fourteen subwatersheds, West Hartford Reservoir, meets or exceeds this threshold value of 65%.

Based on a recommendation of the American Forests organization, 40% forest cover is a reasonable overall threshold goal for urban areas. The recommended tree canopy goal in suburban residential zones is 50%; the recommended goal for urban residential zones is 25%; and the recommended goal for central business districts is 15% due to constraints on open space typical of the urban environment (American Forests, 2009).

Watershed forest cover of 65% or greater is typically associated with a healthy aquatic invertebrate community, while 40% forest cover is a reasonable overall threshold goal for urban areas (American Forests, 2009).

Table 7-5 compares the existing forest cover in each subwatershed with the tree canopy goals recommended by American Forests for urban land use. The green shaded cells indicate subwatersheds that are currently at or above the 40% general tree canopy goal for urban areas and at or above their respective goal for specific urban land uses (i.e., suburban residential, urban residential, central business district). The gray shaded cells indicate subwatersheds that are currently below the 40% general tree canopy goal and below their respective goal for specific urban land uses. The watershed as a whole (35%) is slightly below the 40% tree canopy goal for urban areas. Note that while this analysis provides preliminary insight into the existing forest cover in the watershed and potential priorities for establishing urban tree canopy goals for the watershed, the results should be refined using more detailed tree canopy information gathered from field inventories or higher-resolution satellite imagery due to the relatively coarse resolution of the CLEAR land cover data.

Table 7-5. Comparison of Forest Cover and Tree Canopy Goals

Subwatershed Name	Percent Forest Cover in Subwatershed	American Forests Tree Canopy Goal
Beamans Brook East	31%	>50%
Beamans Brook West	16%	25-50%
Blue Hills Reservoir	40%	25-50%
Cold Spring Reservoir	56%	>50%
Filley Brook	13%	15-25%
North Branch Park River	20%	15-25%
Tumbledown Brook	21%	25-50%
Tumbledown Brook South	30%	25-50%
Tunxis Reservoir	43%	25-50%
Wash Brook North	34%	25-50%
Wash Brook South	23%	15-25%
Wash Brook West	44%	>50%
West Hartford Reservoir	80%	>50%
Wintonbury Reservoir	37%	25-50%
Watershed (total)	**35%**	**40%**

Source: Forest cover estimated from data provided by University of Connecticut's Center for Land Use Education and Research (CLEAR). Tree canopy goals recommended by American Forests, 2009.

7.1.5 Developed Areas

Developed land cover, characterized by significant amounts of impervious surfaces such as roofs, roads, and other concrete and asphalt surfaces, accounts for approximately 33% of the watershed. When considered together with the turf/grass land cover category (primarily cultivated lawns typical of residential neighborhoods, parks, cemeteries, golf courses, turf farms, and other maintained grassy areas), approximately 51% of the watershed land area consists of developed land cover types. The percentage of developed land cover (not including turf/grass) in each subwatershed (*Table 7-6*) ranges from approximately 5% in the West Hartford Reservoir subwatershed to approximately 57% in the North Branch Park River subwatershed.

Table 7-6. Developed Land Cover by Subwatershed

Subwatershed Name	Developed Land Cover in Subwatershed (acres)	Percent Developed Land Cover in Subwatershed (%)
Beamans Brook East	32	20%
Beamans Brook West	466	39%
Blue Hills Reservoir	299	29%
Cold Spring Reservoir	237	21%
Filley Brook	208	52%
North Branch Park River	2,295	57%
Tumbledown Brook	466	30%
Tumbledown Brook South	477	29%
Tunxis Reservoir	181	21%
Wash Brook North	226	30%
Wash Brook South	615	39%
Wash Brook West	168	16%
West Hartford Reservoir	96	5%
Wintonbury Reservoir	198	22%
Watershed (total)	**5,966**	**33%**

Source: University of Connecticut's Center for Land Use Education and Research (CLEAR)

7.1.6 Impervious Cover

Impervious cover has emerged as a measurable, integrating concept used to assess the overall condition of a watershed. Numerous studies have documented the cumulative effects of urbanization on stream and watershed ecology (Center for Watershed Protection, 2003; Schueler et al., 1992; Schueler, 1994; Schueler, 1995; Booth and Reinelt, 1993, Arnold and Gibbons, 1996; Brant, 1999; Shaver and Maxted, 1996). Research has also demonstrated similar effects of urbanization and watershed impervious cover on downstream receiving waters such as lakes, reservoirs, estuaries, and coastal areas.

> Impervious cover has emerged as a measurable, integrating concept used to assess the overall condition of a watershed. These research findings have been integrated into a general watershed planning model known as the Impervious Cover Model (ICM).

The correlation between watershed impervious cover and stream indicators is due to the relationship between impervious cover and stormwater runoff, since streams and receiving water bodies are directly influenced by stormwater quantity and quality. Although well-defined imperviousness thresholds are difficult to recommend, research has generally shown that when impervious cover in a watershed reaches between 10 and 25 percent, ecological stress becomes clearly apparent. Between 25 and

60 percent, stream stability is reduced, habitat is lost, water quality becomes degraded, and biological diversity decreases (NRDC, 1999). Watershed imperviousness in excess of 60 percent is generally indicative of watersheds with significant urban drainage. *Figure 7-4* illustrates this effect. These research findings have been integrated into a general watershed planning model known as the Impervious Cover Model (ICM) (CWP, 2003).

Figure 7-4 also demonstrates the wide variability in stream response found in less-urban watersheds at lower levels of impervious cover (generally less than 10 percent). Stream quality at lower range of impervious cover is generally influenced more by other watershed metrics, such as forest cover, road density, extent of riparian vegetative cover, and cropping practices. Less variability exists in the stream quality at higher levels of impervious cover because most streams in highly impervious, urban watersheds exhibit fair or poor stream health conditions, regardless of other conditions (CWP, 2008).

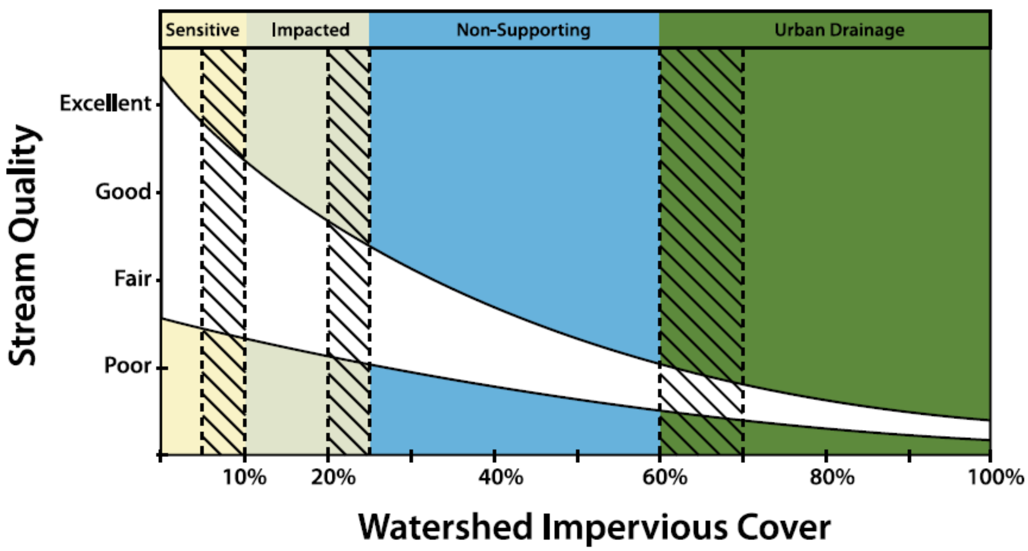


Figure 7-4. Conceptual Model Illustrating Relationship Between Watershed Impervious Cover and Stream Quality

A GIS-based impervious cover analysis was performed for the North Branch Park River watershed. The impervious cover acreage was calculated through direct measurement of buildings, parking lots, and roads from available GIS mapping of the watershed. Driveway areas in residential subdivisions were estimated using typical driveway dimensions based on parcel sizes and building density. The percent imperviousness by basin was calculated using the subwatershed GIS layer. *Figure 7-5* graphically summarizes the results of this analysis.

The overall impervious cover of the North Branch Park River watershed is estimated at approximately 15% (*Table 7-5*), which exceeds the 10% threshold in the ICM where ecological stress and stream impacts become apparent. As shown in *Figure 7-5*, impervious cover is generally highest (20% to 36%) in the urbanized central (Bloomfield) and southeastern portion (Hartford) of the watershed. Impervious cover in most of the residential areas of the watershed generally ranges from less than 10% up to 19.9%.

Figure 7-5

Figure 7-5 and *Table 7-7* summarize estimates of impervious cover by subwatershed. Most of the subwatersheds fall into the "impacted" category (impervious cover between 10 and 25%) according to the ICM. Several of the subwatersheds have significantly less than 10% impervious cover, including the Wash Brook West and West Hartford Reservoir subwatersheds. The North Branch Park River subwatershed has the highest impervious cover (27.9%), which is consistent with the high-density development in this portion of the watershed and indicative of degraded stream conditions according to the ICM.

Table 7-7. Existing Subwatershed Impervious Cover

Subwatershed	Percent Impervious Cover[1]
Beamans Brook East	9.6%
Beamans Brook West	16.6%
Blue Hills Reservoir	14.9%
Cold Spring Reservoir	6.2%
Filley Brook	22.6%
North Branch Park River	27.9%
Tumbledown Brook	13.5%
Tumbledown Brook South	11.5%
Tunxis Reservoir	9.3%
Wash Brook North	18.2%
Wash Brook South	17.5%
Wash Brook West	5.7%
West Hartford Reservoir	1.1%
Wintonbury Reservoir	13.2%
Watershed (total)	**15.0%**

Source: Metropolitan District Commission GIS data, CT DEP GIS data.
[1]Percent impervious cover calculated based on total impervious area (TIA).

The results of this analysis provide an initial diagnosis of potential stream and receiving water quality within the watershed study area. The analysis method and ICM are based on several assumptions and caveats, which limits its application to screening-level evaluations. Some of the assumptions of the ICM include:

- Requires accurate estimates of percent impervious cover, which is defined as the total amount of impervious cover over a subwatershed area.
- Predicts potential rather than actual stream quality.
- Does not predict the precise score of an individual stream quality indicator but rather predicts the average behavior of a group of indicators over a range of impervious cover.
- The 10 and 25% thresholds are approximate transitions rather than sharp breakpoints.
- Does not currently predict the impact of watershed best management practices (treatment or non-structural controls).

- Does not consider the geographic distribution of the impervious cover relative to the streams and receiving waters. Effective impervious cover (impervious cover that is hydraulically connected to the drainage system) has been recommended as a better metric, although determining effective impervious cover requires extensive and often subjective judgment as to whether it is connected or not.
- Impervious cover is a more robust and reliable indicator of overall stream quality beyond the 10 percent threshold. The influence of impervious cover on stream quality is relatively weak compared to other potential watershed factors such as percent forest cover, riparian community, historical land use, soils, agriculture, etc. for impervious cover less than 10 percent.
- Use should be restricted to 1st to 3rd order alluvial streams with no major point sources of pollutant discharge and no major impoundments or dams.
- Stream slope, as measured across the subwatershed, should be in the same range for all subwatersheds.
- Management practices in the contributing watershed must be good (e.g. no deforestation, acid mine drainage, major point sources, intensive row crops, etc.).

7.1.7 Open Space

Open space areas were identified based on data compiled and published by the CTDEP, including federal land, state-owned property, and other municipal and private open space. Additionally, MDC watershed land associated with West Hartford Reservoir No. 6 were included as protected open space. Approximately 23% of the watershed consists of protected open space that is primarily conservation land and public parks (*Figure 7-6*). This land is protected against future development. In addition, recreational open space (golf courses, and private institutional open space) accounts for another 5% to 10% of the watershed area (*Figure 7-1*). Future development of these parcels is unlikely, unless their continued use becomes threatened. Additional privately held natural open space exists on already subdivided parcels and large estates.

The Town of Bloomfield, which comprises the majority of the land area in the watershed, has a total of approximately 1,800 acres set aside as open space, including school and park land that is used for both active and passive recreation. In addition to locally-controlled land, the state owns and manages a number of areas within the Town including Penwood State Park, West Hartford Reservoir No. 6, Talcott Mountain State Park, Cold Spring Flood Water Retention Reservoir and Dam, and the Wintonbury Flood Water Retention Reservoir and Dam. Public open space constitutes approximately 20% of the Town of Bloomfield.

Some of the notable or sizable open space areas within the watershed include:

- Samuel Wheeler Reed Park: (School Street, Bloomfield) hiking trails, passive recreation in the eastern portion of the watershed
- LaSalette Open Space: (120 Mountain Avenue, Bloomfield) located in a central area of the watershed, amenities include fishing, gardens/flowers, hiking trails, passive recreation, pond and Captain Oliver Filley House

Figure 7-6

- Wintonbury Flood Water Retention Reservoir No. 1 and Dam: (Bloomfield) located in the northeastern portion of the watershed
- Blue Hills Water Retention Reservoir No. 2: (Blue Hills Avenue, Bloomfield) located in the eastern section of the watershed, this area includes hiking trails, passive recreation, brooks, a radio-control model airplane flying field operated by Wintonbury Flying Club
- Tunxis Flood Water Retention Reservoir No. 3: (Tunxis Avenue) located in the northern section of the watershed, this area offers fishing, ponds, gardens/flowers, hiking trails, passive recreation, picnic area, tennis courts, and community gardens
- Cold Spring Flood Water Retention Reservoir and Dam: (Bloomfield) located in the western half of the watershed.
- Penwood State Park: (Gun Mill Road, Bloomfield) nearly 800 acres of maintained hiking/cross country skiing trials, biking, and picnic areas located in the western side of the watershed. It contains colorful wildflowers such as trillium, dutchman's breeches, hepatica, bloodroot, and trailing arbutus. Pileated woodpecker, turkey vulture, and bald eagle also inhabit this area.
- Talcott Mountain State Park:(Route 185, Bloomfield) approximately 557 acres of maintained hiking trails including the 1.25-miles Tower Trail leading to the 165 foot, Heublein Tower. Wildlife found in the area includes deer, fox, rabbits, turkey vulture, bald eagle, and pileated woodpecker. Flora includes wildflowers such as trillium, trout lily, wood anemone, and Dutchman's breeches. This state-owned park is located in the western portion of the watershed
- Filley Park: (Tunxis Avenue, Bloomfield) located in the center of the watershed, this park includes an elderly & children's fishing pond, garden/flowers, Scott Trail, winter ice-skating area with warming shelter.
- West Hartford Reservoir No. 6: (Route 44, West Hartford) this 3,000 acre parcel, located in the southwestern portion of the watershed, contains reservoirs, vast woodlands, and hiking, jogging, biking, cross-country skiing, and snow shoeing trails.
- Fisher Meadows Recreation Area: (West Hartford)
- Meadows Park: (West Hartford)
- Eisenhower Park: (Sheep Hill Drive, West Hartford) This parcel contains a playground, basketball courts, and ball fields.
- Elizabeth Park: (corner of Prospect Avenue and Asylum Avenue, West Hartford/Hartford) a horticultural park encompassing 102 acres located in the southern area of the watershed. This parcel contains garden areas, pathways, greenhouses, lawns, a picnic grove, a pond and recreation areas.

The Wintonbury Land Trust maintains various open space areas throughout the watershed with plans to preserve additional areas. The Land Trust's major property holdings in the watershed include Capewell Greene (21 acres, Adams Road, Bloomfield) and Sinnot Farm Knoll (29 acres, Terry Plains, Bloomfield).

7.2 Future Conditions

7.2.1 Watershed Buildout Analysis

A watershed buildout analysis was conducted to estimate future potential land use and impervious cover conditions in the watershed as a result of maximum development allowed by current zoning.

7.2.1.1 Land Use

Watershed lands that could be developed in the future (i.e., "developable" land) were subdivided into two categories, based on the CRCOG parcel-based land use data:

- *New Development* - areas that are currently undeveloped and could be developed in the future. New development parcels include those that are designated as "undeveloped" and "unknown" in the CROCG land use data and not identified as protected open space.

- *Redevelopment* - areas that that have existing development, but are below the allowable maximum lot coverage based on current zoning. Commercial and industrial parcels were included in the analysis. Existing residential lots in well-established subdivisions were excluded from the analysis since they are unlikely to be redeveloped.

Areas having the following physical and/or regulatory constraints were also removed from consideration for future development or redevelopment: water bodies, wetland soils, slopes exceeding 25%, and areas in the FEMA-designated 100-year flood zone. *Table 7-8* and *Figure 7-7* summarize the amount of developable land by subwatershed, including the new development and redevelopment categories.

Table 7-8. Developable Land – North Branch Park River Watershed

Subwatershed	New Development (acres)	New Development Percent in Subwatershed	Redevelopment (acres)	Redevelopment Percent in Subwatershed
Beamans Brook East	12	7.2%	65	39.7%
Beamans Brook West	60	5.0%	90	7.6%
Blue Hills Reservoir	60	5.8%	353	34.1%
Cold Spring Reservoir	166	14.4%	117	10.1%
Filley Brook	20	4.8%	53	13.1%
North Branch Park River	188	4.7%	412	10.2%
Tumbledown Brook	45	2.9%	346	22.1%
Tumbledown Brook South	175	10.8%	12	0.7%
Tunxis Reservoir	27	3.1%	158	18.1%
Wash Brook North	98	12.8%	271	35.6%
Wash Brook South	100	6.4%	347	22.2%
Wash Brook West	112	10.9%	170	16.5%
West Hartford Reservoir	234	11.4%	23	1.1%
Wintonbury Reservoir	126	14.1%	188	21.1%
Watershed (Total)	**1,422**	**7.8%**	**2,605**	**14.2%**

Figure 7-7

The future land use buildout scenario was estimated by assigning new land uses to developable areas, while maintaining the existing land uses for developed and unbuildable land (wetland soils, steep slope soils, floodplains and committed open space). The developable areas were assigned a future land use based on maximum degree of development allowed by existing zoning. Parcels that were developed prior to the promulgation of the existing zoning categories and regulations and may have a land use that is inconsistent with existing zoning. The current land use of these existing, non-conforming parcels is assumed to remain the same under future conditions for the purpose of this analysis.

Table 7-9 summarizes the future land use category assigned to each developable parcel based on the existing zoning. This analysis assumes development of Public Act 490 (which provides tax incentives to preserve farmland, forest and open space land) parcels consistent with the underlying zoning and does not account for future zone changes or future land development regulatory changes.

Table 7-9. Assigned Future Land Use Categories

Zoning Category	Assigned Future Land Use
1-3 Unit Residential, Low Density	Single-Family
1-3 Unit Residential, Medium Density	Single-Family
1-3 Unit Residential, Medium-Low Density	Single-Family
Multi-Family	Multi-Family
Planned Residential	Multi-Family
Planned Area Development Including Residential	Mixed Use
Industrial	Industrial
General Mixed Use	Mixed Use
Neighborhood Scale Commercial	Commercial
Town Scale Commercial	Commercial
Recreation	Resource/Recreation

The results of the watershed buildout analysis are summarized in *Table 7-10*, which compares acreage of existing and future land use in the watershed. Single-family residential and industrial land uses are predicted to increase by 13.5% and 9.4%, respectively. The majority of the increase in industrial land use is anticipated to occur in the northeast portion of the watershed, in an area of Bloomfield along Blue Hills Avenue (State Route 187) that is zoned for industrial use and is now largely undeveloped except for limited commercial development.

Approximately 4.7% of the existing commercial land use could be converted to industrial use in this area. There are also large areas of Bloomfield that are currently undeveloped and are zoned for low to medium density single-family residential use. The overall amount of resource/recreation and undeveloped land in the watershed is predicted to decrease by 42%.

Table 7-10. Watershed Buildout Analysis Results

Land Use	$Acres_{Existing}$	Percent of $Basin_{Existing}$	$Acres_{Future}$	Percent of $Basin_{Future}$	Relative Percent Change[1]
Agriculture	408	2.2%	84	0.5%	-1.8%
Cemetery	27	0.1%	26	0.1%	0.0%
Commercial	1947	10.6%	1086	5.9%	-4.7%
Government/Non-Profit	1302	7.1%	1114	6.1%	-1.0%
Group Quarters	14	0.1%	10	0.1%	0.0%
Health/Medical	96	0.5%	68	0.4%	-0.2%
Industrial	0	0.0%	1721	9.4%	9.4%
Mixed Use	20	0.1%	99	0.5%	0.4%
Multi-Family	1132	6.2%	1147	6.3%	0.1%
Single-Family	5010	27.3%	7478	40.8%	13.5%
Resource/Recreation	4192	22.9%	3570	19.5%	-3.4%
ROW	1495	8.2%	1495	8.2%	0.0%
Undeveloped	2600	14.2%	347	1.9%	-12.3%
Unknown	7	0.0%	7	0.0%	0.0%

[1]Calculation = % land use $_{future}$ - % land use $_{existing}$

7.2.1.2 Impervious Cover

The results of the watershed buildout and existing conditions impervious cover analyses were used to estimate future impervious cover in the North Branch Park River watershed. The difference between existing and future impervious cover was calculated as the potential increase in lot coverage for the developable parcels in the watershed. Future impervious cover for new development and redevelopment parcels was assumed equal to the maximum coverage allowed by zoning.

Table 7-11 presents estimates of existing and future impervious cover by subwatershed. The blue shaded cells in the table highlight the subwatersheds for which impervious cover is predicted to change from “sensitive” (< 10% impervious cover) or “impacted” (10% to 25% impervious cover) to the “non-supporting” (25% to 60% impervious cover) category as described by the Impervious Cover Model. The Beamans Brook East subwatershed has the greatest predicted percent increase in impervious cover at nearly 50%, crossing the threshold from “sensitive” to “non-supporting.” The gray shaded cells in the table highlight the subwatersheds for which impervious cover is predicted to change from “sensitive” to “impacted.” The Cold Spring Reservoir, Tunxis Reservoir, and Wash Brook West subwatersheds are currently classified as “sensitive” but are predicted to exceed the “impacted” threshold under a future buildout scenario. Based on this analysis, the overall impervious cover in the North Branch Park River watershed is predicted to increase from 15.0% to 22.2% which is approaching the threshold for a “non-supporting” watershed.

Table 7-11. Percent Impervious Cover – Existing and Future Conditions

Subwatershed	Existing Percent Impervious Cover	Future Percent Impervious Cover	Percent Change (IC_{Future} - $IC_{Existing}$)
Beamans Brook East	9.6%	56.5%	46.9%
Beamans Brook West	16.6%	20.4%	3.8%
Blue Hills Reservoir	14.9%	27.3%	12.4%
Cold Spring Reservoir	6.2%	11.9%	5.7%
Filley Brook	22.6%	26.2%	3.6%
North Branch Park River	27.9%	33.0%	5.1%
Tumbledown Brook	13.5%	29.5%	16.0%
Tumbledown Brook South	11.5%	15.2%	3.7%
Tunxis Reservoir	9.3%	12.4%	3.1%
Wash Brook North	18.2%	36.5%	18.3%
Wash Brook South	17.5%	24.0%	6.5%
Wash Brook West	5.7%	13.3%	7.6%
West Hartford Reservoir	1.1%	2.4%	1.3%
Wintonbury Reservoir	13.2%	24.7%	11.5%
Watershed (total)	**15.0%**	**22.2%**	**7.2%**

Another useful metric was developed by Goetz et al. (2003) for the Chesapeake Bay region, which combines subwatershed impervious cover and tree cover within the 100-foot stream buffer. Each of the subwatersheds within the North Branch Park River watershed was analyzed with regard to the combined impervious cover/riparian zone metric, which is summarized in *Table 7-12* by Goetz et al. (2003).

Table 7-12. Impervious Cover/Riparian Zone Metric

Stream Health	% Watershed Impervious Cover	% Natural Vegetation in 100-ft Stream Buffer
Excellent	< = 6%	>=65%
Good	6-10%	60-65%
Fair	10-25%	40-60%
Poor	> 25%	< 40%

The existing areas of natural vegetation were determined using the 2006 CLEAR land cover data. Natural vegetation was defined to include the deciduous forest, coniferous forest, forested wetland, and non-forested wetland categories. The future natural vegetation was determined to be areas within the 100 foot stream buffer that are currently vegetated and are not included in the potentially developable land areas identified in the buildout analysis. The Town of Bloomfield has a recommended riparian buffer of 75 feet along the banks of perennial streams, which was considered protected land in this analysis. (The Town of West Hartford does not have a riparian buffer recommendation in their zoning regulations, and negligible developable land exists within the riparian area in the Hartford portion of the watershed.) *Table 7-13* presents the results of the combined impervious cover/riparian zone metric for existing and future conditions. The color shading in the table corresponds to the metric classifications in *Table 7-12*.

Table 7-13. Impervious Cover/Riparian Zone Metric – Existing and Future Conditions

Subwatershed	Existing		Future	
	% Watershed Impervious Cover	% Natural Vegetation in 100-ft Stream Buffer	% Watershed Impervious Cover	% Natural Vegetation in 100-ft Stream Buffer
Beamans Brook East	10%	48%	56%	38%
Beamans Brook West	17%	48%	20%	43%
Blue Hills Reservoir	15%	61%	27%	56%
Cold Spring Reservoir	6%	64%	12%	58%
Filley Brook	23%	51%	26%	45%
North Branch Park River	28%	48%	33%	37%
Tumbledown Brook	14%	39%	29%	35%
Tumbledown Brook South	12%	40%	15%	32%
Tunxis Reservoir	9%	74%	12%	66%
Wash Brook North	18%	70%	36%	57%
Wash Brook South	18%	44%	24%	36%
Wash Brook West	6%	62%	13%	48%
West Hartford Reservoir	1%	86%	2%	77%
Wintonbury Reservoir	13%	73%	25%	67%
Watershed (total)	**15%**	**55%**	**22%**	**47%**

Currently, the North Branch Park River subwatersheds are highly varied and are categorized as "excellent" to "poor" based on the riparian zone metric published by Goetz et al. (2003). The Cold Spring Reservoir, Tunxis Reservoir, Wash Brook West, and West Hartford Reservoir subwatersheds are rated as "excellent" or "good" based on the combined impervious cover/riparian zone metrics. The North Branch Park River and Tumbledown Brook subwatersheds have a "poor" rating for at least one of the metrics.

Under a watershed buildout scenario, many of the subwatersheds are predicted to experience a decline in stream health as a result of increases in impervious cover and development within the riparian corridor. One or both of the metrics are predicted to decline from a "good" or "fair" rating to a "poor" rating for the Beamans Brook East, Blue Hills Reservoir, Filley Brook, North Branch Park River, Tumbledown Brook, Tumbledown Brook South, Wash Brook North, and Wash Brook South subwatersheds.

8 Existing Watershed Practices

This section summarizes existing management practices in the watershed that could impact water quality in the North Branch Park River and its tributaries, focusing on municipal, institutional, and commercial/industrial practices. Additional information on residential, commercial, and municipal practices gathered through field assessments of upland areas in the watershed will be presented in a separate, companion report to this baseline assessment document.

8.1 Municipal Phase II Stormwater Program

The CTDEP regulates stormwater discharges from municipalities in designated urbanized areas under the General Permit for the Discharge of Stormwater from Small Municipal Separate Storm Sewer Systems (MS4). The MS4 General Permit requires municipalities to register with CTDEP, develop and implement a Stormwater Management Plan that addresses six minimum control measures, and annually collect stormwater samples for representative industrial, commercial, and residential land uses. The six minimum control measures include public education and outreach, public participation, illicit discharge detection/elimination, construction stormwater management, post-construction stormwater management, and pollution prevention/good housekeeping. The CTDEP is currently in the process of revising and reissuing the MS4 General Permit.

The municipalities within the North Branch Park River watershed are regulated under the General Permit for the Discharge of Stormwater from Small Municipal Separate Storm Sewer Systems (MS4).

The municipalities within the North Branch Park River watershed are regulated under the MS4 General Permit. The discussion in this section is limited to the communities of Hartford, West Hartford, and Bloomfield since these municipalities comprise the majority of the watershed land area and have the greatest potential to impact water quality resulting from the discharge of urban stormwater runoff. The following sections summarize current and ongoing municipal stormwater management practices in Hartford, West Hartford, and Bloomfield as described in the Stormwater Management Plans and most recent annual reports prepared by each municipality. An evaluation of local land use regulations, including local stormwater management regulatory requirements, will be presented in a separate, companion report to this baseline assessment document.

8.1.1 Hartford

Much of the City of Hartford's stormwater system is maintained by the Metropolitan District Commission (MDC). Portions of the stormwater system are combined with the sanitary sewer system. The City of Hartford's Stormwater Management Plan applies to the areas in the City that have separate sewer and stormwater drainage systems. Compliance with the MS4 General Permit has been a combined effort between the City of Hartford and the MDC. The City works collaboratively with the MDC in implementing their Stormwater Management Plan. This collaborative effort is documented in a Memorandum of Understanding (MOU) between the City and MDC. The City's stormwater management-related activities and practices are summarized as follows:

- The MDC has developed ordinances against illicit discharges to the stormwater system. Additionally, the City is in the process of developing procedures for eliminating illicit discharges.
- Trash is collected along river corridors during summer months, and the MDC participates as a partner in the annual Connecticut River Watershed Council's volunteer-based "Source to the Sound" cleanup.
- A goal of stenciling or re-stenciling 1,000 catch basins per year, beginning in 2004, is set to identify catch basins which drain to a watercourse. The stenciling is intended to discourage illegal dumping into storm drainage systems.
- The MDC held two household hazardous waste collection days in Hartford in 2008, during which 302 households participated and approximately 30,000 pounds of waste was collected.
- The MDC implements a catch basin inspection and maintenance program. During inspections, the MDC evaluates the catch basin for structural damage and cleanliness. Work Orders are generated as needed for maintenance requirements.
- Catch basins in the drainage system throughout the City are maintained through catch basin cleaning using vacuum trucks. Over 4,000 (more than 60 percent) catch basins were cleaned in 2008.
- Street sweeping is performed regularly throughout the City. Downtown streets are swept three times per week, residential streets once per week, and major City facilities once per year.
- The City conducts annual stormwater training for DPW staff, while the MDC conducts stormwater training for selected operational staff.
- In 2008 the MDC began "the MDC Community Forum Series" to allow communities to meet with MDC management to discuss the Clean Water Project, which includes a component on stormwater management.

As discussed in Section5 of this baseline assessment report, the MDC and the City of Hartford are evaluating the use of green infrastructure approaches and low impact development (LID) to further manage wet weather flows, including storm runoff volume and quality. Such practices include the installation of rain gardens, open channels/swales, and pervious pavements which promote the infiltration of runoff into the soil instead of directing it into the storm and/or combined sewer system.

8.1.2 West Hartford

In accordance with their Stormwater Management Plan, the Town of West Hartford has implemented best management practices to meet each of the six minimum control measures, including but not limited to public education, post-construction stormwater management, and pollution prevention and good housekeeping. All paved streets are swept once per year at a minimum, and in 2007 approximately 2,800 catch basins were cleaned. Magnesium chloride is used for roadway de-icing in West Hartford to reduce the use of road sand. An effort to replace existing catch basin covers with new covers labeled "Drains to Watercourse" is underway throughout the town.

8.1.3 Bloomfield

Streets and municipal parking lots in Bloomfield are swept at least once per year as soon as possible after snowmelt. Catch basins throughout the municipality are cleaned at least once per year, and more frequently if needed. Town-owned catch basins located in recreational and high pedestrian traffic areas are targeted for stenciling to identify the catch basin as draining to a watercourse, and will include approximately 30% of the total number of catch basins in Bloomfield. Two MDC-sponsored household hazardous water disposal days are held per year in Bloomfield. As part of the Town's Stormwater Management Plan, stormwater outfalls and structures of the stormwater system have been mapped in support of the Town's illicit discharge detection and elimination program, as required by the MS4 General Permit.

8.2 Source Controls and Pollution Prevention

8.2.1 Regulated Commercial and Industrial Facilities

As discussed in Section 5, there are a number of commercial and industrial facilities within the North Branch Park River watershed that have NPDES discharge permits and/or other regulated waste streams. These facilities are required to comply with the permit conditions and associated regulations/statutes, including source controls, pollution prevention, monitoring, treatment, and other best management practices as specified by the permits. The recent compliance records of these regulated facilities were reviewed to evaluate potential issues related to existing commercial and industrial facility practices in the watershed.

Table 8-1 lists industrial facilities in the watershed, which are registered under the CTDEP General Permit for the Discharge of Stormwater Associated with Industrial Activity, with stormwater sampling results that exceeded the General Permit effluent quality goals between August 2008 and August 2009. The number of facilities with results above the General Permit effluent quality goals (4) represents approximately 27 percent of the industrial facilities in the North Branch Park River watershed.

Table 8-1. Watershed Facilities with Stormwater Sample Results Above the Industrial Stormwater General Permit Effluent Quality Goals (August 2008 to August 2009)

Facility	Address	Subwatershed	Water Quality Parameters Detected Above the General Permit Effluent Quality Goals
Capewell Horsenails, Inc.	1404 Blue Hills Avenue, Bloomfield	Blue Hills Reservoir	Total Zinc, Aquatic Toxicity (LC50)
Finlay Printing, LLC	44 Tobey Road, Bloomfield	North Branch Park River	Chemical Oxygen Demand, Total Suspended Solids, Total Kjeldahl Nitrogen, Total Zinc
Kamatics Corporation	1330 Blue Hills Avenue, Bloomfield	Blue Hills Reservoir	Aquatic Toxicity (LC50)
Pepperidge Farm	1414 Blue Hills Avenue, Bloomfield	Wintonbury Reservoir	Total Kjeldahl Nitrogen

Source: CTDEP, August 2009.

Similarly, three of the four industrial facilities in the watershed with individual NPDES surface water discharge permits also reported violations as of October 2009 (*Table 8-2*).

Table 8-2. NPDES Regulated Facilities in the Watershed – Non-Compliance Record

Facility	Address	Quarters in Non-Compliance	Reasons for Non-Compliance
JDS Uniphase Corp	45 Griffin Road South; Bloomfield, CT	6 of 12	Effluent Violations (2)*, Report Violations (4)
Birken Manufacturing Company, Inc.	3 Old Windsor Road; Bloomfield, CT	4 of 12	Effluent Violations (2)*, Report Violations (2)
Swift Textile Metalizing, LLC	23 Britton Drive; Bloomfield, CT	2 of 12	Effluent Violations (2)*
Eisenhower Park	15 Sheep Hill Road; West Hartford, CT	- -	- -

* Unresolved significant non-compliance violations
Source: EPA, Facility Registry System (FRS), October 2009.

Several commercial properties in the watershed are registered under the CTDEP General Permit for the Discharge of Stormwater Associated with Commercial Activity. The CTDEP recently developed an outreach program for commercial establishments that may be subject to stormwater permitting requirements, waste regulations, pesticide regulations and other compliance requirements. Some examples of such establishments include garden centers, nurseries, greenhouses, hardware stores, and home improvement centers. The *Environmental Best Management Practices Guide for Small Businesses* (CTDEP, 2009) lists specific practices that are recommended for preventing and minimizing groundwater and surface water pollution as a result of day-to-day activities at these commercial facilities.

Facility operating practices were evaluated at several representative industrial and commercial facilities in the watershed to further assess the potential for water quality impacts, improvements in the use of BMPs, and potential retrofit opportunities. The results of this hotspot land use assessment will be discussed in a separate, companion report to this baseline assessment document.

8.2.2 Institutions and Golf Courses

> The numerous institutional facilities and golf courses within the North Branch Park River watershed are major land owners that can have a significant impact on the water quality of the North Branch Park

The numerous institutional facilities (university campuses, schools, corporate campuses, and hospitals) and golf courses (Wintonbury Hills Golf Course, Tumble Brook Country Club, Gillette Ridge Golf Course, Hartford Golf Club, and Wampanoag Country Club) within the North Branch Park River watershed are major land owners that can have a significant impact on the water quality of the North Branch Park River, through both new development and redevelopment projects, as well as grounds management of these properties, many of which are located adjacent to or nearby the North Branch Park River and its tributaries. Impacts from new development and redevelopment are primarily related to post-construction stormwater runoff, emphasizing the importance of LID and Green Infrastructure approaches such as the use of pervious pavement, rain gardens, green roofs, etc. Grounds management issues include facility operation and maintenance practices with potential for water quality impacts such as landscape maintenance (nutrient and Integrated Pest Management, grass clippings management, leaf/brush waste management, etc.), parking lot and road maintenance (deicing, snow management), drainage system maintenance (catch basins, storm drains, LID and traditional structural stormwater BMPs, etc.), and flooding issues.

The Wintonbury Hills Golf Course is one of five golf courses within the North Branch Park River watershed.

Limited information was available on the existing practices of the institutional facilities and golf courses within the watershed, many of which are privately-owned. The CTDEP guidance document *Best Management Practices for Golf Course Water Use* (July 2006) provides recommended BMPs for golf courses to promote water conservation, preserve or improve water quality, and protect water resources. The document describes BMPs that minimize the potential of pollutants reaching surface or ground water as a result of golf course construction and maintenance operations, thereby minimizing non-point source pollution. Recommended BMPs are presented for vegetative buffers, wetlands and watercourse protection, stormwater management, erosion and sediment control, turf management (nutrient and Integrated Pest Management), equipment maintenance and fueling, chemical storage and handling, waste management, and spill response. Many golf courses in the state have implemented some form of IPM and other BMPs recommended by the CTDEP. The level of adherence to these practices is unknown for the golf courses in the North Branch Park River watershed.

Some of the university campuses and schools in the watershed have begun to implement environmentally-sensitive campus management practices. The University of Connecticut (UConn) is one such example. The UConn Law School follows many of the same initiatives that are practiced at the main UConn campus in Storrs. The UConn Office of Environmental Policy (OEP) promotes environmental responsibility and sustainability. Some of the current OEP initiatives include the development of an initial *Invasive Plant Species Management Plan*, consideration of porous pavers and other permeable pavement options for on-campus parking lots, the installation of rain gardens, and the overall implementation of sustainable design, specifically the implementation of the University's *Guidelines for Sustainable Design*, with provisions for both new and renovation projects. Although not reportedly used on the Law School Campus, IPM is actively utilized at the main Storrs and Depot Campuses in Mansfield, including athletic fields.

Ongoing outreach activities that are being conducted as part of the watershed management plan development for the North Branch Park River include coordination with campus facility managers to identify common issues of concern and more effective facility management approaches that are also sensitive to water quality.

Operating practices were evaluated at several representative institutional facilities in the watershed to further assess the potential for water quality impacts, as well as potential improvements to existing practices and retrofit opportunities. The results of this assessment will be discussed in a separate, companion report to this baseline assessment document.

9 Pollutant Loading

A pollutant loading analysis was performed for the North Branch Park River. A pollutant loading model was applied to the watershed using the land use/land cover data described in Section 7. The model was used to compare existing pollutant loads from the watershed to projected future pollutant loads under a watershed buildout scenario. The predicted change in pollutant loads in each of the subwatersheds is an indicator of their relative vulnerability to future development. The pollutant loading model is also used to identify and rank pollution sources, as well as assist in identifying, prioritizing, and evaluating subwatershed pollution control strategies. It is important to note that the results of this screening-level analysis are intended for the purpose of comparing existing and future conditions and not to predict future water quality. This section summarizes the methods and results of the analysis, which are presented in greater detail in *Appendix E*.

9.1 Model Description

The Watershed Treatment Model (WTM), Version 3.1, developed by the Center for Watershed Protection, was used for this analysis. This model calculates watershed pollutant loads primarily based on nonpoint source (NPS) runoff from various land uses. The model was also used to estimate pollutant loads from other sources, including:

- Combined Sewer Overflows
- Illicit Discharges
- Septic Systems
- Sanitary Sewer Overflows
- Managed Turf
- Road Sanding

Reductions in future pollutant loads in the watershed can be estimated using a range of treatment measures, such as structural and nonstructural best management practices, that are included in the WTM.

Other similar screening-level pollutant loading models were considered for use in development of a watershed management plan for the North Branch Park River, including the Spreadsheet Tool for the Estimation of Pollutant Load (STEPL), the Generalized Watershed Loading Function (GWLF) model, and other similar models. While STEPL was identified as a suitable choice for the North Branch Park River, it was determined that the WTM is better suited for modeling bacterial loads and provides a larger suite of best management practices for urban areas. The ArcView GIS version of the GWLF model was also considered for use in the evaluation, although the AVGWLF model has limited capability for modeling CSOs when using the urban runoff module RUNQUAL within the GWLF model. Again, the WTM model was determined to be better suited for modeling CSOs than the AVGWLF model.

The pollutants modeled in this analysis are the default pollutants contained in the WTM model: total phosphorus, total nitrogen, total suspended solids, and total fecal coliform bacteria. These pollutants are the major NPS pollutants of concern in environmental systems. Additional loadings from combined sewer overflows (CSOs) and sanitary sewer overflows (SSOs) were simulated where such wet weather discharges are known to exist (i.e., North Branch Park River subwatershed).

9.2 Model Inputs

9.2.1 Nonpoint Source Runoff

The land use and land cover data described in Section 7 were adapted for use in the WTM to simulate pollutant loadings under existing and potential future (watershed buildout) conditions. The WTM uses the Simple Method to calculate nutrient, sediment, and bacteria loads from various land uses. The user specifies several model parameters for each land use in the watershed to estimate runoff quantity and pollutant levels. These parameters include Event Mean Concentrations (EMCs), which are literature values for the mean concentration of a pollutant in stormwater runoff for each land use, and an average impervious cover percentage for each land use.

A literature review was conducted to determine EMC values and impervious percentage values for use in the evaluation. EMC values were selected to reflect the relative difference in NPS pollutant characteristics between existing and future land uses. The default impervious cover coefficients in the WTM were adjusted to better reflect local conditions in the North Branch Park River watershed. Impervious cover estimates for each land use category were modified based on measured total impervious area (TIA) for representative parcels or areas within each land use.

9.2.2 Other Pollutant Sources

In addition to nonpoint source runoff pollutant loads, the WTM also provides the capability to model other pollutant sources including point sources and subsurface contributions. The following sections summarize the model inputs for other pollutant sources within the North Branch Park River watershed.

9.2.2.1 Combined Sewer Overflows

The WTM uses a modification of the Simple Method to calculate annual loads from CSOs. The primary assumption is that CSO discharges occur when the combined volume of stormwater and wastewater exceeds the total system capacity. The MDC system experiences approximately 50 CSO discharge events annually in the North Branch Park River (MDC, 2009). Statistical analysis of 15 years of precipitation data at a nearby weather station reveals that the approximate critical depth of rainfall to cause 50 CSO discharge events per year is 0.3 inches.

The volume of a typical CSO is based on the median storm event. In the WTM, any rainfall beyond the system capacity contributes to the CSO volume. Thus, this volume is calculated as the runoff caused by the difference between the median storm event depth and the rainfall depth that causes CSOs (assumed to be 0.3 inch). The runoff volume from this storm event is determined using the Simple Method. The resulting CSO pollutant load is the product of the CSO volume, the number of CSO events, and typical CSO pollutant concentrations.

9.2.2.2 Illicit Discharges

The WTM default assumptions for illicit discharges were used (i.e., a fraction of the total sewage flow contributes to illicit connections). The WTM makes separate assumptions for residential and business illicit connections. For residential connections, the WTM's default assumption is that one in every 1,000 sewered individuals is connected to the sewer system via an illicit connection. This value is then multiplied by the number of individuals connected to the system, and then by typical per capita flow and pollutant concentrations for raw sewage. For businesses, it is assumed that 10% of businesses have illicit connections, and approximately 10% of those have direct sewage discharges.

9.2.2.3 Septic Systems

Although the majority of the North Branch Park River watershed is served by sanitary sewers, portions of the western and northwestern sections of Bloomfield are on private septic systems (Thiesse, pers. comm., December 18, 2009). The number of unsewered dwelling units in each subwatershed was estimated using GIS data including the mapped sewer service area, impervious cover, and aerial photographs. The WTM default values were used for septic system failure rate (30%) and effluent concentrations from both working and failing septic systems.

9.2.2.4 Managed Turf

In urban watersheds, subsurface flow constitutes a relatively small fraction of total annual flow, and most constituents have a relatively low concentration in groundwater. One possible exception is nitrogen, which can leach from urban lawns and other managed turf grass. The annual nitrogen load from managed turf areas is calculated as the product of its concentration and the annual infiltration volume. The area of managed turf in each subwatershed is based on the land cover data described in Section 7 and includes residential lawns, golf courses, parks, and other areas with grass or turf.

9.2.2.5 Road Sanding

Sediment loads from road sanding are calculated based on the quantity of sand applied to roads in a typical year. Data from the West Hartford Public Works Department was extrapolated to the rest of the watershed since more detailed data was unavailable. A sanding application rate for typical roads was calculated based on the average rate in West Hartford in pounds per mile per year. The local roads GIS layer was used to calculate the total length of roads in each subwatershed and the total amount of sand applied to the roads in an average year. Default delivery ratios were used for various road types since not all road sand that is applied will reach the receiving water body.

9.3 Existing Pollutant Loads

Table 9-1 presents the existing modeled pollutant loads for the North Branch Park River watershed. Nonpoint source runoff accounts for approximately 71% of the total nitrogen load, 89% of the total phosphorus load, 33% of the total suspended solids load, and 7% of the fecal coliform bacteria load for the entire watershed. Road sanding accounts for nearly the entire balance of the total suspended solids load, while CSOs and SSOs contribute more than 90% of the fecal coliform load for the watershed. *Table 9-2* presents a breakdown of estimated annual loadings of total nitrogen, total phosphorus, TSS, and fecal coliform by subwatershed.

Table 9-1. Modeled Existing Pollutant Loads by Source Type

Source	N (lb/yr)	P (lb/yr)	TSS (lb/yr)	Fecal Coliform (billion/yr)
Nonpoint Source Runoff	97,441	15,234	3,686,296	883,935
Other Sources	38,949	1,874	7,487,076	11,170,230
Septic Systems	14,487	182	7,274	0
SSOs	516	86	3,441	390,550
CSOs	3,653	731	73,054	10,654,285
Illicit Discharges	1,004	586	9,416	125,395
Managed Turf	19,288	289	0	0
Road Sanding	0	0	7,393,891	0
Watershed Total	**136,389**	**17,108**	**11,173,372**	**12,054,165**

Table 9-2. Modeled Existing Pollutant Loads

Subwatershed	N (lb/yr)	P (lb/yr)	TSS (lb/yr)	Fecal Coliform (billion/yr)	N (lb/ac-yr)	P (lb/ac-yr)	TSS (lb/ac-yr)	Fecal Coliform (billion/ ac-yr)
Beaman Brook East (163 ac)	778	112	65,702	18,530	4.8	0.7	403	113.8
Beaman Brook West (1,185 ac)	8,917	1,096	892,088	63,816	7.5	0.9	753	53.9
Blue Hills Reservoir (1,035 ac)	6,740	1,115	500,837	27,292	6.5	1.1	484	26.4
Cold Spring Reservoir (1,155 ac)	8,825	822	499,416	95,667	7.6	0.7	432	82.8
Filley Brook (404 ac)	4,349	543	454,764	30,696	10.8	1.3	1,126	76.0
North Branch Park River (4,033 ac) (excluding CSOs and SSOs)	37,808	5,121	3,537,838	279,377	9.4	1.3	877	69.3
CSOs and SSOs	4,169	817	76,495	11,044,834	1.0	0.2	19.0	2,738.4
Tumbledown Brook (1,561 ac)	15,486	1,660	1,112,424	93,446	9.9	1.1	713	59.9
Tumbledown Brook South (1,622 ac)	10,149	937	895,817	84,370	6.3	0.6	552	52.0
Tunxis Reservoir (874 ac)	7,142	672	381,828	41,445	8.2	0.8	437	47.4
Wash Brook North (762 ac)	5,187	845	527,067	26,722	6.8	1.1	692	35.1
Wash Brook South (1,559 ac)	13,603	1,778	1,263,600	111,061	8.7	1.1	810	71.2
Wash Brook West (1,029 ac)	6,680	602	329,983	68,767	6.5	0.6	321	66.8
West Hartford Reservoir (2,048 ac)	1,839	332	246,421	33,749	0.9	0.2	120	16.5
Wintonbury Reservoir (894 ac)	4,719	657	389,091	34,393	5.3	0.7	435	38.5
Watershed Total (18,323 ac)	**136,389**	**17,108**	**11,173,372**	**12,054,165**	**7.4**	**0.9**	**610**	**657.9**

Because the study subwatersheds vary in size, pollutant loads were also evaluated in terms of loading rates (i.e., pollutant loads per acre of land area, as shown in *Table 9-2*). A higher loading rate indicates relatively greater pollutant sources per unit area, which suggests that implementation of best management practices (BMPs) in these areas may be more effective in reducing pollutant loads. The highest loading rates for nitrogen and phosphorus are associated with the North Branch Park River, Filley Brook, Wash Brook South, Tumbledown Brook, and Wash Brook North subwatersheds. Filley Brook has the loading rates of total suspended solids, while the North Branch Park River subwatershed has the largest fecal coliform loading rate due to contributions from CSOs and SSOs.

- *North Branch Park River*. The North Branch Park River subwatershed is the largest subwatershed by area. It also has the largest amount of commercial/industrial, institutional, and transportation land uses. The nutrient loads in this subwatershed are approximately 3 times greater than the next highest subwatershed, primarily due to the comparatively large size and highly urban nature of the subwatershed. The estimated nitrogen loading rate (excluding CSO contributions) is the second highest of the subwatersheds at 9.4 lb/ac-year, while the phosphorus loading rate is the highest of the subwatersheds at 1.3 lb/ac-year. The estimated fecal coliform loading due to nonpoint source runoff is 279,377 billion per year, while the contribution of fecal coliform from sewer overflows is approximately 2 orders of magnitude larger than the nonpoint source runoff contribution.

- *Wash Brook South*. Wash Brook South ranks among the top four subwatersheds in annual pollutant loading and loading rates. The high loading is due to the proportionally high commercial/industrial, residential, and roadway land uses in this subwatershed.

- *Filley Brook*. The Filley Brook subwatershed has the highest TSS loading rate in the watershed and is among the 4 highest subwatersheds in terms of pollutant loading rates for nitrogen, phosphorus, and fecal coliform bacteria. However, the total loading of each pollutant is among the lowest in the watershed due to its small size. The high pollutant loading rates reflect the large percentage of medium density residential (50%) and commercial/industrial (20%) development in the subwatershed.

Table 9-3 summarizes the contribution of nonpoint source pollutant loads by land use for the entire watershed. The majority of the nitrogen and phosphorus loads are from roadway, commercial/industrial, and residential land uses. The majority of the TSS loads is due to roadway (41.8%) and commercial/industrial (31.1%) land use. Residential land use accounts for approximately 81% of the nonpoint source bacterial load. Other modeled pollutant sources contribute significantly to the watershed pollutant loads, particularly CSOs and SSOs, which are the predominant source of the fecal coliform loads in the watershed.

Table 9-3. Modeled Existing Pollutant Loads by Land Use

Land Use	N (lb/yr)	P (lb/yr)	TSS (lb/yr)	Fecal Coliform (billion/yr)	N	P	TSS	Fecal Coliform
Agriculture	274	37	3,506	416	0.3%	0.2%	0.1%	0.0%
Commercial/Industrial	25,239	4,589	1,147,223	73,199	25.9%	30.1%	31.1%	8.3%
Forest	389	195	136,280	4,436	0.4%	1.3%	3.7%	0.5%
Institutional	7,112	1,185	264,709	25,209	7.3%	7.8%	7.2%	2.9%
Medium Density Residential	18,778	2,209	336,905	437,981	19.2%	14.5%	9.1%	49.5%
Multi-family/High Density Residential	8,071	897	142,590	118,528	8.3%	5.9%	3.9%	13.4%
Open Space (Urban)	2,109	211	28,126	3,205	2.2%	1.4%	0.8%	0.4%
Roadway	30,887	5,148	1,544,327	65,691	31.7%	33.7%	41.8%	7.4%
Single-family/Low Density Residential	4,713	785	86,793	155,719	4.8%	5.1%	2.4%	17.6%
Watershed Total	**97,572**	**15,256**	**3,690,458**	**884,382**	**100%**	**100%**	**100%**	**100%**

9.4 Future Pollutant Loads

Anticipated future land use due to new development and redevelopment within the watershed was used in the WTM model to simulate potential future pollutant loads under a watershed buildout scenario. Future land use categories were derived from the watershed buildout scenario presented in Section 7. Future controls or best management practices were not considered in the calculation of future pollutant loads. Therefore, the predicted future pollutant loads reflect a potential worst-case scenario against which potential watershed management pollution control strategies may be evaluated. Additionally, future pollutant loads were modeled with and without CSO mitigation to evaluate the potential reductions in pollutant loads that could be achieved by the MDC's ongoing and planned CSO abatement measures.

Table 9-4 presents projected future pollutant loads in terms of loading rate increase and percent increase in total loads under a watershed buildout scenario. Significant increases in pollutant loads are predicted in many of the subwatersheds. The watershed as a whole is predicted to experience a 13% increase in nitrogen loads, a 16% increase in phosphorus loads, and a 20% increase in TSS loads under a future buildout scenario and assuming completion of the ongoing and planned CSO mitigation projects. Overall, fecal coliform loads for the entire watershed are predicted to decrease by 64%, primarily as a result of the MDC sewer overflow mitigation projects. However, these projects will only affect pollutant loads in the North Branch Park River subwatershed. Almost all of the other subwatersheds are predicted to experience significant increases in fecal coliform loads (generally 20% to 80% increases) under a watershed buildout scenario due to nonpoint source runoff. Several of the subwatersheds are predicted to experience significantly higher increases in pollutant loads and loading rates under a watershed buildout scenario. These subwatersheds, which include the Beamans Brook East, Wash Brook North, Wash Brook West, and Wintonbury Reservoir subwatersheds, correspond to areas with significant developable land.

Table 9-4. Modeled Future Pollutant Loading Rate Increases and Load Increases

Subwatershed	Projected Future Loading Rate*				Projected Load Increase* (%)			
	N (lb/ac-yr)	P (lb/ac-yr)	TSS (lb/ac-yr)	Fecal Coliform (billion/yr)	N	P	TSS	Fecal Coliform
Beamans Brook East (163 ac)	11.2	1.2	638	169	134%	75%	58%	49%
Beamans Brook West (1,185 ac)	8.4	1.0	845	65	11%	12%	12%	21%
Blue Hills Reservoir (1,035 ac)	7.8	1.3	581	36	20%	20%	20%	35%
Cold Spring Reservoir (1,155 ac)	8.3	0.8	499	105	9%	14%	15%	27%
Filley Brook (404 ac)	12.0	1.6	1315	82	11%	18%	17%	8%
North Branch Park River (4,033 ac) (excluding CSOs and SSOs)	10.4	1.4	990	83	11%	12%	13%	19%
CSOs and SSOs	0.4	0.1	5.4	757	-66%	-67%	-72%	-72%
Tumbledown Brook (1,561 ac)	11.0	1.2	804	73	11%	13%	13%	22%
Tumbledown Brook South (1,622 ac)	7.1	0.7	695	78	13%	19%	26%	50%
Tunxis Reservoir (874 ac)	8.8	0.9	503	65	8%	11%	15%	36%
Wash Brook North (762 ac)	10.5	1.8	1099	46	54%	61%	59%	32%
Wash Brook South (1,559 ac)	9.8	1.3	912	92	13%	11%	13%	29%
Wash Brook West (1,029 ac)	6.1	0.8	453	113	-7%	30%	41%	70%
West Hartford Reservoir (2,048 ac)	1.2	0.2	163	29	37%	32%	36%	77%
Wintonbury Reservoir (894 ac)	8.4	1.3	733	57	59%	71%	68%	48%
Watershed Total* (18,323 ac)	**8.4**	**1.1**	**729**	**239**	**13%**	**16%**	**20%**	**-64%**

*Reflects completion of ongoing and planned CSO mitigation projects.

10 Comparative Subwatershed Analysis

A Comparative Subwatershed Analysis was performed for the North Branch Park River subwatersheds to identify the subwatersheds with the greatest vulnerability and restoration potential. Subwatershed "metrics" were used to conduct this analysis. Metrics are numeric values that characterize the relative vulnerability and restoration potential of a subwatershed. The results of this analysis will be used to prioritize field assessment efforts in future phases of this study and to guide plan recommendations.

The analysis involves a screening-level evaluation of selected subwatershed metrics that are derived by analyzing available GIS layers and other subwatershed data sources. The basic approach used to conduct the Comparative Subwatershed Analysis consisted of:

1. Delineation of subwatershed boundaries and review of available data.
2. Selection and calculation of metrics that best describe subwatershed vulnerability and restoration potential. (The metrics used to rank subwatershed vulnerability were selected separately from the metrics used to rank subwatershed restoration potential.)
3. Developing weighting and scoring rules to assign values to each metric.
4. Computing aggregate scores and developing subwatershed rankings.

Subwatersheds with higher aggregate "vulnerability" scores are more sensitive to future development and should be the focus of watershed conservation efforts to maintain existing high-quality resources and conditions. Subwatersheds with higher aggregate "restoration potential" scores are more likely to have been impacted and have greater potential for restoration to improve upon existing conditions. This approach enables watershed planners to allocate limited resources on subwatersheds where restoration and conservation efforts have the greatest chances of success. The Comparative Subwatershed Analysis was performed for the following North Branch Park River subwatersheds:

- Beamans Brook East
- Beamans Brook West
- Blue Hills Reservoir
- Cold Spring Reservoir
- Filley Brook
- North Branch Park River
- Tumbledown Brook
- Tumbledown Brook South
- Tunxis Reservoir
- Wash Brook North
- Wash Brook South
- Wash Brook West
- West Hartford Reservoir
- Wintonbury Reservoir

The following sections present the metrics used, the rationale for their selection, how numerical values for the various metrics were calculated, and the results of the analysis. Available GIS and other data were used to assign a value for each metric.

10.1 Priority Subwatersheds for Conservation

Eight metrics were used to evaluate each subwatershed for vulnerability to future development, with a numerical value assigned for each metric based on the analyses presented in previous sections of this Baseline Watershed Assessment. *Table 10-1* presents the metrics used for determining the relative vulnerability of each subwatershed. Many of the metrics evaluate the potential changes in watershed in land use, land cover, impervious cover, and pollutant loading between existing and future conditions, as presented in previous sections of this report. Note that the pollutant loading metric does not account for combined sewer overflow loading in the watershed, and is comparing the loading from non-point sources (land use) only. Each metric was assigned a value of between 1 and 10, with 1 indicating the lowest vulnerability and 10 indicating the highest vulnerability to future development. The scores for each of the metrics were then added to arrive at an overall score for each subwatershed. The total number of points possible for each subwatershed is 80.

Table 10-1. Summary of Subwatershed Vulnerability Metrics

Subwatershed Metric	How Metric is Measured	Indicates Higher Vulnerability Potential When	Metric Points
1. Impervious Cover Change	% increase in impervious cover in subwatershed	**Predicted increase in IC is high**, suggesting greater development potential and stream impacts	Add 1 pt for each 2% increase in impervious cover, up to 10 pts
2. Impervious Cover Threshold	Comparison of current and future IC relative to ICM threshold	**Predicted increase in IC crosses "impacted" (10%) threshold**, development could result in significant stream impacts	Add 5 pts for each exceedance into higher category (0-10%; 10-25%; 25-60%, >60%)
3. Stream Order	% of subwatershed streams that are 1st or 2nd order	**Subwatershed contains lower order streams**, suggesting greater vulnerability of headwater streams to future development	Add 1 pt for each 10% of streams in subwatershed that are 1st or 2nd order
4. Pollutant Loading	Average % increase of N, P, TSS, and bacterian pollutant loading in subwatershed	**Predicted increase in pollutant loads is high,** suggesting greater water quality impacts from future development	Award 1 pt for each 10% increase in the average pollutant loading
5. Commercial & Industrial Land Use Change	% increase of commercial & industrial land in subwatershed	**Predicted increase in commercial & industrial land use is high**, suggesting greater potential for water quality impacts from pollutant hot spot	0% = 0 pts; 1 to 10% = 3 pts; 11 to 50% = 5 pts; 51 to 100% = 7 pts, > 100 % = 10 pt

Table 10-1. Summary of Subwatershed Vulnerability Metrics

Subwatershed Metric	How Metric is Measured	Indicates Higher Vulnerability Potential When	Metric Points
6. Developable Forest Cover	% of subwatershed with developable forest cover	**Area of developable forest cover is high**, suggesting greater potential for future reductions in forested land	Add 1 pt for each 5% of developable forest cover
7. Stream Corridor Forest Cover and Public Ownership	% of stream corridor that is developable forest	**Stream corridor forest cover is high and public ownership within stream corridor is low**, suggesting greater potential for future reductions in vegetated riparian areas	Award 1 point for each 1% of stream corridor that is developable forest
8. Road Crossings	number of road crossings / square mile	**Number of road crossings is high**, suggesting greater potential for direct stormwater discharges from roadways	Add 3 pts for each stream crossing /sq mi

The results of the vulnerability analysis are summarized in *Table 10-2*. The overall subwatershed vulnerability scores range from 22 to 68 points out of a possible 80 points. The highlighting identifies subwatersheds with high (orange), moderate (yellow), and low (green) relative vulnerability in the North Branch Park River watershed.

Table 10-2. Results of Subwatershed Vulnerability Analysis

Subwatershed	Impervious Cover Change	Impervious Cover Threshold	Stream Order	Pollutant Loading	Commercial & Industrial Land Use Change	Developable Forest Cover	Stream Corridor Forest Cover and Public Ownership	Road Crossings	Total	Rank
Wash Brook North	9	5	10	5	10	7	7	9	**62**	**1**
Beaman Brook East	10	10	10	8	0	7	4	6	**55**	**2**
Wintonbury Reservoir	5	0	10	6	10	7	7	5	**50**	**3**
Blue Hills Reservoir	6	5	10	2	5	4	6	4	**42**	**4**
Filley Brook	1	5	10	1	5	5	5	6	**38**	**5**
Tumbledown Brook	7	5	5	1	0	4	3	10	**35**	**6**
Beaman Brook West	1	0	10	1	5	3	4	10	**34**	**7**
Cold Spring Reservoir	2	5	6	2	0	5	6	8	**34**	**8**
Wash Brook West	3	5	10	5	0	3	6	2	**34**	**9**

Table 10-2. Results of Subwatershed Vulnerability Analysis

Subwatershed	Impervious Cover Change	Impervious Cover Threshold	Stream Order	Pollutant Loading	Commercial & Industrial Land Use Change	Developable Forest Cover	Stream Corridor Forest Cover and Public Ownership	Road Crossings	Total	Rank
Tunxis Reservoir	1	5	6	2	3	3	7	4	**31**	**10**
Wash Brook South	3	0	3	2	3	5	4	10	**30**	**11**
West Hartford Reservoir	0	0	10	4	0	2	8	2	**26**	**12**
Tumbledown Brook South	1	0	6	3	0	2	4	9	**25**	**13**
North Branch Park River	2	0	2	1	5	4	4	6	**24**	**14**

As shown in *Table 10-2*, the following subwatersheds are considered most vulnerable to future development impacts and should be given higher priority for conservation efforts to maintain existing resource conditions:

- *Wash Brook North* – The Wash Brook North subwatershed is ranked as the most vulnerable subwatershed to future development. The subwatershed contains headwater streams (1st and 2nd order streams), which are important components of ecosystem health because they are a critical food source for the river, influence downstream conditions, and support biodiversity. The subwatershed is predicted to experience a significant increase in impervious cover from existing to future watershed conditions, with a large potential increase in commercial and industrial land uses. The percentage of developable forest cover in the subwatershed is moderate to high. There is also a high density of stream crossings in this watershed, which suggests a potential for increased stormwater runoff from roads as the subwatershed becomes more developed.

- *Beamans Brook East* – The Beamans Brook East subwatershed is the smallest subwatershed in land area, at only 163 acres. However, this subwatershed is predicted to experience significant land use changes under a buildout scenario. The majority of the subwatershed is within a "planned residential" zoning area and much of the existing land is forested. Impervious cover is predicted to increase by almost 50% under a future buildout scenario.

- *Wintonbury Reservoir* – The northern portion of the Wintonbury Reservoir subwatershed is currently undeveloped and is located in an area zoned for industrial use along Blue Hills Avenue (Route 187). Potential future development in this area is predicted to increase the amount of impervious cover and industrial land use in the subwatershed, while decreasing forest cover. The subwatershed contains a 1st order stream that flows through an area of potential industrial development, which may be impacted by these potential future changes in land cover and land use.

- *Blue Hills Reservoir* – The Blue Hills Reservoir subwatershed is adjacent to the Wintonbury Reservoir subwatershed. Similar to the Wintonbury Reservoir subwatershed, potential future development is anticipated along the industrial-zoned areas of the Route 187 corridor, resulting in the conversion of forest and open space to additional industrial land use. Therefore, the hydrology and water quality of the headwater streams in this subwatershed are vulnerable to future industrial development.

- *Filley Brook* –Filley Brook is a headwater (1st order) stream that joins Tumbledown Brook near the confluence with the North Branch Park River. Although there is a limited amount of developable land within the Filley Brook subwatershed, the remaining developable land is generally located along the Filley Brook stream corridor.

10.2 Priority Subwatersheds for Restoration

Ten metrics were used to evaluate each subwatershed for restoration potential, with a numerical value assigned for each metric based on the analyses presented in previous sections of this Baseline Watershed Assessment. *Table 10-3* presents the metrics used for determining the relative restoration potential of each subwatershed. Each metric was assigned a value of between 1 and 10, with 1 indicating the lowest restoration potential and 10 indicating the highest restoration potential. The scores for each of the metrics were then added to arrive at an overall score for each subwatershed. The total number of points possible for each subwatershed is 100.

Table 10-3. Summary of Subwatershed Restoration Potential Metrics

Subwatershed Metric	How Metric is Measured	Indicates Higher Restoration Potential When	Metric Points
1. Existing Impervious Cover	% impervious cover in subwatershed	**Current impervious cover is low**, suggesting range of possible sites for storage retrofits and stream repairs	< 10% = 10pts; 10 to 25% = 7 pts; 26 to 40 = 5 pts; 41 to 60% = 3 pts; > 60% = 1 pts
2. Forest Cover	% forest cover in subwatershed	**Forest cover is low**, suggesting greater potential for upland and riparian reforestation	< 20% = 10 pts; 21 to 30% = 7 pts; 31 to 40% = 5 pts; 41 to 60% = 3 pts, > 60 % = 1 pt
3. Subwatershed Development Potential	% of subwatershed that is developable	**The amount of potential future development is low,** suggesting stable conditions and greater potential for stream repairs and storage retrofits	Award 1 pt for each 10% percent below 100%

Table 10-3. Summary of Subwatershed Restoration Potential Metrics

Subwatershed Metric	How Metric is Measured	Indicates Higher Restoration Potential When	Metric Points
4. Publicly-owned land	% of subwatershed that is publicly owned	**Public land ownership is high**, providing range of potential sites for restoration practices	Award 1 pt for ea 2% in public ownership (up to 10 pts)
5. Single-family Residential Land	% of subwatershed residential land use	**Detached residential land is high**, suggesting greater potential for neighborhood source controls, on-site retrofits and upland forestry	Award 1 pt for each 5% single-family land use
6. Commercial Land	% of subwatershed commercial land use	**Commercial land use is high**, suggesting greater potential for source controls, discharge prevention, and on-site retrofits	Award 1 pt for each 2% of subwatershed classified as commercial land use
7. Stream Corridor Forest Cover and Public Ownership	% of stream corridor that is publicly-owned and not forested	**Stream corridor forest cover is low and public ownership within stream corridor is high,** suggesting greater potential for riparian reforestation, stream restoration, and storage retrofits	Award 2 pt for each 10% of stream corridor area
8. Stream Density	stream miles / square mile	**Stream density is high**, suggesting greater potential for stream corridor practices	Award 3 pts for each mile of stream/sq mi
9. Regulated Site Density	regulated sites / sq mi. (CTDEP General Permits)	**Regulated site density is high,** suggesting greater potential to implement source controls, discharge prevention and on-site retrofits	0 to 1 = 1 pt; 1 to 2 = 3 pts; 2 to 5 = 5 pts; 5 to 10 = 7 pts; > 10 = 10 pts
10. Road Crossings	crossings / stream mile	**Number of road crossings is high**, suggesting greater potential for stream and potential fish passage restoration	Award 3 pts for each road crossing /sq mi

The results of the subwatershed restoration potential analysis are summarized in *Table 10-4*. The restoration potential scores range from 31 to 63 points out of a possible 100 points. The highlighting identifies subwatersheds with high (orange), moderate (yellow), and low (green) relative restoration potential in the North Branch Park River watershed.

Table 10-4. Results of Subwatershed Restoration Potential Analysis

Subwatershed	Existing Impervious Cover	Forest Cover	Subwatershed Development Potential	Publicly-owned land	Single-family Residential Land	Commercial Land	Stream Corridor Forest Cover and Public Ownership	Stream Density	Regulated Site Density	Road Crossings	Total	Rank
Beamans Brook West	7	10	8	8	5	2	3	5	5	10	**63**	**1**
Tumbledown Brook	7	7	7	2	5	6	6	8	5	10	**63**	**1**
Filley Brook	7	10	8	2	9	6	1	6	7	6	**62**	**3**
North Branch Park River	5	10	8	7	5	3	6	4	7	6	**61**	**4**
Wash Brook South	7	7	7	2	7	5	1	8	7	10	**61**	**4**
Tumbledown Brook South	7	7	8	2	6	0	7	7	3	9	**56**	**6**
Wash Brook North	7	5	5	2	2	8	2	9	7	9	**56**	**6**
Blue Hills Reservoir	7	5	6	3	0	10	5	4	10	4	**54**	**8**
Cold Spring Reservoir	10	3	7	0	9	0	5	7	1	8	**50**	**9**
Wash Brook West	10	3	7	0	9	0	9	7	3	2	**50**	**9**
Tunxis Reservoir	10	3	7	1	5	3	3	4	5	4	**45**	**11**
Wintonbury Reservoir	7	5	6	0	3	4	5	3	7	5	**45**	**11**
Beamans Brook East	10	7	5	0	3	0	2	6	1	6	**40**	**13**
West Hartford Reservoir	10	1	8	1	1	0	2	5	1	2	**31**	**14**

As shown in *Table 10-4*, the following subwatersheds are considered to have the greatest restoration potential:

- *Beamans Brook West* – The Beamans Brook West subwatershed has a high percentage of developed land, impervious cover, and few remaining forested areas, suggesting a stable subwatershed with the potential for a variety of retrofits. Additionally, this subwatershed has a high percentage of publicly-owned land, thereby providing greater retrofit opportunities.

- *Tumbledown Brook* – The Tumbledown Brook subwatershed ranked moderate to high in many of the evaluation categories. The subwatershed has a high density of streams and road crossings, providing numerous opportunities for stream restoration, stormwater retrofits, and stream cleanups.

- *Filley Brook* – Filley Brook ranks among the subwatersheds with the greatest restoration potential in the North Branch Park River watershed. Forest cover in the subwatershed is low, suggesting the potential for upland and riparian reforestation practices. Single-family residential neighborhoods comprise a large percentage of the land use in the subwatershed, providing opportunities for neighborhood source controls and on-site residential retrofits. The subwatershed has a moderate to high density of streams, permitted commercial and industrial facilities, and road crossings which may provide a variety of potential restoration opportunities.

- *North Branch Park River* – The North Branch Park River subwatershed is highly developed with a mix of residential, commercial, institutional, and recreational uses. Despite the dense development in this subwatershed, there are publicly-owned undeveloped areas that are potentially suitable for restoration projects. The watershed has high visibility since the runoff drains directly to the North Branch Park River and it encompasses the urban areas of Hartford and West Harford.

- *Wash Brook South* – The Wash Brook South subwatershed has a high restoration potential since much of its land area is developed, with a high percentage of impervious cover and relatively little buildable land. The subwatershed also has a high stream density and numerous road crossings, which could yield potential opportunities for stormwater retrofits and stream restoration. Potential reforestation opportunities also exist along the stream corridor and in upland areas.

10.3 Subwatersheds Recommended for Field Assessments

The Comparative Subwatershed Analysis results were used to identify "priority subwatersheds" that are targeted for subsequent field assessments. The objective of the field assessments is to further evaluate subwatershed conditions and identify potential candidate restoration sites and opportunities. Based on the Comparative Subwatershed Analysis results, the priority subwatersheds include those subwatersheds that are ranked "high" in terms of potential vulnerability to future development or restoration potential. *Figure 10-1* depicts the resulting priority subwatersheds.

The following priority subwatersheds are therefore recommended for detailed field assessments, including stream corridor assessments, stream corridor restoration and recapture investigation, upland subwatershed site reconnaissance (neighborhood source assessment, hotspot confirmation, and streets and storm drain assessment), and upland stormwater retrofit inventories:

- Filley Brook
- Wash Brook North and South
- Beamans Brook East and West
- Tumbledown Brook
- North Branch Park River
- Blue Hills Reservoir
- Wintonberry Reservoir

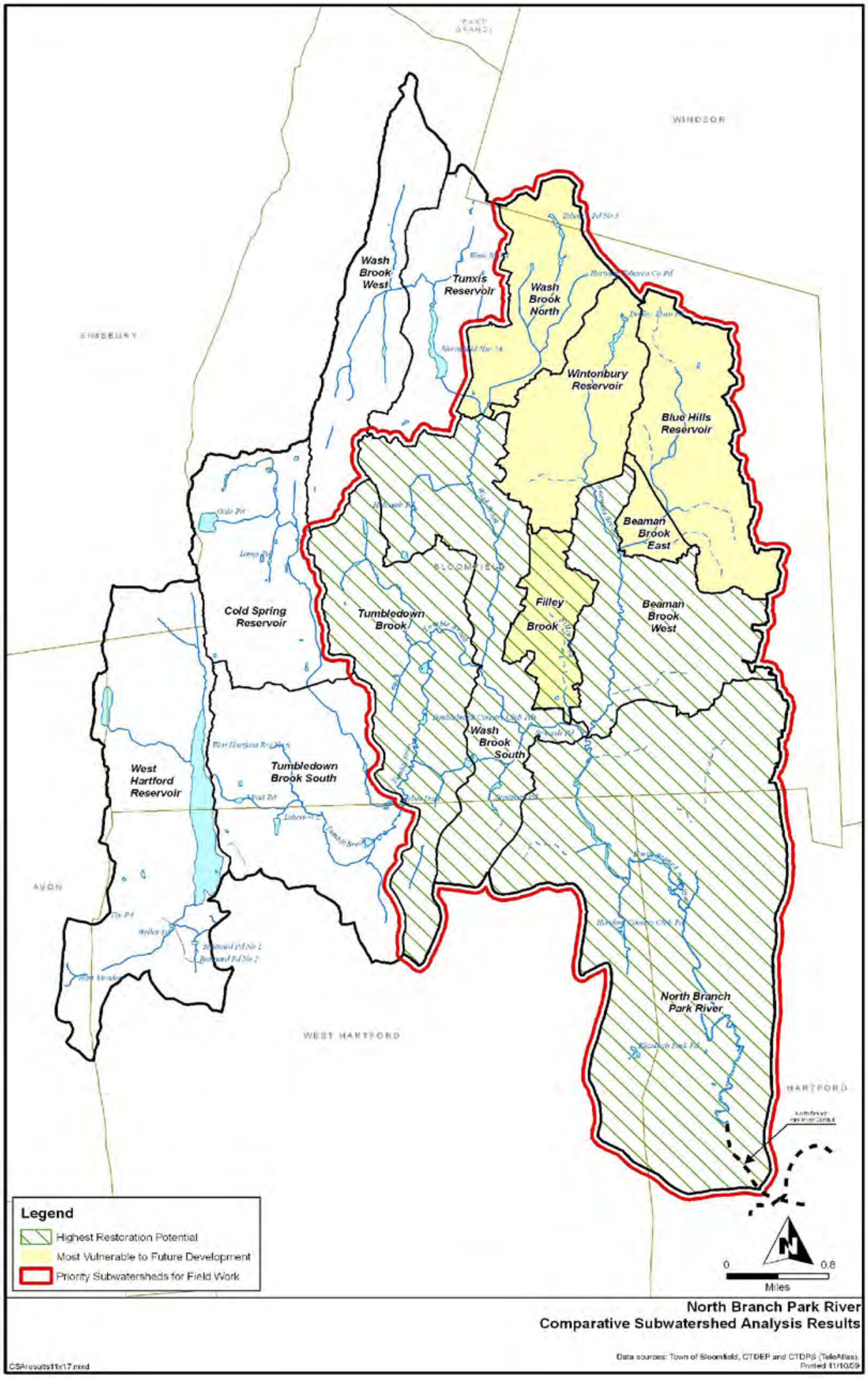


Figure 10-1. Priority Subwatersheds Based on Comparative Subwatershed Analysis

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FUSS & O'NEILL

Appendix A

Wetlands Field Assessment

NEW ENGLAND ENVIRONMENTAL, INC.
ENVIRONMENTAL CONSULTING SERVICES

October 8, 2009

Mr. Erik Mas, P.E.
Fuss and O'Neill Inc.
78 Interstate Drive
West Springfield, MA 01089

RE: Wetlands Assessment
North Branch Park River Watershed Evaluation
Bloomfield, Connecticut

Dear Mr. Mas:

New England Environmental, Inc. (NEE) completed an assessment of nine representative wetlands within the Park River watershed on September 14, 2009. This assessment was performed by Bruce Griffin, who is a Professional Wetland Scientist and a Certified Professional Soil Scientist. He was accompanied by Mary Rickel Pelletier, Project Director of the Park River Revitalization Initiative, at all the sites except the last, at Dudley Town Pond. Corps of Engineers Highway Method Wetland Function-Value Evaluation forms were completed for each wetland, and submitted previously. This report further describes conditions found at these sites, and compares them to the findings of the 1985 "Inland Wetlands of Bloomfield" report by Inwoods Environmental Consultants.

BLUE HILLS RESERVOIR

This assessment was limited to the southwestern portion of the Blue Hills reservoir. The reservoir lies within the watershed of the east branch of Beaman Brook. The 1985 report lumped into wetland #34 the reservoir, headwater wetlands upstream, and downstream wetlands leading to the main stem of Beaman Brook. Our assessment transect passed through wet meadow and marsh in the open southern end of the site, shrub habitat and a small stream walking north, a recreational field which contains large patches of mown wet meadow, a Red Maple swamp adjacent to another stream north of the field, mixed shrub/herbaceous and wetland/upland in a power line easement, and exited along the reservoir dike. The reservoir (which is not normally flooded) contains a mosaic of uplands as well as wetlands. As noted in the 1985 report, this is a diverse and rich habitat, protected as open space. Aside from ongoing maintenance of the recreational field and the power line corridors, and its function as flood control in extreme storm and meltwater events, it will remain a large unit of undisturbed habitat. The site contains multiple circles on the CTDEP Natural Diversity Data Base (NDDB) map. Although our transect did not run through any potential vernal pools, there is a possibility of their being found in wooded areas north and east of our route.

SCHOOL STREET – WHEELER PARK

Wheeler Park is located in a former agricultural field west of School Street. It is maintained in an open condition by seasonal mowing. It incorporates both wetland #30 and a portion of wetland #26 from the 1985 report. It was mown in late summer 2009, and this may be a consistent policy to preserve grassland bird breeding capacity. The mowing, grazing, and agricultural practices noted in 1985 are now eliminated or limited, improving the habitat functions and reducing erosional potential. Its park status and location adjacent to Bloomfield Middle School enhance its capacity to provide educational and recreational functions. Its groundwater and surface water quality functions remain important.

COPACO SHOPPING MALL

The wetlands assessed were a portion of the #4 wetlands in the 1985 report. The area we visited was located west of the shopping center parking lot and east of Goodman Street. Although much of this area was altered in the past and continues to be impacted by stormwater from the shopping center and other nearby impervious areas, a square-shaped wooded portion in the southeast corner remains relatively undisturbed. Open water and marsh dominate the northern end of this wetland. Four distinct vernal pools (breeding habitat not confirmed) are evident within the undisturbed woods. One of them held a small amount of water on September 14, while the other three were dry. Because of the large amount of water directed to these wetlands from developed areas, they provide important water quality functions.

CROYDON DRIVE

Croydon Drive runs along the northern border of West Hartford, and the wetlands are contained in the forested area north of the residential development along Croydon Drive and several other subdivision roads connecting to it. Much or all of the forested swamp designated as wetland #5 in the 1985 report is hydrologically isolated on the surface, and contains potential vernal pool habitat in isolated depressions. The 1985 assessment classified this area with low wildlife habitat function, due to the assessment matrix used, which did not take into account important connectivity and contextual qualities. The area is connected to a long stretch of the north branch of the Park River by relatively undisturbed forest, and contains tightly interspersed wetlands and uplands.

HOE POND

Hoe Pond is located on the border of Bloomfield and Avon, and is roughly bisected by the town line. It occupies an unusual place in the landscape for a pond, near the top of a stony ridge with steep slopes nearby on the west and east. It is not included in the 1985 report, but its outlet stream flows east from the Metacomet Ridge to MDC Reservoir #6. Hoe Pond is impounded by a dam at the south end, and its outlet flows intermittently though an extremely rocky channel to the east. Emergent wetlands along the shore are narrow. The pond and its shoreline are on private land, but this land is surrounded on three sides by Talcott Mountain State Park. The south end is covered by a habitat circle on the NDDB map.

CLIFFMONT OPEN SPACE

This small isolated wetland, #20 in the 1985 report, is within a pocket of open space in the middle of a mature residential development, and probably has changed very little since 1985. It is in a wooded depression with no outlet, and does not apparently hold standing water for an extended period. It has a groundwater recharge function, and provides limited wildlife habitat and educational/recreational opportunities within its residential setting.

SUNSET LANE AND VALLEY VIEW DRIVE

This is a wetland fragmented and altered by agricultural use (now reduced to a single corn field) and residential development. The 1985 report designated this as wetland #23, and noted a heavy sediment load from adjacent residential construction. While the corn field and surrounding residential neighborhoods continue to exert pressure on this wetland corridor, it remains a diverse system providing important functions, especially with respect to water quality. The main stream running through the middle of the corridor drains east to Wash Brook. We saw a marsh south of Sharon Lane, identified as a cat-tail marsh in 1985, which is now dominated by Common Reed (*Phragmites australis*) as seen from the road. North of Sharon Lane is a patchwork of Red Maple swamp, marsh, and shrub/scrub habitat. From the west end of Ryefield Hollow Drive, we walked to the bottom of the corn field on the west side of the stream, and observed extensive wetland vegetation in the bottom of the plowed field. We also walked to open water (a small pond west of Countryview Drive) past a wet meadow covered with Reed Canary-grass, and along an open stream channel bordered by Alders and other shrubs. From the end of Valley View Drive, we accessed the wooded swamp adjacent to the main stream as it turns east. There are some shallow potential vernal pools in this area, and also some trash and abandoned vehicles and equipment, as noted in the 1985 report. The northernmost section of woods, extending to Terry Plains Road, is within a circle on the NDBB map. We did not explore this portion of the system, which drains south toward the main stream.

ADAMS ROAD TO DUNCASTER HOLLOW

The wetland complex assessed in 2009 is within the northern, headwaters portion of a very large wetland system, #38 in the 1985 report. We assessed that portion which is north of Adams Road and south of Duncaster Hollow. This is a patchwork of old farm land in various stages of regeneration, from second growth forest to recently abandoned fields. From Adams Road, we walked through wet meadow, shallow marsh, and shrub/scrub patches. Among the diverse wetland vegetation, we noted a rare plant, Swamp Lousewort (*Pedicularis lanceolata*), which is listed as Threatened in Connecticut. A circle on the NDDB map touches the southwestern corner of the wetlands we assessed, where the plant was found. We also accessed this wetland along an old farm road which extends from Duncaster Road to Harvest Lane, which runs along the northern edge of a large open field, apparently farmed until recently. The eastern end of the field is dominated by wetland vegetation, and beyond the edge of the field is a wooded swamp. North of the old farm road is a dammed farm pond, surrounded by woods on three sides. As noted in 1985, this is a diverse, functionally rich wetland system.

DUDLEY TOWN POND

Dudley Town Pond lies at the top of the western branch of Beaman's Brook. Commercial and industrial development along Dudley Town Road borders it to the east. A very large warehouse complex was recently built to the northwest, and a large area which was previously forested to the west has now been cleared and is being regraded. Emergent wetlands extend out from the pond to the north and northwest. The pond and these wetlands are generally protected by a forested buffer in most places, but the pond is suffering from eutrophication. On September 14, it was almost completely covered with a thick, green, evil-smelling scum. Ducks were landing in the water at the northern end of the pond despite the algae, but the southern end was so solidly covered it looked like artificial turf. We walked through wooded swamp along the northwestern branch down to an open cat-tail marsh adjacent to the pond, and walked down through upland woods to the pond edge from an industrial parking lot behind one of the Dudley Town Road buildings. With the exception of the wetlands along the stream corridors to the north and northwest, the wetland fringe around the pond is narrow. The pond drains south toward the Wintonbury reservoir, and is included in 1985 wetland #35 along with the reservoir. The 1985 function sheet lists under upstream impacts, "direct runoff from surrounding industries into the pond." However, it does not mention eutrophication, and specifically mentions diverse wildlife use around the pond. It appears that there has been significant degradation since 1985.

We hope this information is useful in assessing the state of the North Branch watershed. The assessed wetlands range from completely isolated to fully integrated with watercourses, from small to large, from degraded to relatively pristine, and include the full range of wetland types, often in combination. If you have any questions regarding this report, please do not hesitate to contact us at our office.

Sincerely,
New England Environmental Inc.

Bruce Griffin, PWS
Senior Scientist

Wetland Function-Value Evaluation Form

Total area of wetland 2150 AC Human made? NO Is wetland part of a wildlife corridor? YES or a "habitat island"? ______

Adjacent land use RESIDENTIAL, COMMERCIAL, UNDEVELOPED Distance to nearest roadway or other development ADJACENT

Dominant wetland systems present FORESTED, SHALLOW MARSH Contiguous undeveloped buffer zone present IN PART

Is the wetland a separate hydraulic system? NO If not, where does the wetland lie in the drainage basin? UPPER PART (BEAMAN BROOK)

How many tributaries contribute to the wetland? 3 OR MORE Wildlife & vegetation diversity/abundance (see attached list)

Wetland I.D. BLUE HILLS RES. (PART OF 34)
Latitude ______ Longitude ______
Prepared by: BG Date 14 SEP 09
Wetland Impact: N/A
Type ______ Area ______

Evaluation based on:
Office ✓ Field ✓
Corps manual wetland delineation completed? Y ______ N ✓

Function/Value	Suitability Y	Suitability N	Rationale (Reference #)*	Principal Function(s)/Value(s)	Comments
Groundwater Recharge/Discharge	✓		4,5,7,9,12,15		
Floodflow Alteration	✓		2,3,5,6,8,9,10,11,12+	X	FLOOD CONTROL DIKE AT WESTERN MARGIN
Fish and Shellfish Habitat	✓		1,4,8,14,16,17		
Sediment/Toxicant Retention	✓		2,3,4,5,7,8,10,11,12,15+		
Nutrient Removal	✓		3,4,5,7,8,9,10,11,12,13,14		
Production Export	✓		1,2,4,5,7,8,10,11,12	X	
Sediment/Shoreline Stabilization	✓		2,4,7,9,12,13,14		
Wildlife Habitat	✓		3,4,6,8,9,10,15,17,19,20,21	X	
Recreation	✓		4,5,7,10,11,12,13*		* OPEN FIELD USED FOR FLYING MODEL PLANES
Educational/Scientific Value	✓		1,2,3,5,9,11,16		
Uniqueness/Heritage	✓		4,5,7,12,17,19,22,23		
Visual Quality/Aesthetics	✓		1,2,3,5,6,8,9,12		
ES Endangered Species Habitat	✓		1*		* ON CTDEP NDDB MAP (RARE SPP. + IMPORTANT NATURAL COMMUNITIES)
Other					

Notes:

* Refer to backup list of numbered considerations.

Wetland Function-Value Evaluation Form

Total area of wetland 27 AC Human made? NO Is wetland part of a wildlife corridor? YES or a "habitat island"? ______

Adjacent land use RESIDENTIAL + INSTITUTIONAL S+E, OPEN N+W Distance to nearest roadway or other development ABUTS SCHOOL ST.

Dominant wetland systems present WET MEADOW Contiguous undeveloped buffer zone present YES, N+W

Is the wetland a separate hydraulic system? NO If not, where does the wetland lie in the drainage basin? MIDDLE (LOWER BEAMAN BROOK)

How many tributaries contribute to the wetland? 1 OUTLET Wildlife & vegetation diversity/abundance (see attached list)

WHEELER PARK
Wetland I.D. SCHOOL ST. #30+26
Latitude ______ Longitude ______
Prepared by: BG Date 14SEP09
Wetland Impact: N/A
Type ______ Area ______

Evaluation based on:
Office ✓ Field ✓

Corps manual wetland delineation completed? Y ____ N ✓

Function/Value	Suitability Y	Suitability N	Rationale (Reference #)*	Principal Function(s)/Value(s)	Comments
Groundwater Recharge/Discharge	✓		5,7,10		
Floodflow Alteration	✓		5,6,9,10,11,12,18		
Fish and Shellfish Habitat		✓			
Sediment/Toxicant Retention	✓		3,4,7,8,13,16		
Nutrient Removal	✓		3,4,7,8,9,10,11,14	X	
Production Export	✓		1,2,7,10,12		
Sediment/Shoreline Stabilization	✓		2,5,7,12,13,15		
Wildlife Habitat	✓		3,6,7,8,13,21,23*	X	*SEASONAL MOWING FOR GRASSLAND BIRDS
Recreation	✓		1,4,10,11,12		
Educational/Scientific Value	✓		2,5,6,8,9,10,13	X	
Uniqueness/Heritage	✓		8,9,10,12,13,15,16,19+		
Visual Quality/Aesthetics	✓		1,4,5,7,8,9,11,12		
ES Endangered Species Habitat		✓			
Other					

Notes:

* Refer to backup list of numbered considerations.

Wetland Function-Value Evaluation Form

Total area of wetland 715 AC Human made? NO Is wetland part of a wildlife corridor? NO or a "habitat island"? YES

Adjacent land use ROADS + SHOPPING MALL + STORMWATER STRUCTURES Distance to nearest roadway or other development ADJACENT

Dominant wetland systems present FORESTED, DEEP MARSH Contiguous undeveloped buffer zone present NO

Is the wetland a separate hydraulic system? NO If not, where does the wetland lie in the drainage basin? MIDDLE (→ NORTH BRANCH)

How many tributaries contribute to the wetland? NONE Wildlife & vegetation diversity/abundance (see attached list)

Wetland I.D. COPACO TO GOODMAN ST. (PART OF #4)
Latitude ____ Longitude ____
Prepared by: BG Date 14 SEP 09
Wetland Impact: N/A
Type ____ Area ____

Evaluation based on:
Office ✓ Field ✓

Corps manual wetland delineation completed? Y ____ N ✓

Function/Value	Suitability Y	Suitability N	Rationale (Reference #)*	Principal Function(s)/Value(s)	Comments
Groundwater Recharge/Discharge	✓		5, 7, 15		
Floodflow Alteration	✓		3, 4, 5, 6, 7, 8, 9, 12, 18		
Fish and Shellfish Habitat		✓	17		
Sediment/Toxicant Retention	✓		1, 2, 3, 4, 5, 7, 8, 10, 12, 13+	X	MUCH STORMWATER PASSES THROUGH THIS WETLAND
Nutrient Removal	✓		2, 3, 5, 6, 7, 8, 9, 10, 14		
Production Export	✓		1, 2, 4, 7, 8, 10, 12		
Sediment/Shoreline Stabilization	✓		2, 3, 8, 9, 10, 12, 13		
Wildlife Habitat	✓		6, 7, 8, 10, 11, 18, 19, 20, 23	X	VERNAL POOLS WITHIN WOODED SWAMP
Recreation		✓	5, 10, 12		
Educational/Scientific Value	✓		3, 7, 8, 9, 14		
Uniqueness/Heritage	✓		1, 5, 6, 7, 8, 9, 12, 13		
Visual Quality/Aesthetics		✓	1, 2		EXTERNAL VIEWS POOR, INTERNALLY ATTRACTIVE
ES Endangered Species Habitat		✓			
Other					

Notes:

* Refer to backup list of numbered considerations.

Wetland Function-Value Evaluation Form

Total area of wetland > 10AC. Human made? NO Is wetland part of a wildlife corridor? YES or a "habitat island"? ____

Adjacent land use RESIDENTIAL S., UNDEVELOPED E,N,W Distance to nearest roadway or other development ADJACENT

Dominant wetland systems present WOODED SWAMP Contiguous undeveloped buffer zone present ON 3 SIDES

Is the wetland a separate hydraulic system? YES If not, where does the wetland lie in the drainage basin? ____

How many tributaries contribute to the wetland? NONE Wildlife & vegetation diversity/abundance (see attached list)

Wetland I.D. N. OF CROYDON DR. #5

Latitude ____ Longitude ____

Prepared by: BG Date 14SEP09

Wetland Impact: N/A
Type ____ Area ____

Evaluation based on:
Office ✓ Field ✓

Corps manual wetland delineation completed? Y ____ N ✓

Function/Value	Suitability Y	Suitability N	Rationale (Reference #)*	Principal Function(s)/Value(s)	Comments
Groundwater Recharge/Discharge	✓		5,9,15		OLD AGRICULTURAL DITCHES BETWEEN POOLS
Floodflow Alteration	✓		3,5,6,7,8,9,18		MAY HAVE NO OUTLET
Fish and Shellfish Habitat		✓	1		
Sediment/Toxicant Retention	✓		1,3,4,5,7,8		
Nutrient Removal	✓		1,3,4,5,7,8,9,10	X	
Production Export	✓		1,2,4,7,12,14		
Sediment/Shoreline Stabilization		✓			
Wildlife Habitat	✓		3,5,7,8,10,11,13,17,14	X	INCLUDES VERNAL POOLS
Recreation	✓		4,5,7		
Educational/Scientific Value	✓		2,5,13,14		
Uniqueness/Heritage	✓		5,6,10,16,19		
Visual Quality/Aesthetics	✓		3,7,8,9		
ES Endangered Species Habitat		✓			
Other					

Notes:

* Refer to backup list of numbered considerations.

Wetland Function-Value Evaluation Form

Total area of wetland 715 AC. Human made? YES Is wetland part of a wildlife corridor? YES or a "habitat island"? ______

Adjacent land use 2 RESIDENCES, MOSTLY FOREST Distance to nearest roadway or other development 100'

Dominant wetland systems present OPEN WATER Contiguous undeveloped buffer zone present MOSTLY

Is the wetland a separate hydraulic system? NO If not, where does the wetland lie in the drainage basin? HEADWATER

How many tributaries contribute to the wetland? NONE Wildlife & vegetation diversity/abundance (see attached list)

Wetland I.D. HOE POND

Latitude ______ Longitude ______

Prepared by: BG Date 14SEP09

Wetland Impact: N/A
Type ______ Area ______

Evaluation based on:
Office ✓ Field ✓

Corps manual wetland delineation completed? Y ____ N ✓

Function/Value	Suitability Y	Suitability N	Rationale (Reference #)*	Principal Function(s)/Value(s)	Comments
Groundwater Recharge/Discharge	✓		7, 9, 12		EVIDENCE OF FRACTURED BEDROCK NEARBY
Floodflow Alteration	✓		1, 2, 3, 7, 9, 15		DAM AT SOUTH END
Fish and Shellfish Habitat	✓		1, 9, 10		POND MAY SUPPORT FISH
Sediment/Toxicant Retention	✓		3, 5, 6, 8, 10, 12		
Nutrient Removal	✓		1, 2, 3, 5, 13		
Production Export	✓		1, 2, 4, 5, 12		
Sediment/Shoreline Stabilization	✓		10, 11, 12		
Wildlife Habitat	✓		1, 3, 4, 5, 6, 7, 8, 12, 19+	X	
Recreation	✓		5, 6, 7, 8		
Educational/Scientific Value	✓		1, 2, 5, 12, 14		
Uniqueness/Heritage	✓		3, 10, 14, 16, 17, 18, 19, 21+	X	
Visual Quality/Aesthetics	✓		2, 5, 6, 8, 9, 10, 11, 12		
ES Endangered Species Habitat	✓		1		SOUTH END ON CTDEP NDDB MAP
Other					

Notes:

* Refer to backup list of numbered considerations.

Wetland Function-Value Evaluation Form

#20

Total area of wetland ~35K ft² Human made? NO Is wetland part of a wildlife corridor? NO or a "habitat island"? YES

Adjacent land use RESIDENTIAL Distance to nearest roadway or other development ADJACENT LAWN

Dominant wetland systems present FORESTED SWAMP Contiguous undeveloped buffer zone present YES (SMALL)

Is the wetland a separate hydraulic system? YES If not, where does the wetland lie in the drainage basin? ______

How many tributaries contribute to the wetland? NONE Wildlife & vegetation diversity/abundance (see attached list)

Wetland I.D. CLIFFMONT/BURNWOOD
Latitude ______ Longitude ______
Prepared by: BG Date 14SEP09
Wetland Impact: N/A
Type ______ Area ______

Evaluation based on:
Office ✓ Field ✓

Corps manual wetland delineation completed? Y ____ N ✓

Function/Value	Suitability Y	Suitability N	Rationale (Reference #)*	Principal Function(s)/Value(s)	Comments
Groundwater Recharge/Discharge	✓		5, 15	X	
Floodflow Alteration	✓		3, 5, 6, 7, 8, 9		NO OUTLET
Fish and Shellfish Habitat		✓			
Sediment/Toxicant Retention	✓		3, 4, 5, 8, 9		
Nutrient Removal	✓		3, 4, 7, 8, 10		
Production Export	✓		1, 2, 4, 7, 12, 14		
Sediment/Shoreline Stabilization		✓			
Wildlife Habitat	✓		3, 8, 11, 17, 23		
Recreation	✓		4, 11, 12		
Educational/Scientific Value	✓		2, 7, 13		
Uniqueness/Heritage	✓		1, 5, 10, 16, 17, 19	X	SMALL WETLAND IN OPEN SPACE WITHIN SUBDIVISION
Visual Quality/Aesthetics	✓		7, 9, 10, 11, 12		
ES Endangered Species Habitat		✓			
Other					

Notes:

* Refer to backup list of numbered considerations.

Wetland Function-Value Evaluation Form

#23

Total area of wetland >50 AC. Human made? NO Is wetland part of a wildlife corridor? YES or a "habitat island"? ____

Adjacent land use AGRICULTURAL, RESIDENTIAL Distance to nearest roadway or other development ADJACENT

Dominant wetland systems present WOODED SWAMP, SHALLOW MARSH, SHRUB/SCRUB Contiguous undeveloped buffer zone present NO

Is the wetland a separate hydraulic system? NO If not, where does the wetland lie in the drainage basin? HEADWATER → WASH BROOK

How many tributaries contribute to the wetland? 3 Wildlife & vegetation diversity/abundance (see attached list)

Wetland I.D. SUNSET + VALLEY VIEW

Latitude ____ Longitude ____

Prepared by: BG Date 14 SEP 09

Wetland Impact: N/A

Type ____ Area ____

Evaluation based on:

Office ✓ Field ✓

Corps manual wetland delineation completed? Y ____ N ✓

Function/Value	Suitability Y	Suitability N	Rationale (Reference #)*	Principal Function(s)/Value(s)	Comments
Groundwater Recharge/Discharge	✓		3, 7, 15		
Floodflow Alteration	✓		2, 3, 4, 5, 6, 8, 9, 13, 18+		
Fish and Shellfish Habitat	✓		2, 4, 8, 10, 14, 17		
Sediment/Toxicant Retention	✓		1, 3, 4, 5, 7, 8, 10, 12, 14+		
Nutrient Removal	✓		2, 3, 4, 5, 7, 8, 9, 10, 11+	X	
Production Export	✓		1, 2, 4, 5, 6, 7, 8, 10, 12	X	
Sediment/Shoreline Stabilization	✓		1, 2, 3, 6, 7, 9, 10, 12, 13+		
Wildlife Habitat	✓		6, 7, 8, 9, 11, 13, 14, 15, 17+	X	
Recreation	✓		4, 5, 11, 12		
Educational/Scientific Value	✓		1, 3, 5, 7, 10, 12		
Uniqueness/Heritage	✓		4, 5, 6, 12, 13, 17, 19, 22+		
Visual Quality/Aesthetics	✓		1, 2, 3, 6, 9, 10		
ES Endangered Species Habitat	✓		1		ON CTDEP NDDB MAP
Other					

Notes:

* Refer to backup list of numbered considerations.

Wetland Function-Value Evaluation Form

Total area of wetland ~75 AC Human made? NO Is wetland part of a wildlife corridor? YES or a "habitat island"? ________

Adjacent land use FALLOW FIELD, RESIDENTIAL, FOREST Distance to nearest roadway or other development ADJACENT

Dominant wetland systems present FORESTED SWAMP, SHALLOW MARSH, SC/WB/SHWB Contiguous undeveloped buffer zone present IN PLACES

Is the wetland a separate hydraulic system? NO If not, where does the wetland lie in the drainage basin? HEADWATERS

How many tributaries contribute to the wetland? 3 OR MORE Wildlife & vegetation diversity/abundance (see attached list)

PART OF #38

Wetland I.D. ADAMS RD TO DUNCASTER HOLLOW

Latitude ________ Longitude ________

Prepared by: BG Date 14 SEP 09

Wetland Impact: N/A

Type ________ Area ________

Evaluation based on:

Office ✓ Field ✓

Corps manual wetland delineation completed? Y ____ N ✓

Function/Value	Suitability Y	Suitability N	Rationale (Reference #)*	Principal Function(s)/Value(s)	Comments
Groundwater Recharge/Discharge	✓		3,4,7,9,12	X	
Floodflow Alteration	✓		2,5,6,8,9,15		
Fish and Shellfish Habitat	✓		1,2,4,8,10,14,17		
Sediment/Toxicant Retention	✓		3,4,5,7,8,10,12,15,16		
Nutrient Removal	✓		1,2,3,4,5,6,7,8,9,10+	X	
Production Export	✓		1,2,4,5,6,7,8,10,12		
Sediment/Shoreline Stabilization	✓		1,2,3,4,6,7,9,10,12+		
Wildlife Habitat	✓		6,7,8,9,11,13,14,15,17+	X	
Recreation	✓		4,5,6,7,12		
Educational/Scientific Value	✓		1,2,3,4,5,11,12,13		
Uniqueness/Heritage	✓		4,5,6,7,10,11,12,13,14+		
Visual Quality/Aesthetics	✓		1,2,3,4,5,7,8,9,11		
ES Endangered Species Habitat	✓		1		SW CORNER ON CTDEP NDDB MAP, RARE PLANT FOUND
Other					

Notes:

*Refer to backup list of numbered considerations.

Wetland Function-Value Evaluation Form

TOP OF #35

Total area of wetland ~12 AC Human made? NO(?) Is wetland part of a wildlife corridor? YES or a "habitat island"? ______

Adjacent land use INDUSTRIAL, COMMERCIAL, OPEN Distance to nearest roadway or other development ADJACENT

Dominant wetland systems present OPEN WATER, MARSH, WOODED SWAMP Contiguous undeveloped buffer zone present IN PLACES

Is the wetland a separate hydraulic system? NO If not, where does the wetland lie in the drainage basin? HEADWATERS, BEAMAN'S BROOK

How many tributaries contribute to the wetland? ______ Wildlife & vegetation diversity/abundance (see attached list)

Wetland I.D. DUDLEY TOWN POND

Latitude ______ Longitude ______

Prepared by: BG Date 14 SEP 09

Wetland Impact: N/A

Type ______ Area ______

Evaluation based on:

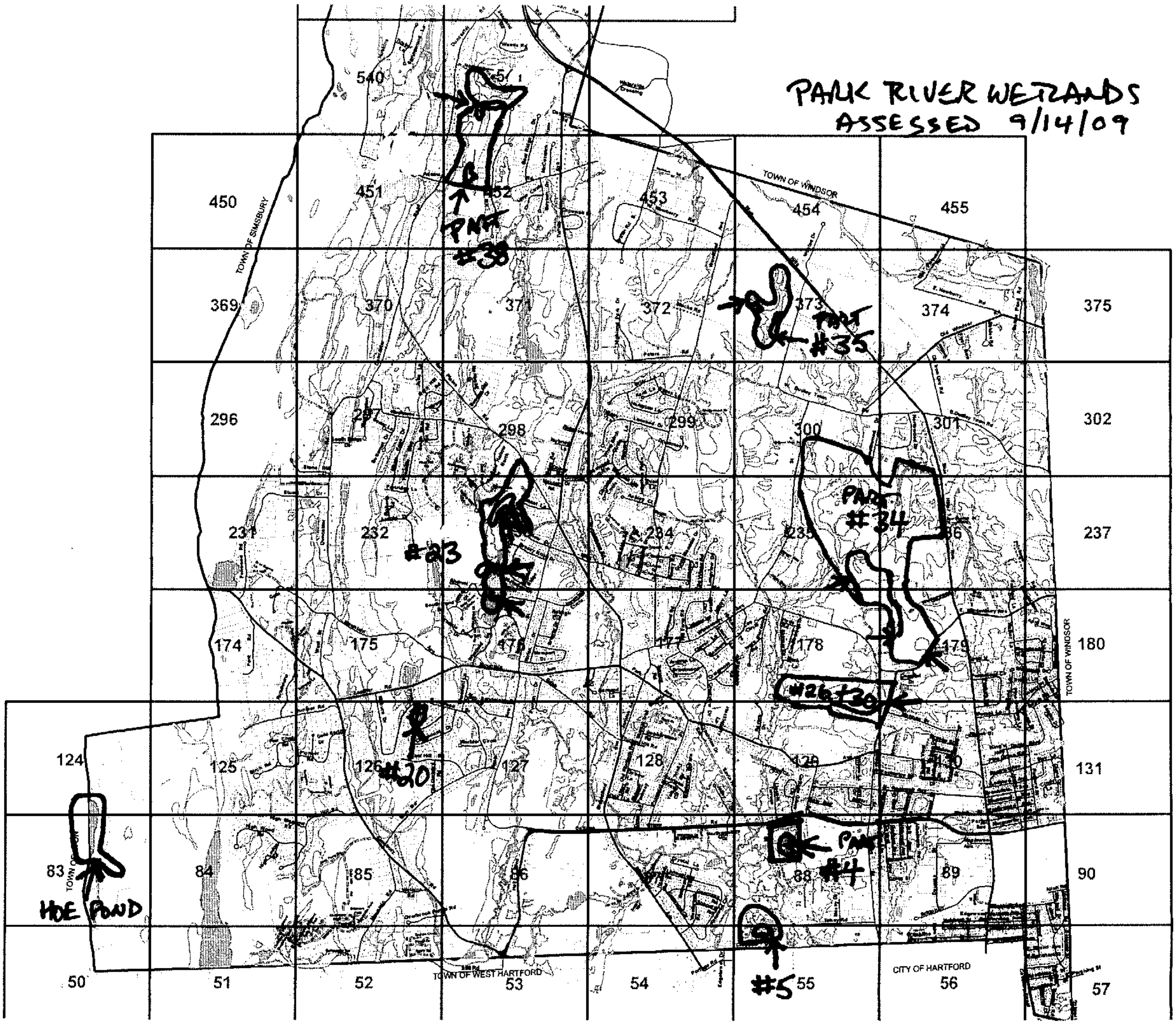
Office ✓ Field ✓

Corps manual wetland delineation completed? Y ______ N ✓

Function/Value	Suitability Y	Suitability N	Rationale (Reference #)*	Principal Function(s)/Value(s)	Comments
Groundwater Recharge/Discharge	✓		3, 4, 7		
Floodflow Alteration	✓		2, 3, 4, 5, 7, 8, 9, 15		
Fish and Shellfish Habitat		✓			EUTROPHICATION DAMAGES FISH HABITAT
Sediment/Toxicant Retention	✓		1, 2, 3, 4, 5, 8, 10, 12, 13+	X	
Nutrient Removal	✓		2, 3, 4, 5, 6, 7, 10	X	
Production Export	✓		1, 2, 4, 5, 10, 12		
Sediment/Shoreline Stabilization	✓		1, 3, 6, 12		
Wildlife Habitat	✓		6, 7, 8, 12, 17, 19, 20		EUTROPHICATION REDUCES VALUE
Recreation	✓		9		POTENTIAL FOR RECREATION, BUT WATER QUALITY LOW
Educational/Scientific Value	✓		1, 3, 8, 12, 14		
Uniqueness/Heritage	✓		2, 3, 4, 9, 12, 13, 14, 17+		
Visual Quality/Aesthetics	✓		1, 2, 5, 9, 12		
ES Endangered Species Habitat	✓		1		NORTHERN EDGE OF POND ON CTDEP NDDB MAP
Other					

Notes:

* Refer to backup list of numbered considerations.



PARK RIVER WETLANDS
ASSESSED 9/14/09
PARK #38
PARK #35
PARK #34
#23
#26+30
#20
PARK #4
HOE POND
#5
TOWN OF SIMSBURY
TOWN OF WINDSOR
TOWN OF WEST HARTFORD
CITY OF HARTFORD
540
450
451
452
453
454
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FUSS & O'NEILL

Appendix B

Species Lists

Bird Information from Jay Kaplan, Roaring Brook Nature Center (860) 693-0263

Here is a list of birds seen along the Park River in the area we previously discussed (Route 44 north to University of Hartford Magnet School) during the Hartford Summer Bird Count over the past two years (2008-2009). Please note this only indicates birds were observed, it does not mean they were confirmed as breeders at this location. The Summer Bird Count is held the second weekend in June. I will send the Christmas Count list shortly. The CBC is held in December and covers a much longer time frame. CBC birds would be considered either permanent residents, winter visitors, or lingering migrants that may have not yet moved southward for a variety of reasons.

Red-tailed Hawk
Mourning Dove
Red-bellied Woodpecker
Downy Woodpecker
N. Flicker
Barn Swallow
Blue Jay
American Crow
Black-capped Chickadee
Tufted Titmouse
White-breasted Nuthatch
Carolina Wren
House Wren
Wood Thrush
Amer. Robin
Gray Catbird
N. Mockingbird
Eurasian Starling
Cedar Waxwing
Yellow Warbler
Common Yellowthroat
Chipping Sparrow
Song Sparrow
N.Cardinal
Rose-breasted Grosbeak
Red-winged Blackbird
Common Grackle
Brown-headed Cowbird
Baltimore Oriole
House Finch
American Godlfinch
House Sparrow

Please find below those bird species found on the Hartford Christmas Bird Count in the previously discussed area of the Park River over the past 20 years or so. Those with asteriks (*) only reported on one or two occasions.

Canada Goose	fly-by
Mallard	
Bald Eagle*	fly-by
Sharp-shinned Hawk	
Cooper's Hawk	
Red-tailed Hawk	fly-by
Peregrine Falcon*	
Ring-necked Pheasant	not in recent years
Ring-billed Gull	fly-by
Herring Gull	fly-by
Mourning Dove	
Great Horned Owl	
Downy Woodpecker	
Northern Flicker	
Blue Jay	
American Crow	
Fish Crow	
Black-capped Chickadee	
Tufted Titmouse	
White-breasted Nuthatch	
Carolina Wren	
Winter Wren	
Ruby-crowned Kinglet*	
Eastern Bluebird	
American Robin	
Gray Catbird	
Northern Mockingbird	
Brown Thrasher*	
European Starling	
Cedar Waxwing	
Yellow-rumped Warbler	
American Tree Sparrow	
Field Sparrow	
Savannah Sparrow	
Fox Sparrow*	
Song Sparrow	

Swamp Sparrow
White-throated Sparrow
Dark-eyed Junco
Northern Cardinal
Baltimore Oriole
House Finch
American Goldfinch
House Sparrow

Status	Cell	Species Name
POSSIBLE	21F	Black-crowned Night-Heron
POSSIBLE	21F	American Kestrel
POSSIBLE	21F	Northern Rough-winged Swallow
POSSIBLE	21F	Yellow-throated Vireo
POSSIBLE	21F	Warbling Vireo
POSSIBLE	21F	Black-and-white Warbler
POSSIBLE	21F	American Redstart
PROBABLE	21F	Green-backed Heron
PROBABLE	21F	Broad-winged Hawk
PROBABLE	21F	Spotted Sandpiper
PROBABLE	21F	Rock Dove
PROBABLE	21F	Willow Flycatcher
PROBABLE	21F	Bank Swallow
PROBABLE	21F	Carolina Wren
PROBABLE	21F	Veery
PROBABLE	21F	Brown Thrasher
PROBABLE	21F	Cedar Waxwing
PROBABLE	21F	Blue-winged Warbler
PROBABLE	21F	Yellow Warbler
PROBABLE	21F	Pine Warbler
PROBABLE	21F	Prairie Warbler
PROBABLE	21F	Louisiana Waterthrush
PROBABLE	21F	Scarlet Tanager
PROBABLE	21F	Rufous-sided Towhee
PROBABLE	21F	Field Sparrow
PROBABLE	21F	Bobolink
PROBABLE	21F	Purple Finch
CONFIRMED	21F	Wood Duck
CONFIRMED	21F	Mallard
CONFIRMED	21F	Common Merganser
CONFIRMED	21F	Killdeer
CONFIRMED	21F	Mourning Dove
CONFIRMED	21F	Eastern Screech-Owl
CONFIRMED	21F	Chimney Swift
CONFIRMED	21F	Belted Kingfisher
CONFIRMED	21F	Red-bellied Woodpecker
CONFIRMED	21F	Downy Woodpecker
CONFIRMED	21F	Hairy Woodpecker
CONFIRMED	21F	Northern Flicker
CONFIRMED	21F	Pileated Woodpecker
CONFIRMED	21F	Eastern Wood-Pewee
CONFIRMED	21F	Eastern Phoebe
CONFIRMED	21F	Great Crested Flycatcher
CONFIRMED	21F	Eastern Kingbird
CONFIRMED	21F	Tree Swallow

Source:

Askins R., et al. The Atlas of Breeding Birds of Connecticut. Louis R. Bevier, Editor. Hartford: State Geological and Natural History Survey of Connecticut, Bulletin 113, 1994. Sponsored by the National Audubon Society and the Audubon of Connecticut.

The data was collected from 1982-1986.

CONFIRMED	21F	Cliff Swallow
CONFIRMED	21F	Barn Swallow
CONFIRMED	21F	Blue Jay
CONFIRMED	21F	American Crow
CONFIRMED	21F	Black-capped Chickadee
CONFIRMED	21F	Tufted Titmouse
CONFIRMED	21F	White-breasted Nuthatch
CONFIRMED	21F	House Wren
CONFIRMED	21F	Blue-gray Gnatcatcher
CONFIRMED	21F	Wood Thrush
CONFIRMED	21F	American Robin
CONFIRMED	21F	Gray Catbird
CONFIRMED	21F	Northern Mockingbird
CONFIRMED	21F	European Starling
CONFIRMED	21F	Red-eyed Vireo
CONFIRMED	21F	Chestnut-sided Warbler
CONFIRMED	21F	Ovenbird
CONFIRMED	21F	Common Yellowthroat
CONFIRMED	21F	Northern Cardinal
CONFIRMED	21F	Rose-breasted Grosbeak
CONFIRMED	21F	Indigo Bunting
CONFIRMED	21F	Chipping Sparrow
CONFIRMED	21F	Grasshopper Sparrow
CONFIRMED	21F	Song Sparrow
CONFIRMED	21F	Red-winged Blackbird
CONFIRMED	21F	Common Grackle
CONFIRMED	21F	Brown-headed Cowbird
CONFIRMED	21F	Northern Oriole
CONFIRMED	21F	House Finch
CONFIRMED	21F	American Goldfinch
CONFIRMED	21F	House Sparrow
POSSIBLE	22E	American Black Duck
POSSIBLE	22E	Great Horned Owl
POSSIBLE	22E	Barred Owl
POSSIBLE	22E	Brown-headed Cowbird
PROBABLE	22E	Red-tailed Hawk
PROBABLE	22E	American Kestrel
PROBABLE	22E	Rock Dove
PROBABLE	22E	Chimney Swift
PROBABLE	22E	Northern Flicker
PROBABLE	22E	Pileated Woodpecker
PROBABLE	22E	Willow Flycatcher
PROBABLE	22E	Bank Swallow
PROBABLE	22E	Red-breasted Nuthatch
PROBABLE	22E	Brown Creeper
PROBABLE	22E	Louisiana Waterthrush

PROBABLE	22E	Savannah Sparrow
CONFIRMED	22E	Green-backed Heron
CONFIRMED	22E	Wood Duck
CONFIRMED	22E	Mallard
CONFIRMED	22E	Ruffed Grouse
CONFIRMED	22E	Northern Bobwhite
CONFIRMED	22E	Mourning Dove
CONFIRMED	22E	Black-billed Cuckoo
CONFIRMED	22E	Yellow-billed Cuckoo
CONFIRMED	22E	Belted Kingfisher
CONFIRMED	22E	Downy Woodpecker
CONFIRMED	22E	Hairy Woodpecker
CONFIRMED	22E	Eastern Wood-Pewee
CONFIRMED	22E	Eastern Phoebe
CONFIRMED	22E	Great Crested Flycatcher
CONFIRMED	22E	Eastern Kingbird
CONFIRMED	22E	Barn Swallow
CONFIRMED	22E	Blue Jay
CONFIRMED	22E	American Crow
CONFIRMED	22E	Black-capped Chickadee
CONFIRMED	22E	Tufted Titmouse
CONFIRMED	22E	White-breasted Nuthatch
CONFIRMED	22E	House Wren
CONFIRMED	22E	Winter Wren
CONFIRMED	22E	Veery
CONFIRMED	22E	Hermit Thrush
CONFIRMED	22E	Wood Thrush
CONFIRMED	22E	American Robin
CONFIRMED	22E	Gray Catbird
CONFIRMED	22E	Northern Mockingbird
CONFIRMED	22E	Brown Thrasher
CONFIRMED	22E	Cedar Waxwing
CONFIRMED	22E	European Starling
CONFIRMED	22E	Warbling Vireo
CONFIRMED	22E	Red-eyed Vireo
CONFIRMED	22E	Blue-winged Warbler
CONFIRMED	22E	Yellow Warbler
CONFIRMED	22E	Prairie Warbler
CONFIRMED	22E	Black-and-white Warbler
CONFIRMED	22E	American Redstart
CONFIRMED	22E	Ovenbird
CONFIRMED	22E	Common Yellowthroat
CONFIRMED	22E	Scarlet Tanager
CONFIRMED	22E	Northern Cardinal
CONFIRMED	22E	Rose-breasted Grosbeak
CONFIRMED	22E	Indigo Bunting

CONFIRMED	22E	Rufous-sided Towhee
CONFIRMED	22E	Chipping Sparrow
CONFIRMED	22E	Field Sparrow
CONFIRMED	22E	Song Sparrow
CONFIRMED	22E	Red-winged Blackbird
CONFIRMED	22E	Common Grackle
CONFIRMED	22E	Orchard Oriole
CONFIRMED	22E	Northern Oriole
CONFIRMED	22E	House Finch
CONFIRMED	22E	American Goldfinch
CONFIRMED	22E	House Sparrow
POSSIBLE	36B	Green-backed Heron
POSSIBLE	36B	Pileated Woodpecker
POSSIBLE	36B	Common Grackle
POSSIBLE	36B	Brown-headed Cowbird
PROBABLE	36B	Red-bellied Woodpecker
PROBABLE	36B	Hairy Woodpecker
PROBABLE	36B	Great Crested Flycatcher
PROBABLE	36B	Brown Thrasher
PROBABLE	36B	Solitary Vireo
PROBABLE	36B	Red-eyed Vireo
PROBABLE	36B	Indigo Bunting
PROBABLE	36B	Rufous-sided Towhee
PROBABLE	36B	Field Sparrow
PROBABLE	36B	Swamp Sparrow
CONFIRMED	36B	Wood Duck
CONFIRMED	36B	Mallard
CONFIRMED	36B	Red-tailed Hawk
CONFIRMED	36B	Killdeer
CONFIRMED	36B	Rock Dove
CONFIRMED	36B	Mourning Dove
CONFIRMED	36B	Great Horned Owl
CONFIRMED	36B	Chimney Swift
CONFIRMED	36B	Belted Kingfisher
CONFIRMED	36B	Downy Woodpecker
CONFIRMED	36B	Northern Flicker
CONFIRMED	36B	Eastern Phoebe
CONFIRMED	36B	Eastern Kingbird
CONFIRMED	36B	Tree Swallow
CONFIRMED	36B	Barn Swallow
CONFIRMED	36B	Blue Jay
CONFIRMED	36B	American Crow
CONFIRMED	36B	Black-capped Chickadee
CONFIRMED	36B	Tufted Titmouse
CONFIRMED	36B	House Wren
CONFIRMED	36B	Veery

CONFIRMED	36B	Wood Thrush
CONFIRMED	36B	American Robin
CONFIRMED	36B	Gray Catbird
CONFIRMED	36B	Northern Mockingbird
CONFIRMED	36B	European Starling
CONFIRMED	36B	Warbling Vireo
CONFIRMED	36B	Blue-winged Warbler
CONFIRMED	36B	Yellow Warbler
CONFIRMED	36B	Prairie Warbler
CONFIRMED	36B	Black-and-white Warbler
CONFIRMED	36B	Common Yellowthroat
CONFIRMED	36B	Northern Cardinal
CONFIRMED	36B	Chipping Sparrow
CONFIRMED	36B	Song Sparrow
CONFIRMED	36B	Bobolink
CONFIRMED	36B	Red-winged Blackbird
CONFIRMED	36B	Eastern Meadowlark
CONFIRMED	36B	Northern Oriole
CONFIRMED	36B	House Finch
CONFIRMED	36B	American Goldfinch
CONFIRMED	36B	House Sparrow
POSSIBLE	36D	Green-backed Heron
POSSIBLE	36D	Ruffed Grouse
POSSIBLE	36D	Yellow-throated Vireo
POSSIBLE	36D	Prairie Warbler
POSSIBLE	36D	Louisiana Waterthrush
POSSIBLE	36D	Purple Finch
PROBABLE	36D	Broad-winged Hawk
PROBABLE	36D	Eastern Screech-Owl
PROBABLE	36D	Chimney Swift
PROBABLE	36D	Hairy Woodpecker
PROBABLE	36D	Pileated Woodpecker
PROBABLE	36D	Great Crested Flycatcher
PROBABLE	36D	White-breasted Nuthatch
PROBABLE	36D	House Wren
PROBABLE	36D	Veery
PROBABLE	36D	Scarlet Tanager
PROBABLE	36D	Indigo Bunting
CONFIRMED	36D	Canada Goose
CONFIRMED	36D	Mallard
CONFIRMED	36D	Northern Goshawk
CONFIRMED	36D	Red-tailed Hawk
CONFIRMED	36D	American Kestrel
CONFIRMED	36D	Killdeer
CONFIRMED	36D	Rock Dove
CONFIRMED	36D	Mourning Dove

CONFIRMED	36D	Great Horned Owl
CONFIRMED	36D	Barred Owl
CONFIRMED	36D	Belted Kingfisher
CONFIRMED	36D	Downy Woodpecker
CONFIRMED	36D	Northern Flicker
CONFIRMED	36D	Eastern Phoebe
CONFIRMED	36D	Eastern Kingbird
CONFIRMED	36D	Tree Swallow
CONFIRMED	36D	Barn Swallow
CONFIRMED	36D	Blue Jay
CONFIRMED	36D	American Crow
CONFIRMED	36D	Black-capped Chickadee
CONFIRMED	36D	Tufted Titmouse
CONFIRMED	36D	Blue-gray Gnatcatcher
CONFIRMED	36D	Wood Thrush
CONFIRMED	36D	American Robin
CONFIRMED	36D	Gray Catbird
CONFIRMED	36D	Northern Mockingbird
CONFIRMED	36D	Brown Thrasher
CONFIRMED	36D	Cedar Waxwing
CONFIRMED	36D	European Starling
CONFIRMED	36D	Solitary Vireo
CONFIRMED	36D	Warbling Vireo
CONFIRMED	36D	Red-eyed Vireo
CONFIRMED	36D	Blue-winged Warbler
CONFIRMED	36D	Yellow Warbler
CONFIRMED	36D	Black-and-white Warbler
CONFIRMED	36D	Worm-eating Warbler
CONFIRMED	36D	Ovenbird
CONFIRMED	36D	Common Yellowthroat
CONFIRMED	36D	Northern Cardinal
CONFIRMED	36D	Rose-breasted Grosbeak
CONFIRMED	36D	Rufous-sided Towhee
CONFIRMED	36D	Chipping Sparrow
CONFIRMED	36D	Field Sparrow
CONFIRMED	36D	Song Sparrow
CONFIRMED	36D	Dark-eyed Junco
CONFIRMED	36D	Red-winged Blackbird
CONFIRMED	36D	Common Grackle
CONFIRMED	36D	Brown-headed Cowbird
CONFIRMED	36D	Northern Oriole
CONFIRMED	36D	House Finch
CONFIRMED	36D	American Goldfinch
CONFIRMED	36D	House Sparrow
POSSIBLE	36F	Green-backed Heron
POSSIBLE	36F	American Black Duck

POSSIBLE	36F	Broad-winged Hawk
POSSIBLE	36F	Common Nighthawk
POSSIBLE	36F	Brown Creeper
POSSIBLE	36F	Savannah Sparrow
PROBABLE	36F	Spotted Sandpiper
PROBABLE	36F	Black-billed Cuckoo
PROBABLE	36F	Pileated Woodpecker
PROBABLE	36F	Eastern Wood-Pewee
PROBABLE	36F	Great Crested Flycatcher
PROBABLE	36F	Red-breasted Nuthatch
PROBABLE	36F	Blue-gray Gnatcatcher
PROBABLE	36F	Veery
PROBABLE	36F	Chestnut-sided Warbler
PROBABLE	36F	American Redstart
PROBABLE	36F	Worm-eating Warbler
PROBABLE	36F	Northern Waterthrush
PROBABLE	36F	Louisiana Waterthrush
PROBABLE	36F	Scarlet Tanager
PROBABLE	36F	Indigo Bunting
PROBABLE	36F	Field Sparrow
PROBABLE	36F	Swamp Sparrow
PROBABLE	36F	Bobolink
PROBABLE	36F	Eastern Meadowlark
CONFIRMED	36F	Canada Goose
CONFIRMED	36F	Wood Duck
CONFIRMED	36F	Mallard
CONFIRMED	36F	Red-tailed Hawk
CONFIRMED	36F	Ring-necked Pheasant
CONFIRMED	36F	Ruffed Grouse
CONFIRMED	36F	Killdeer
CONFIRMED	36F	American Woodcock
CONFIRMED	36F	Rock Dove
CONFIRMED	36F	Mourning Dove
CONFIRMED	36F	Eastern Screech-Owl
CONFIRMED	36F	Chimney Swift
CONFIRMED	36F	Belted Kingfisher
CONFIRMED	36F	Downy Woodpecker
CONFIRMED	36F	Hairy Woodpecker
CONFIRMED	36F	Northern Flicker
CONFIRMED	36F	Eastern Phoebe
CONFIRMED	36F	Eastern Kingbird
CONFIRMED	36F	Tree Swallow
CONFIRMED	36F	Barn Swallow
CONFIRMED	36F	Blue Jay
CONFIRMED	36F	American Crow
CONFIRMED	36F	Black-capped Chickadee

CONFIRMED	36F	Tufted Titmouse
CONFIRMED	36F	White-breasted Nuthatch
CONFIRMED	36F	House Wren
CONFIRMED	36F	Wood Thrush
CONFIRMED	36F	American Robin
CONFIRMED	36F	Gray Catbird
CONFIRMED	36F	Northern Mockingbird
CONFIRMED	36F	Brown Thrasher
CONFIRMED	36F	Cedar Waxwing
CONFIRMED	36F	European Starling
CONFIRMED	36F	Warbling Vireo
CONFIRMED	36F	Red-eyed Vireo
CONFIRMED	36F	Blue-winged Warbler
CONFIRMED	36F	Yellow Warbler
CONFIRMED	36F	Prairie Warbler
CONFIRMED	36F	Black-and-white Warbler
CONFIRMED	36F	Ovenbird
CONFIRMED	36F	Common Yellowthroat
CONFIRMED	36F	Northern Cardinal
CONFIRMED	36F	Rose-breasted Grosbeak
CONFIRMED	36F	Rufous-sided Towhee
CONFIRMED	36F	Chipping Sparrow
CONFIRMED	36F	Song Sparrow
CONFIRMED	36F	Red-winged Blackbird
CONFIRMED	36F	Common Grackle
CONFIRMED	36F	Brown-headed Cowbird
CONFIRMED	36F	Northern Oriole
CONFIRMED	36F	House Finch
CONFIRMED	36F	Pine Siskin
CONFIRMED	36F	American Goldfinch
CONFIRMED	36F	House Sparrow
POSSIBLE	37A	Green-backed Heron
POSSIBLE	37A	Canada Goose
POSSIBLE	37A	Chimney Swift
POSSIBLE	37A	Belted Kingfisher
POSSIBLE	37A	Eastern Phoebe
POSSIBLE	37A	Tree Swallow
POSSIBLE	37A	Scarlet Tanager
POSSIBLE	37A	Indigo Bunting
PROBABLE	37A	Downy Woodpecker
PROBABLE	37A	Eastern Kingbird
PROBABLE	37A	Black-capped Chickadee
PROBABLE	37A	White-breasted Nuthatch
PROBABLE	37A	Veery
PROBABLE	37A	Wood Thrush
PROBABLE	37A	Gray Catbird

PROBABLE	37A	Black-and-white Warbler
PROBABLE	37A	Rose-breasted Grosbeak
PROBABLE	37A	Rufous-sided Towhee
PROBABLE	37A	Chipping Sparrow
PROBABLE	37A	Swamp Sparrow
PROBABLE	37A	Eastern Meadowlark
PROBABLE	37A	Brown-headed Cowbird
PROBABLE	37A	Northern Oriole
CONFIRMED	37A	Wood Duck
CONFIRMED	37A	Mallard
CONFIRMED	37A	Common Merganser
CONFIRMED	37A	Red-tailed Hawk
CONFIRMED	37A	American Kestrel
CONFIRMED	37A	Virginia Rail
CONFIRMED	37A	Killdeer
CONFIRMED	37A	Rock Dove
CONFIRMED	37A	Mourning Dove
CONFIRMED	37A	Eastern Screech-Owl
CONFIRMED	37A	Great Horned Owl
CONFIRMED	37A	Northern Flicker
CONFIRMED	37A	Willow Flycatcher
CONFIRMED	37A	Great Crested Flycatcher
CONFIRMED	37A	Barn Swallow
CONFIRMED	37A	Blue Jay
CONFIRMED	37A	American Crow
CONFIRMED	37A	Tufted Titmouse
CONFIRMED	37A	House Wren
CONFIRMED	37A	American Robin
CONFIRMED	37A	Northern Mockingbird
CONFIRMED	37A	European Starling
CONFIRMED	37A	Blue-winged Warbler
CONFIRMED	37A	Yellow Warbler
CONFIRMED	37A	Chestnut-sided Warbler
CONFIRMED	37A	Ovenbird
CONFIRMED	37A	Common Yellowthroat
CONFIRMED	37A	Northern Cardinal
CONFIRMED	37A	Field Sparrow
CONFIRMED	37A	Song Sparrow
CONFIRMED	37A	Bobolink
CONFIRMED	37A	Red-winged Blackbird
CONFIRMED	37A	Common Grackle
CONFIRMED	37A	House Finch
CONFIRMED	37A	American Goldfinch
CONFIRMED	37A	House Sparrow
POSSIBLE	37C	Great Crested Flycatcher
POSSIBLE	37C	Warbling Vireo

POSSIBLE	37C	Red-eyed Vireo
POSSIBLE	37C	Scarlet Tanager
POSSIBLE	37C	Rufous-sided Towhee
PROBABLE	37C	Eastern Phoebe
PROBABLE	37C	Tufted Titmouse
PROBABLE	37C	Carolina Wren
PROBABLE	37C	Common Yellowthroat
PROBABLE	37C	American Goldfinch
CONFIRMED	37C	Mallard
CONFIRMED	37C	Broad-winged Hawk
CONFIRMED	37C	Ring-necked Pheasant
CONFIRMED	37C	Northern Bobwhite
CONFIRMED	37C	Killdeer
CONFIRMED	37C	Rock Dove
CONFIRMED	37C	Mourning Dove
CONFIRMED	37C	Chimney Swift
CONFIRMED	37C	Downy Woodpecker
CONFIRMED	37C	Northern Flicker
CONFIRMED	37C	Eastern Kingbird
CONFIRMED	37C	Tree Swallow
CONFIRMED	37C	Barn Swallow
CONFIRMED	37C	Blue Jay
CONFIRMED	37C	American Crow
CONFIRMED	37C	Black-capped Chickadee
CONFIRMED	37C	House Wren
CONFIRMED	37C	Wood Thrush
CONFIRMED	37C	American Robin
CONFIRMED	37C	Gray Catbird
CONFIRMED	37C	Northern Mockingbird
CONFIRMED	37C	Brown Thrasher
CONFIRMED	37C	European Starling
CONFIRMED	37C	Yellow Warbler
CONFIRMED	37C	Northern Cardinal
CONFIRMED	37C	Chipping Sparrow
CONFIRMED	37C	Song Sparrow
CONFIRMED	37C	Red-winged Blackbird
CONFIRMED	37C	Eastern Meadowlark
CONFIRMED	37C	Common Grackle
CONFIRMED	37C	Brown-headed Cowbird
CONFIRMED	37C	Northern Oriole
CONFIRMED	37C	House Finch
CONFIRMED	37C	House Sparrow
POSSIBLE	37E	Hairy Woodpecker
POSSIBLE	37E	Scarlet Tanager
PROBABLE	37E	Red-bellied Woodpecker
PROBABLE	37E	Eastern Wood-Pewee

PROBABLE	37E	Great Crested Flycatcher
PROBABLE	37E	Warbling Vireo
PROBABLE	37E	Red-eyed Vireo
PROBABLE	37E	American Goldfinch
CONFIRMED	37E	Mallard
CONFIRMED	37E	Ring-necked Pheasant
CONFIRMED	37E	Rock Dove
CONFIRMED	37E	Mourning Dove
CONFIRMED	37E	Eastern Screech-Owl
CONFIRMED	37E	Downy Woodpecker
CONFIRMED	37E	Northern Flicker
CONFIRMED	37E	Eastern Phoebe
CONFIRMED	37E	Eastern Kingbird
CONFIRMED	37E	Blue Jay
CONFIRMED	37E	American Crow
CONFIRMED	37E	Black-capped Chickadee
CONFIRMED	37E	Tufted Titmouse
CONFIRMED	37E	White-breasted Nuthatch
CONFIRMED	37E	House Wren
CONFIRMED	37E	Wood Thrush
CONFIRMED	37E	American Robin
CONFIRMED	37E	Gray Catbird
CONFIRMED	37E	Northern Mockingbird
CONFIRMED	37E	European Starling
CONFIRMED	37E	Yellow Warbler
CONFIRMED	37E	Common Yellowthroat
CONFIRMED	37E	Northern Cardinal
CONFIRMED	37E	Chipping Sparrow
CONFIRMED	37E	Song Sparrow
CONFIRMED	37E	Red-winged Blackbird
CONFIRMED	37E	Common Grackle
CONFIRMED	37E	Northern Oriole
CONFIRMED	37E	House Finch
CONFIRMED	37E	House Sparrow

Amphibian and reptile distributional records from the north branch of the Park River, Hartford County, Connecticut
August 27, 2009 - H.J. Gruner Field Notes

Common Name	Scientific Name	CT Rank	State	County	Town	Northern Branch Park River Watershed Sub-Basin
Four-toed salamander	Hemidactylium scutatum		CT	Hartford	Bloomfield	Cold Spring reservoir
Green frog	Lithobates clamitans		CT	Hartford	Bloomfield	Cold Spring reservoir
Northern spring peeper	Pseudacris crucifer		CT	Hartford	Bloomfield	Cold Spring reservoir
Wood frog	Lithobates sylvatica		CT	Hartford	Bloomfield	Cold Spring reservoir
Eastern garter snake	Thamnophis sirtalis		CT	Hartford	West Hartford	North Branch Park River
Northern brown snake	Storeria dekayi		CT	Hartford	West Hartford	North Branch Park River
Gray treefrog	Hyla versicolor		CT	Hartford	West Hartford	Tumbledown Brook
Eastern box turtle	Terrapene carolina	SC	CT	Hartford	West Hartford	Tumbledown Brook
American bullfrog	Lithobates catesbieanus		CT	Hartford	West Hartford	Tumbledown Brook South
Eastern painted turtle	Chrysemys picta		CT	Hartford	West Hartford	Tumbledown Brook South
Eastern American toad	Bufo americanus		CT	Hartford	West Hartford	Tumbledown Brook South
Eastern garter snake	Thamnophis sirtalis		CT	Hartford	West Hartford	Tumbledown Brook South
Eastern newt	Notophthalmus viridescens		CT	Hartford	West Hartford	Tumbledown Brook South
Eastern rat snake	Scotophis alleghanensis		CT	Hartford	West Hartford	Tumbledown Brook South
Eastern red-backed salamander	Plethodon cinereus		CT	Hartford	West Hartford	Tumbledown Brook South
Four-toed salamander	Hemidactylium scutatum		CT	Hartford	West Hartford	Tumbledown Brook South
Green frog	Lithobates clamitans		CT	Hartford	West Hartford	Tumbledown Brook South
Jefferson salamander	Ambystoma jeffersonianum	SC	CT	Hartford	West Hartford	Tumbledown Brook South
Marbled salamander	Ambystoma opacum		CT	Hartford	West Hartford	Tumbledown Brook South
Northern black racer	Coluber constrictor		CT	Hartford	West Hartford	Tumbledown Brook South
Northern dusky salamander	Desmognathus fuscus		CT	Hartford	West Hartford	Tumbledown Brook South
Northern ringneck snake	Diadophis punctatus edwardsii		CT	Hartford	West Hartford	Tumbledown Brook South
Northern spring peeper	Pseudacris crucifer		CT	Hartford	West Hartford	Tumbledown Brook South
Northern two-lined salamander	Eurycea bislineata		CT	Hartford	West Hartford	Tumbledown Brook South
Northern water snake	Nerodia sipedon		CT	Hartford	West Hartford	Tumbledown Brook South
Spotted turtle	Clemmys guttata		CT	Hartford	West Hartford	Tumbledown Brook South
Wood frog	Lithobates sylvatica		CT	Hartford	West Hartford	Tumbledown Brook South
American bullfrog	Lithobates catesbieanus		CT	Hartford	Bloomfield	Wash Brook West
American bullfrog	Lithobates catesbieanus		CT	Hartford	Bloomfield	Wash Brook West
Eastern newt	Notophthalmus viridescens		CT	Hartford	Bloomfield	Wash Brook West
Eastern ribbon snake	Thamnophis sauritus	SC	CT	Hartford	Bloomfield	Wash Brook West
Northern spring peeper	Pseudacris crucifer		CT	Hartford	Bloomfield	Wash Brook West
Pickerel frog	Lithobates palustris		CT	Hartford	Bloomfield	Wash Brook West
Spotted salamander	Ambystoma maculatum		CT	Hartford	Bloomfield	Wash Brook West
Wood frog	Lithobates sylvatica		CT	Hartford	Bloomfield	Wash Brook West
Common snapping turtle	Chelydra serpentina		CT	Hartford	West Hartford	West Hartford Reservoir
Eastern American toad	Bufo americanus		CT	Hartford	West Hartford	West Hartford Reservoir
Eastern newt	Notophthalmus viridescens		CT	Hartford	West Hartford	West Hartford Reservoir
Eastern red-backed salamander	Plethodon cinereus		CT	Hartford	West Hartford	West Hartford Reservoir
Four-toed salamander	Hemidactylium scutatum		CT	Hartford	West Hartford	West Hartford Reservoir
Green frog	Lithobates clamitans		CT	Hartford	West Hartford	West Hartford Reservoir
Marbled salamander	Ambystoma opacum		CT	Hartford	West Hartford	West Hartford Reservoir
Northern spring peeper	Pseudacris crucifer		CT	Hartford	West Hartford	West Hartford Reservoir
Smooth green snake	Liochlorophis vernalis	SC	CT	Hartford	West Hartford	West Hartford Reservoir
Spotted salamander	Ambystoma maculatum		CT	Hartford	West Hartford	West Hartford Reservoir
Eastern garter snake	Thamnophis sirtalis		CT	Hartford	Bloomfield	Wintonbury Reservoir
Eastern red-backed salamander	Plethodon cinereus		CT	Hartford	Bloomfield	Wintonbury Reservoir
Green frog	Lithobates clamitans		CT	Hartford	Bloomfield	Wintonbury Reservoir

FUSS & O'NEILL

Appendix C

CTDEP Water Quality Monitoring Results

Tripid	tripdate	run name	StreamName/FacilityName	sitenumber	basinid	proximity	landmark/facility name		Municipality	accession	parameterid
2893	10/8/2008	abm fall macros-2008	North Branch Park River		4404	at	Farmington Avenue (Route 4)	behind # 19 Woodland street	Hartford	080186-017	2
2893	10/8/2008	abm fall macros-2008	North Branch Park River		4404	at	Farmington Avenue (Route 4)	behind # 19 Woodland street	Hartford	080186-017	13
2893	10/8/2008	abm fall macros-2008	North Branch Park River		4404	at	Farmington Avenue (Route 4)	behind # 19 Woodland street	Hartford	080186-017	14
2893	10/8/2008	abm fall macros-2008	North Branch Park River		4404	at	Farmington Avenue (Route 4)	behind # 19 Woodland street	Hartford	080186-017	16
2893	10/8/2008	abm fall macros-2008	North Branch Park River		4404	at	Farmington Avenue (Route 4)	behind # 19 Woodland street	Hartford	080186-017	17
2893	10/8/2008	abm fall macros-2008	North Branch Park River		4404	at	Farmington Avenue (Route 4)	behind # 19 Woodland street	Hartford	080186-017	18
2893	10/8/2008	abm fall macros-2008	North Branch Park River		4404	at	Farmington Avenue (Route 4)	behind # 19 Woodland street	Hartford	080186-017	26
2893	10/8/2008	abm fall macros-2008	North Branch Park River		4404	at	Farmington Avenue (Route 4)	behind # 19 Woodland street	Hartford	080186-017	28
2893	10/8/2008	abm fall macros-2008	North Branch Park River		4404	at	Farmington Avenue (Route 4)	behind # 19 Woodland street	Hartford	080186-017	142
2893	10/8/2008	abm fall macros-2008	North Branch Park River		4404	at	Farmington Avenue (Route 4)	behind # 19 Woodland street	Hartford	080186-017	144
2893	10/8/2008	abm fall macros-2008	North Branch Park River		4404	at	Farmington Avenue (Route 4)	behind # 19 Woodland street	Hartford	080186-017	166
2893	10/8/2008	abm fall macros-2008	North Branch Park River		4404	at	Farmington Avenue (Route 4)	behind # 19 Woodland street	Hartford	080186-017	167
2893	10/8/2008	abm fall macros-2008	North Branch Park River		4404	at	Farmington Avenue (Route 4)	behind # 19 Woodland street	Hartford	080186-017	280
2893	10/8/2008	abm fall macros-2008	North Branch Park River		4404	at	Farmington Avenue (Route 4)	behind # 19 Woodland street	Hartford	080186-017	340
2893	10/8/2008	abm fall macros-2008	North Branch Park River		4404	at	Farmington Avenue (Route 4)	behind # 19 Woodland street	Hartford	080186-017	343
2893	10/8/2008	abm fall macros-2008	North Branch Park River		4404	at	Farmington Avenue (Route 4)	behind # 19 Woodland street	Hartford	080186-017	349
2893	10/8/2008	abm fall macros-2008	North Branch Park River		4404	at	Farmington Avenue (Route 4)	behind # 19 Woodland street	Hartford	080186-017	451
2893	10/8/2008	abm fall macros-2008	North Branch Park River		4404	at	Farmington Avenue (Route 4)	behind # 19 Woodland street	Hartford	080186-017	452
2885	9/22/2008	Hockanum River and Park River Nutrient-2008	North Branch Park River		4404	at	Farmington Avenue (Route 4)	behind # 19 Woodland street	Hartford	080159-006	2
2885	9/22/2008	Hockanum River and Park River Nutrient-2008	North Branch Park River		4404	at	Farmington Avenue (Route 4)	behind # 19 Woodland street	Hartford	080159-006	13
2885	9/22/2008	Hockanum River and Park River Nutrient-2008	North Branch Park River		4404	at	Farmington Avenue (Route 4)	behind # 19 Woodland street	Hartford	080159-006	14
2885	9/22/2008	Hockanum River and Park River Nutrient-2008	North Branch Park River		4404	at	Farmington Avenue (Route 4)	behind # 19 Woodland street	Hartford	080159-006	16
2885	9/22/2008	Hockanum River and Park River Nutrient-2008	North Branch Park River		4404	at	Farmington Avenue (Route 4)	behind # 19 Woodland street	Hartford	080159-006	17
2885	9/22/2008	Hockanum River and Park River Nutrient-2008	North Branch Park River		4404	at	Farmington Avenue (Route 4)	behind # 19 Woodland street	Hartford	080159-006	26
2885	9/22/2008	Hockanum River and Park River Nutrient-2008	North Branch Park River		4404	at	Farmington Avenue (Route 4)	behind # 19 Woodland street	Hartford	080159-006	28
2885	9/22/2008	Hockanum River and Park River Nutrient-2008	North Branch Park River		4404	at	Farmington Avenue (Route 4)	behind # 19 Woodland street	Hartford	080159-006	142
2885	9/22/2008	Hockanum River and Park River Nutrient-2008	North Branch Park River		4404	at	Farmington Avenue (Route 4)	behind # 19 Woodland street	Hartford	080159-006	166
2885	9/22/2008	Hockanum River and Park River Nutrient-2008	North Branch Park River		4404	at	Farmington Avenue (Route 4)	behind # 19 Woodland street	Hartford	080159-006	167
2885	9/22/2008	Hockanum River and Park River Nutrient-2008	North Branch Park River		4404	at	Farmington Avenue (Route 4)	behind # 19 Woodland street	Hartford	080159-006	196
2885	9/22/2008	Hockanum River and Park River Nutrient-2008	North Branch Park River		4404	at	Farmington Avenue (Route 4)	behind # 19 Woodland street	Hartford	080159-006	280
2885	9/22/2008	Hockanum River and Park River Nutrient-2008	North Branch Park River		4404	at	Farmington Avenue (Route 4)	behind # 19 Woodland street	Hartford	080159-006	340
2885	9/22/2008	Hockanum River and Park River Nutrient-2008	North Branch Park River		4404	at	Farmington Avenue (Route 4)	behind # 19 Woodland street	Hartford	080159-006	343
2885	9/22/2008	Hockanum River and Park River Nutrient-2008	North Branch Park River		4404	at	Farmington Avenue (Route 4)	behind # 19 Woodland street	Hartford	080159-006	349
2885	9/22/2008	Hockanum River and Park River Nutrient-2008	North Branch Park River		4404	at	Farmington Avenue (Route 4)	behind # 19 Woodland street	Hartford	080159-006	451
2885	9/22/2008	Hockanum River and Park River Nutrient-2008	North Branch Park River		4404	at	Farmington Avenue (Route 4)	behind # 19 Woodland street	Hartford	080159-006	452
2854	9/2/2008	Hockanum River and Park River Nutrient-2008	North Branch Park River		4404	at	Farmington Avenue (Route 4)	behind # 19 Woodland street	Hartford	080137-006	2
2854	9/2/2008	Hockanum River and Park River Nutrient-2008	North Branch Park River		4404	at	Farmington Avenue (Route 4)	behind # 19 Woodland street	Hartford	080137-006	13
2854	9/2/2008	Hockanum River and Park River Nutrient-2008	North Branch Park River		4404	at	Farmington Avenue (Route 4)	behind # 19 Woodland street	Hartford	080137-006	14
2854	9/2/2008	Hockanum River and Park River Nutrient-2008	North Branch Park River		4404	at	Farmington Avenue (Route 4)	behind # 19 Woodland street	Hartford	080137-006	17
2854	9/2/2008	Hockanum River and Park River Nutrient-2008	North Branch Park River		4404	at	Farmington Avenue (Route 4)	behind # 19 Woodland street	Hartford	080137-006	18
2854	9/2/2008	Hockanum River and Park River Nutrient-2008	North Branch Park River		4404	at	Farmington Avenue (Route 4)	behind # 19 Woodland street	Hartford	080137-006	26
2854	9/2/2008	Hockanum River and Park River Nutrient-2008	North Branch Park River		4404	at	Farmington Avenue (Route 4)	behind # 19 Woodland street	Hartford	080137-006	28
2854	9/2/2008	Hockanum River and Park River Nutrient-2008	North Branch Park River		4404	at	Farmington Avenue (Route 4)	behind # 19 Woodland street	Hartford	080137-006	142
2854	9/2/2008	Hockanum River and Park River Nutrient-2008	North Branch Park River		4404	at	Farmington Avenue (Route 4)	behind # 19 Woodland street	Hartford	080137-006	144
2854	9/2/2008	Hockanum River and Park River Nutrient-2008	North Branch Park River		4404	at	Farmington Avenue (Route 4)	behind # 19 Woodland street	Hartford	080137-006	166
2854	9/2/2008	Hockanum River and Park River Nutrient-2008	North Branch Park River		4404	at	Farmington Avenue (Route 4)	behind # 19 Woodland street	Hartford	080137-006	167
2854	9/2/2008	Hockanum River and Park River Nutrient-2008	North Branch Park River		4404	at	Farmington Avenue (Route 4)	behind # 19 Woodland street	Hartford	080137-006	281
2854	9/2/2008	Hockanum River and Park River Nutrient-2008	North Branch Park River		4404	at	Farmington Avenue (Route 4)	behind # 19 Woodland street	Hartford	080137-006	340
2854	9/2/2008	Hockanum River and Park River Nutrient-2008	North Branch Park River		4404	at	Farmington Avenue (Route 4)	behind # 19 Woodland street	Hartford	080137-006	343
2854	9/2/2008	Hockanum River and Park River Nutrient-2008	North Branch Park River		4404	at	Farmington Avenue (Route 4)	behind # 19 Woodland street	Hartford	080137-006	349
2854	9/2/2008	Hockanum River and Park River Nutrient-2008	North Branch Park River		4404	at	Farmington Avenue (Route 4)	behind # 19 Woodland street	Hartford	080137-006	451
2854	9/2/2008	Hockanum River and Park River Nutrient-2008	North Branch Park River		4404	at	Farmington Avenue (Route 4)	behind # 19 Woodland street	Hartford	080137-006	452
2854	9/2/2008	Hockanum River and Park River Nutrient-2008	North Branch Park River		4404	at	Farmington Avenue (Route 4)	behind # 19 Woodland street	Hartford	080137-006	549
2854	9/2/2008	Hockanum River and Park River Nutrient-2008	North Branch Park River		4404	at	Farmington Avenue (Route 4)	behind # 19 Woodland street	Hartford	8288587	182
2853	8/28/2008	Hockanum River and Park River Nutrient-2008	North Branch Park River		4404	at	Farmington Avenue (Route 4)	behind # 19 Woodland street	Hartford	080130-006	2
2853	8/28/2008	Hockanum River and Park River Nutrient-2008	North Branch Park River		4404	at	Farmington Avenue (Route 4)	behind # 19 Woodland street	Hartford	080130-006	13
2853	8/28/2008	Hockanum River and Park River Nutrient-2008	North Branch Park River		4404	at	Farmington Avenue (Route 4)	behind # 19 Woodland street	Hartford	080130-006	14

2853	8/28/2008	Hockanum River and Park River Nutrient-2008	North Branch Park River	4404	at	Farmington Avenue (Route 4)	behind # 19 Woodland street	Hartford	080130-006	17
2853	8/28/2008	Hockanum River and Park River Nutrient-2008	North Branch Park River	4404	at	Farmington Avenue (Route 4)	behind # 19 Woodland street	Hartford	080130-006	18
2853	8/28/2008	Hockanum River and Park River Nutrient-2008	North Branch Park River	4404	at	Farmington Avenue (Route 4)	behind # 19 Woodland street	Hartford	080130-006	26
2853	8/28/2008	Hockanum River and Park River Nutrient-2008	North Branch Park River	4404	at	Farmington Avenue (Route 4)	behind # 19 Woodland street	Hartford	080130-006	28
2853	8/28/2008	Hockanum River and Park River Nutrient-2008	North Branch Park River	4404	at	Farmington Avenue (Route 4)	behind # 19 Woodland street	Hartford	080130-006	142
2853	8/28/2008	Hockanum River and Park River Nutrient-2008	North Branch Park River	4404	at	Farmington Avenue (Route 4)	behind # 19 Woodland street	Hartford	080130-006	144
2853	8/28/2008	Hockanum River and Park River Nutrient-2008	North Branch Park River	4404	at	Farmington Avenue (Route 4)	behind # 19 Woodland street	Hartford	080130-006	166
2853	8/28/2008	Hockanum River and Park River Nutrient-2008	North Branch Park River	4404	at	Farmington Avenue (Route 4)	behind # 19 Woodland street	Hartford	080130-006	167
2853	8/28/2008	Hockanum River and Park River Nutrient-2008	North Branch Park River	4404	at	Farmington Avenue (Route 4)	behind # 19 Woodland street	Hartford	080130-006	281
2853	8/28/2008	Hockanum River and Park River Nutrient-2008	North Branch Park River	4404	at	Farmington Avenue (Route 4)	behind # 19 Woodland street	Hartford	080130-006	340
2853	8/28/2008	Hockanum River and Park River Nutrient-2008	North Branch Park River	4404	at	Farmington Avenue (Route 4)	behind # 19 Woodland street	Hartford	080130-006	343
2853	8/28/2008	Hockanum River and Park River Nutrient-2008	North Branch Park River	4404	at	Farmington Avenue (Route 4)	behind # 19 Woodland street	Hartford	080130-006	349
2853	8/28/2008	Hockanum River and Park River Nutrient-2008	North Branch Park River	4404	at	Farmington Avenue (Route 4)	behind # 19 Woodland street	Hartford	080130-006	451
2853	8/28/2008	Hockanum River and Park River Nutrient-2008	North Branch Park River	4404	at	Farmington Avenue (Route 4)	behind # 19 Woodland street	Hartford	080130-006	452
2853	8/28/2008	Hockanum River and Park River Nutrient-2008	North Branch Park River	4404	at	Farmington Avenue (Route 4)	behind # 19 Woodland street	Hartford	080130-006	549
2853	8/28/2008	Hockanum River and Park River Nutrient-2008	North Branch Park River	4404	at	Farmington Avenue (Route 4)	behind # 19 Woodland street	Hartford	8288535	182
2792	7/23/2008	Hockanum River and Park River Nutrient-2008	North Branch Park River	4404	at	Farmington Avenue (Route 4)	behind # 19 Woodland street	Hartford	8284725	182
2774	7/10/2008	Hockanum River and Park River Nutrient-2008	North Branch Park River	4404	at	Farmington Avenue (Route 4)	behind # 19 Woodland street	Hartford	080081-006	2
2774	7/10/2008	Hockanum River and Park River Nutrient-2008	North Branch Park River	4404	at	Farmington Avenue (Route 4)	behind # 19 Woodland street	Hartford	080081-006	13
2774	7/10/2008	Hockanum River and Park River Nutrient-2008	North Branch Park River	4404	at	Farmington Avenue (Route 4)	behind # 19 Woodland street	Hartford	080081-006	14
2774	7/10/2008	Hockanum River and Park River Nutrient-2008	North Branch Park River	4404	at	Farmington Avenue (Route 4)	behind # 19 Woodland street	Hartford	080081-006	16
2774	7/10/2008	Hockanum River and Park River Nutrient-2008	North Branch Park River	4404	at	Farmington Avenue (Route 4)	behind # 19 Woodland street	Hartford	080081-006	17
2774	7/10/2008	Hockanum River and Park River Nutrient-2008	North Branch Park River	4404	at	Farmington Avenue (Route 4)	behind # 19 Woodland street	Hartford	080081-006	18
2774	7/10/2008	Hockanum River and Park River Nutrient-2008	North Branch Park River	4404	at	Farmington Avenue (Route 4)	behind # 19 Woodland street	Hartford	080081-006	26
2774	7/10/2008	Hockanum River and Park River Nutrient-2008	North Branch Park River	4404	at	Farmington Avenue (Route 4)	behind # 19 Woodland street	Hartford	080081-006	28
2774	7/10/2008	Hockanum River and Park River Nutrient-2008	North Branch Park River	4404	at	Farmington Avenue (Route 4)	behind # 19 Woodland street	Hartford	080081-006	142
2774	7/10/2008	Hockanum River and Park River Nutrient-2008	North Branch Park River	4404	at	Farmington Avenue (Route 4)	behind # 19 Woodland street	Hartford	080081-006	144
2774	7/10/2008	Hockanum River and Park River Nutrient-2008	North Branch Park River	4404	at	Farmington Avenue (Route 4)	behind # 19 Woodland street	Hartford	080081-006	166
2774	7/10/2008	Hockanum River and Park River Nutrient-2008	North Branch Park River	4404	at	Farmington Avenue (Route 4)	behind # 19 Woodland street	Hartford	080081-006	167
2774	7/10/2008	Hockanum River and Park River Nutrient-2008	North Branch Park River	4404	at	Farmington Avenue (Route 4)	behind # 19 Woodland street	Hartford	080081-006	196
2774	7/10/2008	Hockanum River and Park River Nutrient-2008	North Branch Park River	4404	at	Farmington Avenue (Route 4)	behind # 19 Woodland street	Hartford	080081-006	280
2774	7/10/2008	Hockanum River and Park River Nutrient-2008	North Branch Park River	4404	at	Farmington Avenue (Route 4)	behind # 19 Woodland street	Hartford	080081-006	340
2774	7/10/2008	Hockanum River and Park River Nutrient-2008	North Branch Park River	4404	at	Farmington Avenue (Route 4)	behind # 19 Woodland street	Hartford	080081-006	343
2774	7/10/2008	Hockanum River and Park River Nutrient-2008	North Branch Park River	4404	at	Farmington Avenue (Route 4)	behind # 19 Woodland street	Hartford	080081-006	349
2774	7/10/2008	Hockanum River and Park River Nutrient-2008	North Branch Park River	4404	at	Farmington Avenue (Route 4)	behind # 19 Woodland street	Hartford	080081-006	451
2774	7/10/2008	Hockanum River and Park River Nutrient-2008	North Branch Park River	4404	at	Farmington Avenue (Route 4)	behind # 19 Woodland street	Hartford	080081-006	452
2774	7/10/2008	Hockanum River and Park River Nutrient-2008	North Branch Park River	4404	at	Farmington Avenue (Route 4)	behind # 19 Woodland street	Hartford	8283177	182
2755	7/1/2008	Hockanum River and Park River Nutrient-2008	North Branch Park River	4404	at	Farmington Avenue (Route 4)	behind # 19 Woodland street	Hartford	080070-006	2
2755	7/1/2008	Hockanum River and Park River Nutrient-2008	North Branch Park River	4404	at	Farmington Avenue (Route 4)	behind # 19 Woodland street	Hartford	080070-006	13
2755	7/1/2008	Hockanum River and Park River Nutrient-2008	North Branch Park River	4404	at	Farmington Avenue (Route 4)	behind # 19 Woodland street	Hartford	080070-006	14
2755	7/1/2008	Hockanum River and Park River Nutrient-2008	North Branch Park River	4404	at	Farmington Avenue (Route 4)	behind # 19 Woodland street	Hartford	080070-006	16
2755	7/1/2008	Hockanum River and Park River Nutrient-2008	North Branch Park River	4404	at	Farmington Avenue (Route 4)	behind # 19 Woodland street	Hartford	080070-006	17
2755	7/1/2008	Hockanum River and Park River Nutrient-2008	North Branch Park River	4404	at	Farmington Avenue (Route 4)	behind # 19 Woodland street	Hartford	080070-006	18
2755	7/1/2008	Hockanum River and Park River Nutrient-2008	North Branch Park River	4404	at	Farmington Avenue (Route 4)	behind # 19 Woodland street	Hartford	080070-006	26
2755	7/1/2008	Hockanum River and Park River Nutrient-2008	North Branch Park River	4404	at	Farmington Avenue (Route 4)	behind # 19 Woodland street	Hartford	080070-006	28
2755	7/1/2008	Hockanum River and Park River Nutrient-2008	North Branch Park River	4404	at	Farmington Avenue (Route 4)	behind # 19 Woodland street	Hartford	080070-006	142
2755	7/1/2008	Hockanum River and Park River Nutrient-2008	North Branch Park River	4404	at	Farmington Avenue (Route 4)	behind # 19 Woodland street	Hartford	080070-006	144
2755	7/1/2008	Hockanum River and Park River Nutrient-2008	North Branch Park River	4404	at	Farmington Avenue (Route 4)	behind # 19 Woodland street	Hartford	080070-006	166
2755	7/1/2008	Hockanum River and Park River Nutrient-2008	North Branch Park River	4404	at	Farmington Avenue (Route 4)	behind # 19 Woodland street	Hartford	080070-006	167
2755	7/1/2008	Hockanum River and Park River Nutrient-2008	North Branch Park River	4404	at	Farmington Avenue (Route 4)	behind # 19 Woodland street	Hartford	080070-006	196
2755	7/1/2008	Hockanum River and Park River Nutrient-2008	North Branch Park River	4404	at	Farmington Avenue (Route 4)	behind # 19 Woodland street	Hartford	080070-006	280
2755	7/1/2008	Hockanum River and Park River Nutrient-2008	North Branch Park River	4404	at	Farmington Avenue (Route 4)	behind # 19 Woodland street	Hartford	080070-006	340
2755	7/1/2008	Hockanum River and Park River Nutrient-2008	North Branch Park River	4404	at	Farmington Avenue (Route 4)	behind # 19 Woodland street	Hartford	080070-006	343
2755	7/1/2008	Hockanum River and Park River Nutrient-2008	North Branch Park River	4404	at	Farmington Avenue (Route 4)	behind # 19 Woodland street	Hartford	080070-006	349
2755	7/1/2008	Hockanum River and Park River Nutrient-2008	North Branch Park River	4404	at	Farmington Avenue (Route 4)	behind # 19 Woodland street	Hartford	080070-006	451
2755	7/1/2008	Hockanum River and Park River Nutrient-2008	North Branch Park River	4404	at	Farmington Avenue (Route 4)	behind # 19 Woodland street	Hartford	080070-006	452
2755	7/1/2008	Hockanum River and Park River Nutrient-2008	North Branch Park River	4404	at	Farmington Avenue (Route 4)	behind # 19 Woodland street	Hartford	8282155	182
2733	6/16/2008	Hockanum River and Park River Nutrient-2008	North Branch Park River	4404	at	Farmington Avenue (Route 4)	behind # 19 Woodland street	Hartford	080052-006	2

2733	6/16/2008	Hockanum River and Park River Nutrient-2008	North Branch Park River		4404	at	Farmington Avenue (Route 4)	behind # 19 Woodland street	Hartford	080052-006	13
2733	6/16/2008	Hockanum River and Park River Nutrient-2008	North Branch Park River		4404	at	Farmington Avenue (Route 4)	behind # 19 Woodland street	Hartford	080052-006	14
2733	6/16/2008	Hockanum River and Park River Nutrient-2008	North Branch Park River		4404	at	Farmington Avenue (Route 4)	behind # 19 Woodland street	Hartford	080052-006	16
2733	6/16/2008	Hockanum River and Park River Nutrient-2008	North Branch Park River		4404	at	Farmington Avenue (Route 4)	behind # 19 Woodland street	Hartford	080052-006	17
2733	6/16/2008	Hockanum River and Park River Nutrient-2008	North Branch Park River		4404	at	Farmington Avenue (Route 4)	behind # 19 Woodland street	Hartford	080052-006	18
2733	6/16/2008	Hockanum River and Park River Nutrient-2008	North Branch Park River		4404	at	Farmington Avenue (Route 4)	behind # 19 Woodland street	Hartford	080052-006	26
2733	6/16/2008	Hockanum River and Park River Nutrient-2008	North Branch Park River		4404	at	Farmington Avenue (Route 4)	behind # 19 Woodland street	Hartford	080052-006	28
2733	6/16/2008	Hockanum River and Park River Nutrient-2008	North Branch Park River		4404	at	Farmington Avenue (Route 4)	behind # 19 Woodland street	Hartford	080052-006	142
2733	6/16/2008	Hockanum River and Park River Nutrient-2008	North Branch Park River		4404	at	Farmington Avenue (Route 4)	behind # 19 Woodland street	Hartford	080052-006	144
2733	6/16/2008	Hockanum River and Park River Nutrient-2008	North Branch Park River		4404	at	Farmington Avenue (Route 4)	behind # 19 Woodland street	Hartford	080052-006	166
2733	6/16/2008	Hockanum River and Park River Nutrient-2008	North Branch Park River		4404	at	Farmington Avenue (Route 4)	behind # 19 Woodland street	Hartford	080052-006	167
2733	6/16/2008	Hockanum River and Park River Nutrient-2008	North Branch Park River		4404	at	Farmington Avenue (Route 4)	behind # 19 Woodland street	Hartford	080052-006	196
2733	6/16/2008	Hockanum River and Park River Nutrient-2008	North Branch Park River		4404	at	Farmington Avenue (Route 4)	behind # 19 Woodland street	Hartford	080052-006	280
2733	6/16/2008	Hockanum River and Park River Nutrient-2008	North Branch Park River		4404	at	Farmington Avenue (Route 4)	behind # 19 Woodland street	Hartford	080052-006	340
2733	6/16/2008	Hockanum River and Park River Nutrient-2008	North Branch Park River		4404	at	Farmington Avenue (Route 4)	behind # 19 Woodland street	Hartford	080052-006	343
2733	6/16/2008	Hockanum River and Park River Nutrient-2008	North Branch Park River		4404	at	Farmington Avenue (Route 4)	behind # 19 Woodland street	Hartford	080052-006	349
2733	6/16/2008	Hockanum River and Park River Nutrient-2008	North Branch Park River		4404	at	Farmington Avenue (Route 4)	behind # 19 Woodland street	Hartford	080052-006	451
2733	6/16/2008	Hockanum River and Park River Nutrient-2008	North Branch Park River		4404	at	Farmington Avenue (Route 4)	behind # 19 Woodland street	Hartford	080052-006	452
2733	6/16/2008	Hockanum River and Park River Nutrient-2008	North Branch Park River		4404	at	Farmington Avenue (Route 4)	behind # 19 Woodland street	Hartford	080052-006	549
2733	6/16/2008	Hockanum River and Park River Nutrient-2008	North Branch Park River		4404	at	Farmington Avenue (Route 4)	behind # 19 Woodland street	Hartford	080052-007	2
2733	6/16/2008	Hockanum River and Park River Nutrient-2008	North Branch Park River		4404	at	Farmington Avenue (Route 4)	behind # 19 Woodland street	Hartford	080052-007	13
2733	6/16/2008	Hockanum River and Park River Nutrient-2008	North Branch Park River		4404	at	Farmington Avenue (Route 4)	behind # 19 Woodland street	Hartford	080052-007	14
2733	6/16/2008	Hockanum River and Park River Nutrient-2008	North Branch Park River		4404	at	Farmington Avenue (Route 4)	behind # 19 Woodland street	Hartford	080052-007	16
2733	6/16/2008	Hockanum River and Park River Nutrient-2008	North Branch Park River		4404	at	Farmington Avenue (Route 4)	behind # 19 Woodland street	Hartford	080052-007	17
2733	6/16/2008	Hockanum River and Park River Nutrient-2008	North Branch Park River		4404	at	Farmington Avenue (Route 4)	behind # 19 Woodland street	Hartford	080052-007	18
2733	6/16/2008	Hockanum River and Park River Nutrient-2008	North Branch Park River		4404	at	Farmington Avenue (Route 4)	behind # 19 Woodland street	Hartford	080052-007	26
2733	6/16/2008	Hockanum River and Park River Nutrient-2008	North Branch Park River		4404	at	Farmington Avenue (Route 4)	behind # 19 Woodland street	Hartford	080052-007	28
2733	6/16/2008	Hockanum River and Park River Nutrient-2008	North Branch Park River		4404	at	Farmington Avenue (Route 4)	behind # 19 Woodland street	Hartford	080052-007	142
2733	6/16/2008	Hockanum River and Park River Nutrient-2008	North Branch Park River		4404	at	Farmington Avenue (Route 4)	behind # 19 Woodland street	Hartford	080052-007	144
2733	6/16/2008	Hockanum River and Park River Nutrient-2008	North Branch Park River		4404	at	Farmington Avenue (Route 4)	behind # 19 Woodland street	Hartford	080052-007	166
2733	6/16/2008	Hockanum River and Park River Nutrient-2008	North Branch Park River		4404	at	Farmington Avenue (Route 4)	behind # 19 Woodland street	Hartford	080052-007	167
2733	6/16/2008	Hockanum River and Park River Nutrient-2008	North Branch Park River		4404	at	Farmington Avenue (Route 4)	behind # 19 Woodland street	Hartford	080052-007	196
2733	6/16/2008	Hockanum River and Park River Nutrient-2008	North Branch Park River		4404	at	Farmington Avenue (Route 4)	behind # 19 Woodland street	Hartford	080052-007	280
2733	6/16/2008	Hockanum River and Park River Nutrient-2008	North Branch Park River		4404	at	Farmington Avenue (Route 4)	behind # 19 Woodland street	Hartford	080052-007	340
2733	6/16/2008	Hockanum River and Park River Nutrient-2008	North Branch Park River		4404	at	Farmington Avenue (Route 4)	behind # 19 Woodland street	Hartford	080052-007	343
2733	6/16/2008	Hockanum River and Park River Nutrient-2008	North Branch Park River		4404	at	Farmington Avenue (Route 4)	behind # 19 Woodland street	Hartford	080052-007	349
2733	6/16/2008	Hockanum River and Park River Nutrient-2008	North Branch Park River		4404	at	Farmington Avenue (Route 4)	behind # 19 Woodland street	Hartford	080052-007	451
2733	6/16/2008	Hockanum River and Park River Nutrient-2008	North Branch Park River		4404	at	Farmington Avenue (Route 4)	behind # 19 Woodland street	Hartford	080052-007	452
2733	6/16/2008	Hockanum River and Park River Nutrient-2008	North Branch Park River		4404	at	Farmington Avenue (Route 4)	behind # 19 Woodland street	Hartford	080052-007	549
2733	6/16/2008	Hockanum River and Park River Nutrient-2008	North Branch Park River		4404	at	Farmington Avenue (Route 4)	behind # 19 Woodland street	Hartford	8280737	182
2733	6/16/2008	Hockanum River and Park River Nutrient-2008	North Branch Park River		4404	at	Farmington Avenue (Route 4)	behind # 19 Woodland street	Hartford	8280738	182
2724	6/13/2008	ambient fish community sampling-2008	Wash Brook	111.01	4404		US Cottage Grove Road (Route 218)		Bloomfield	080054-005	2
2724	6/13/2008	ambient fish community sampling-2008	Wash Brook	111.01	4404		US Cottage Grove Road (Route 218)		Bloomfield	080054-005	13
2724	6/13/2008	ambient fish community sampling-2008	Wash Brook	111.01	4404		US Cottage Grove Road (Route 218)		Bloomfield	080054-005	14
2724	6/13/2008	ambient fish community sampling-2008	Wash Brook	111.01	4404		US Cottage Grove Road (Route 218)		Bloomfield	080054-005	16
2724	6/13/2008	ambient fish community sampling-2008	Wash Brook	111.01	4404		US Cottage Grove Road (Route 218)		Bloomfield	080054-005	17
2724	6/13/2008	ambient fish community sampling-2008	Wash Brook	111.01	4404		US Cottage Grove Road (Route 218)		Bloomfield	080054-005	18
2724	6/13/2008	ambient fish community sampling-2008	Wash Brook	111.01	4404		US Cottage Grove Road (Route 218)		Bloomfield	080054-005	26
2724	6/13/2008	ambient fish community sampling-2008	Wash Brook	111.01	4404		US Cottage Grove Road (Route 218)		Bloomfield	080054-005	28
2724	6/13/2008	ambient fish community sampling-2008	Wash Brook	111.01	4404		US Cottage Grove Road (Route 218)		Bloomfield	080054-005	142
2724	6/13/2008	ambient fish community sampling-2008	Wash Brook	111.01	4404		US Cottage Grove Road (Route 218)		Bloomfield	080054-005	144
2724	6/13/2008	ambient fish community sampling-2008	Wash Brook	111.01	4404		US Cottage Grove Road (Route 218)		Bloomfield	080054-005	166
2724	6/13/2008	ambient fish community sampling-2008	Wash Brook	111.01	4404		US Cottage Grove Road (Route 218)		Bloomfield	080054-005	167
2724	6/13/2008	ambient fish community sampling-2008	Wash Brook	111.01	4404		US Cottage Grove Road (Route 218)		Bloomfield	080054-005	280
2724	6/13/2008	ambient fish community sampling-2008	Wash Brook	111.01	4404		US Cottage Grove Road (Route 218)		Bloomfield	080054-005	340
2724	6/13/2008	ambient fish community sampling-2008	Wash Brook	111.01	4404		US Cottage Grove Road (Route 218)		Bloomfield	080054-005	343
2724	6/13/2008	ambient fish community sampling-2008	Wash Brook	111.01	4404		US Cottage Grove Road (Route 218)		Bloomfield	080054-005	349
2724	6/13/2008	ambient fish community sampling-2008	Wash Brook	111.01	4404		US Cottage Grove Road (Route 218)		Bloomfield	080054-005	350

2724	6/13/2008	ambient fish community sampling-2008	Wash Brook	111.01	4404		US Cottage Grove Road (Route 218)	Bloomfield	080054-005	351
2724	6/13/2008	ambient fish community sampling-2008	Wash Brook	111.01	4404		US Cottage Grove Road (Route 218)	Bloomfield	080054-005	451
2724	6/13/2008	ambient fish community sampling-2008	Wash Brook	111.01	4404		US Cottage Grove Road (Route 218)	Bloomfield	080054-005	452
2724	6/13/2008	ambient fish community sampling-2008	Wash Brook	111.01	4404		US Cottage Grove Road (Route 218)	Bloomfield	080054-005	549
150	9/27/1999	Quarterly Monitoring (Summer)	North Branch Park River	NPR1	4404	downstream	Albany Avenue	Hartford	22253171	1
150	9/27/1999	Quarterly Monitoring (Summer)	North Branch Park River	NPR1	4404	downstream	Albany Avenue	Hartford	22253171	2
150	9/27/1999	Quarterly Monitoring (Summer)	North Branch Park River	NPR1	4404	downstream	Albany Avenue	Hartford	22253171	3
150	9/27/1999	Quarterly Monitoring (Summer)	North Branch Park River	NPR1	4404	downstream	Albany Avenue	Hartford	22253171	4
150	9/27/1999	Quarterly Monitoring (Summer)	North Branch Park River	NPR1	4404	downstream	Albany Avenue	Hartford	22253171	12
150	9/27/1999	Quarterly Monitoring (Summer)	North Branch Park River	NPR1	4404	downstream	Albany Avenue	Hartford	22253171	13
150	9/27/1999	Quarterly Monitoring (Summer)	North Branch Park River	NPR1	4404	downstream	Albany Avenue	Hartford	22253171	14
150	9/27/1999	Quarterly Monitoring (Summer)	North Branch Park River	NPR1	4404	downstream	Albany Avenue	Hartford	22253171	15
150	9/27/1999	Quarterly Monitoring (Summer)	North Branch Park River	NPR1	4404	downstream	Albany Avenue	Hartford	22253171	16
150	9/27/1999	Quarterly Monitoring (Summer)	North Branch Park River	NPR1	4404	downstream	Albany Avenue	Hartford	22253171	17
150	9/27/1999	Quarterly Monitoring (Summer)	North Branch Park River	NPR1	4404	downstream	Albany Avenue	Hartford	22253171	18
150	9/27/1999	Quarterly Monitoring (Summer)	North Branch Park River	NPR1	4404	downstream	Albany Avenue	Hartford	22253171	19
150	9/27/1999	Quarterly Monitoring (Summer)	North Branch Park River	NPR1	4404	downstream	Albany Avenue	Hartford	22253171	20
150	9/27/1999	Quarterly Monitoring (Summer)	North Branch Park River	NPR1	4404	downstream	Albany Avenue	Hartford	22253171	21
150	9/27/1999	Quarterly Monitoring (Summer)	North Branch Park River	NPR1	4404	downstream	Albany Avenue	Hartford	22253171	22
150	9/27/1999	Quarterly Monitoring (Summer)	North Branch Park River	NPR1	4404	downstream	Albany Avenue	Hartford	22253171	24
150	9/27/1999	Quarterly Monitoring (Summer)	North Branch Park River	NPR1	4404	downstream	Albany Avenue	Hartford	22253171	25
150	9/27/1999	Quarterly Monitoring (Summer)	North Branch Park River	NPR1	4404	downstream	Albany Avenue	Hartford	22253171	26
150	9/27/1999	Quarterly Monitoring (Summer)	North Branch Park River	NPR1	4404	downstream	Albany Avenue	Hartford	22253171	27
150	9/27/1999	Quarterly Monitoring (Summer)	North Branch Park River	NPR1	4404	downstream	Albany Avenue	Hartford	22253171	28
150	9/27/1999	Quarterly Monitoring (Summer)	North Branch Park River	NPR1	4404	downstream	Albany Avenue	Hartford	22253171	30
150	9/27/1999	Quarterly Monitoring (Summer)	North Branch Park River	NPR1	4404	downstream	Albany Avenue	Hartford	22253171	31
150	9/27/1999	Quarterly Monitoring (Summer)	North Branch Park River	NPR1	4404	downstream	Albany Avenue	Hartford	22253190	5
150	9/27/1999	Quarterly Monitoring (Summer)	North Branch Park River	NPR1	4404	downstream	Albany Avenue	Hartford	22253190	6
150	9/27/1999	Quarterly Monitoring (Summer)	North Branch Park River	NPR1	4404	downstream	Albany Avenue	Hartford	22253190	7
150	9/27/1999	Quarterly Monitoring (Summer)	North Branch Park River	NPR1	4404	downstream	Albany Avenue	Hartford	22253190	8
150	9/27/1999	Quarterly Monitoring (Summer)	North Branch Park River	NPR1	4404	downstream	Albany Avenue	Hartford	22253190	9
150	9/27/1999	Quarterly Monitoring (Summer)	North Branch Park River	NPR1	4404	downstream	Albany Avenue	Hartford	22253190	10
150	9/27/1999	Quarterly Monitoring (Summer)	North Branch Park River	NPR1	4404	downstream	Albany Avenue	Hartford	22253190	11
150	9/27/1999	Quarterly Monitoring (Summer)	North Branch Park River	NPR1	4404	downstream	Albany Avenue	Hartford	22253190	29
150	9/27/1999	Quarterly Monitoring (Summer)	North Branch Park River	NPR1	4404	downstream	Albany Avenue	Hartford	8177221	180
150	9/27/1999	Quarterly Monitoring (Summer)	North Branch Park River	NPR1	4404	downstream	Albany Avenue	Hartford	8177221	181
150	9/27/1999	Quarterly Monitoring (Summer)	North Branch Park River	NPR1	4404	downstream	Albany Avenue	Hartford	8177221	182
150	9/27/1999	Quarterly Monitoring (Summer)	North Branch Park River	NPR2	4404	downstream	upper campus road at University of Hartford	Hartford	22253172	1
150	9/27/1999	Quarterly Monitoring (Summer)	North Branch Park River	NPR2	4404	downstream	upper campus road at University of Hartford	Hartford	22253172	2
150	9/27/1999	Quarterly Monitoring (Summer)	North Branch Park River	NPR2	4404	downstream	upper campus road at University of Hartford	Hartford	22253172	3
150	9/27/1999	Quarterly Monitoring (Summer)	North Branch Park River	NPR2	4404	downstream	upper campus road at University of Hartford	Hartford	22253172	4
150	9/27/1999	Quarterly Monitoring (Summer)	North Branch Park River	NPR2	4404	downstream	upper campus road at University of Hartford	Hartford	22253172	12
150	9/27/1999	Quarterly Monitoring (Summer)	North Branch Park River	NPR2	4404	downstream	upper campus road at University of Hartford	Hartford	22253172	13
150	9/27/1999	Quarterly Monitoring (Summer)	North Branch Park River	NPR2	4404	downstream	upper campus road at University of Hartford	Hartford	22253172	14
150	9/27/1999	Quarterly Monitoring (Summer)	North Branch Park River	NPR2	4404	downstream	upper campus road at University of Hartford	Hartford	22253172	15
150	9/27/1999	Quarterly Monitoring (Summer)	North Branch Park River	NPR2	4404	downstream	upper campus road at University of Hartford	Hartford	22253172	16
150	9/27/1999	Quarterly Monitoring (Summer)	North Branch Park River	NPR2	4404	downstream	upper campus road at University of Hartford	Hartford	22253172	17
150	9/27/1999	Quarterly Monitoring (Summer)	North Branch Park River	NPR2	4404	downstream	upper campus road at University of Hartford	Hartford	22253172	18
150	9/27/1999	Quarterly Monitoring (Summer)	North Branch Park River	NPR2	4404	downstream	upper campus road at University of Hartford	Hartford	22253172	19
150	9/27/1999	Quarterly Monitoring (Summer)	North Branch Park River	NPR2	4404	downstream	upper campus road at University of Hartford	Hartford	22253172	20
150	9/27/1999	Quarterly Monitoring (Summer)	North Branch Park River	NPR2	4404	downstream	upper campus road at University of Hartford	Hartford	22253172	21
150	9/27/1999	Quarterly Monitoring (Summer)	North Branch Park River	NPR2	4404	downstream	upper campus road at University of Hartford	Hartford	22253172	22
150	9/27/1999	Quarterly Monitoring (Summer)	North Branch Park River	NPR2	4404	downstream	upper campus road at University of Hartford	Hartford	22253172	24
150	9/27/1999	Quarterly Monitoring (Summer)	North Branch Park River	NPR2	4404	downstream	upper campus road at University of Hartford	Hartford	22253172	25
150	9/27/1999	Quarterly Monitoring (Summer)	North Branch Park River	NPR2	4404	downstream	upper campus road at University of Hartford	Hartford	22253172	26
150	9/27/1999	Quarterly Monitoring (Summer)	North Branch Park River	NPR2	4404	downstream	upper campus road at University of Hartford	Hartford	22253172	27
150	9/27/1999	Quarterly Monitoring (Summer)	North Branch Park River	NPR2	4404	downstream	upper campus road at University of Hartford	Hartford	22253172	28
150	9/27/1999	Quarterly Monitoring (Summer)	North Branch Park River	NPR2	4404	downstream	upper campus road at University of Hartford	Hartford	22253172	30

150	9/27/1999	Quarterly Monitoring (Summer)	North Branch Park River	NPR2	4404	downstream	upper campus road at University of Hartford	Hartford	22253172	31
150	9/27/1999	Quarterly Monitoring (Summer)	North Branch Park River	NPR2	4404	downstream	upper campus road at University of Hartford	Hartford	22253191	5
150	9/27/1999	Quarterly Monitoring (Summer)	North Branch Park River	NPR2	4404	downstream	upper campus road at University of Hartford	Hartford	22253191	6
150	9/27/1999	Quarterly Monitoring (Summer)	North Branch Park River	NPR2	4404	downstream	upper campus road at University of Hartford	Hartford	22253191	7
150	9/27/1999	Quarterly Monitoring (Summer)	North Branch Park River	NPR2	4404	downstream	upper campus road at University of Hartford	Hartford	22253191	8
150	9/27/1999	Quarterly Monitoring (Summer)	North Branch Park River	NPR2	4404	downstream	upper campus road at University of Hartford	Hartford	22253191	9
150	9/27/1999	Quarterly Monitoring (Summer)	North Branch Park River	NPR2	4404	downstream	upper campus road at University of Hartford	Hartford	22253191	10
150	9/27/1999	Quarterly Monitoring (Summer)	North Branch Park River	NPR2	4404	downstream	upper campus road at University of Hartford	Hartford	22253191	11
150	9/27/1999	Quarterly Monitoring (Summer)	North Branch Park River	NPR2	4404	downstream	upper campus road at University of Hartford	Hartford	22253191	29
150	9/27/1999	Quarterly Monitoring (Summer)	North Branch Park River	NPR2	4404	downstream	upper campus road at University of Hartford	Hartford	8177222	180
150	9/27/1999	Quarterly Monitoring (Summer)	North Branch Park River	NPR2	4404	downstream	upper campus road at University of Hartford	Hartford	8177222	181
150	9/27/1999	Quarterly Monitoring (Summer)	North Branch Park River	NPR2	4404	downstream	upper campus road at University of Hartford	Hartford	8177222	182
74	6/16/1999	Quarterly Monitoring (Spring)	North Branch Park River	NPR1	4404	downstream	Albany Avenue	Hartford	22248279	1
74	6/16/1999	Quarterly Monitoring (Spring)	North Branch Park River	NPR1	4404	downstream	Albany Avenue	Hartford	22248279	2
74	6/16/1999	Quarterly Monitoring (Spring)	North Branch Park River	NPR1	4404	downstream	Albany Avenue	Hartford	22248279	3
74	6/16/1999	Quarterly Monitoring (Spring)	North Branch Park River	NPR1	4404	downstream	Albany Avenue	Hartford	22248279	4
74	6/16/1999	Quarterly Monitoring (Spring)	North Branch Park River	NPR1	4404	downstream	Albany Avenue	Hartford	22248279	12
74	6/16/1999	Quarterly Monitoring (Spring)	North Branch Park River	NPR1	4404	downstream	Albany Avenue	Hartford	22248279	13
74	6/16/1999	Quarterly Monitoring (Spring)	North Branch Park River	NPR1	4404	downstream	Albany Avenue	Hartford	22248279	14
74	6/16/1999	Quarterly Monitoring (Spring)	North Branch Park River	NPR1	4404	downstream	Albany Avenue	Hartford	22248279	15
74	6/16/1999	Quarterly Monitoring (Spring)	North Branch Park River	NPR1	4404	downstream	Albany Avenue	Hartford	22248279	16
74	6/16/1999	Quarterly Monitoring (Spring)	North Branch Park River	NPR1	4404	downstream	Albany Avenue	Hartford	22248279	17
74	6/16/1999	Quarterly Monitoring (Spring)	North Branch Park River	NPR1	4404	downstream	Albany Avenue	Hartford	22248279	18
74	6/16/1999	Quarterly Monitoring (Spring)	North Branch Park River	NPR1	4404	downstream	Albany Avenue	Hartford	22248279	19
74	6/16/1999	Quarterly Monitoring (Spring)	North Branch Park River	NPR1	4404	downstream	Albany Avenue	Hartford	22248279	20
74	6/16/1999	Quarterly Monitoring (Spring)	North Branch Park River	NPR1	4404	downstream	Albany Avenue	Hartford	22248279	21
74	6/16/1999	Quarterly Monitoring (Spring)	North Branch Park River	NPR1	4404	downstream	Albany Avenue	Hartford	22248279	22
74	6/16/1999	Quarterly Monitoring (Spring)	North Branch Park River	NPR1	4404	downstream	Albany Avenue	Hartford	22248279	24
74	6/16/1999	Quarterly Monitoring (Spring)	North Branch Park River	NPR1	4404	downstream	Albany Avenue	Hartford	22248279	25
74	6/16/1999	Quarterly Monitoring (Spring)	North Branch Park River	NPR1	4404	downstream	Albany Avenue	Hartford	22248279	26
74	6/16/1999	Quarterly Monitoring (Spring)	North Branch Park River	NPR1	4404	downstream	Albany Avenue	Hartford	22248279	27
74	6/16/1999	Quarterly Monitoring (Spring)	North Branch Park River	NPR1	4404	downstream	Albany Avenue	Hartford	22248279	28
74	6/16/1999	Quarterly Monitoring (Spring)	North Branch Park River	NPR1	4404	downstream	Albany Avenue	Hartford	22248279	30
74	6/16/1999	Quarterly Monitoring (Spring)	North Branch Park River	NPR1	4404	downstream	Albany Avenue	Hartford	22248279	31
74	6/16/1999	Quarterly Monitoring (Spring)	North Branch Park River	NPR1	4404	downstream	Albany Avenue	Hartford	22248280	1
74	6/16/1999	Quarterly Monitoring (Spring)	North Branch Park River	NPR1	4404	downstream	Albany Avenue	Hartford	22248280	2
74	6/16/1999	Quarterly Monitoring (Spring)	North Branch Park River	NPR1	4404	downstream	Albany Avenue	Hartford	22248280	3
74	6/16/1999	Quarterly Monitoring (Spring)	North Branch Park River	NPR1	4404	downstream	Albany Avenue	Hartford	22248280	4
74	6/16/1999	Quarterly Monitoring (Spring)	North Branch Park River	NPR1	4404	downstream	Albany Avenue	Hartford	22248280	12
74	6/16/1999	Quarterly Monitoring (Spring)	North Branch Park River	NPR1	4404	downstream	Albany Avenue	Hartford	22248280	13
74	6/16/1999	Quarterly Monitoring (Spring)	North Branch Park River	NPR1	4404	downstream	Albany Avenue	Hartford	22248280	14
74	6/16/1999	Quarterly Monitoring (Spring)	North Branch Park River	NPR1	4404	downstream	Albany Avenue	Hartford	22248280	15
74	6/16/1999	Quarterly Monitoring (Spring)	North Branch Park River	NPR1	4404	downstream	Albany Avenue	Hartford	22248280	16
74	6/16/1999	Quarterly Monitoring (Spring)	North Branch Park River	NPR1	4404	downstream	Albany Avenue	Hartford	22248280	17
74	6/16/1999	Quarterly Monitoring (Spring)	North Branch Park River	NPR1	4404	downstream	Albany Avenue	Hartford	22248280	18
74	6/16/1999	Quarterly Monitoring (Spring)	North Branch Park River	NPR1	4404	downstream	Albany Avenue	Hartford	22248280	19
74	6/16/1999	Quarterly Monitoring (Spring)	North Branch Park River	NPR1	4404	downstream	Albany Avenue	Hartford	22248280	20
74	6/16/1999	Quarterly Monitoring (Spring)	North Branch Park River	NPR1	4404	downstream	Albany Avenue	Hartford	22248280	21
74	6/16/1999	Quarterly Monitoring (Spring)	North Branch Park River	NPR1	4404	downstream	Albany Avenue	Hartford	22248280	22
74	6/16/1999	Quarterly Monitoring (Spring)	North Branch Park River	NPR1	4404	downstream	Albany Avenue	Hartford	22248280	24
74	6/16/1999	Quarterly Monitoring (Spring)	North Branch Park River	NPR1	4404	downstream	Albany Avenue	Hartford	22248280	25
74	6/16/1999	Quarterly Monitoring (Spring)	North Branch Park River	NPR1	4404	downstream	Albany Avenue	Hartford	22248280	26
74	6/16/1999	Quarterly Monitoring (Spring)	North Branch Park River	NPR1	4404	downstream	Albany Avenue	Hartford	22248280	27
74	6/16/1999	Quarterly Monitoring (Spring)	North Branch Park River	NPR1	4404	downstream	Albany Avenue	Hartford	22248280	28
74	6/16/1999	Quarterly Monitoring (Spring)	North Branch Park River	NPR1	4404	downstream	Albany Avenue	Hartford	22248280	30
74	6/16/1999	Quarterly Monitoring (Spring)	North Branch Park River	NPR1	4404	downstream	Albany Avenue	Hartford	22248280	31
74	6/16/1999	Quarterly Monitoring (Spring)	North Branch Park River	NPR1	4404	downstream	Albany Avenue	Hartford	22248289	5
74	6/16/1999	Quarterly Monitoring (Spring)	North Branch Park River	NPR1	4404	downstream	Albany Avenue	Hartford	22248289	6

74	6/16/1999	Quarterly Monitoring (Spring)	North Branch Park River	NPR1	4404	downstream	Albany Avenue	Hartford	22248289	7
74	6/16/1999	Quarterly Monitoring (Spring)	North Branch Park River	NPR1	4404	downstream	Albany Avenue	Hartford	22248289	8
74	6/16/1999	Quarterly Monitoring (Spring)	North Branch Park River	NPR1	4404	downstream	Albany Avenue	Hartford	22248289	9
74	6/16/1999	Quarterly Monitoring (Spring)	North Branch Park River	NPR1	4404	downstream	Albany Avenue	Hartford	22248289	10
74	6/16/1999	Quarterly Monitoring (Spring)	North Branch Park River	NPR1	4404	downstream	Albany Avenue	Hartford	22248289	11
74	6/16/1999	Quarterly Monitoring (Spring)	North Branch Park River	NPR1	4404	downstream	Albany Avenue	Hartford	22248289	29
74	6/16/1999	Quarterly Monitoring (Spring)	North Branch Park River	NPR1	4404	downstream	Albany Avenue	Hartford	22248290	5
74	6/16/1999	Quarterly Monitoring (Spring)	North Branch Park River	NPR1	4404	downstream	Albany Avenue	Hartford	22248290	6
74	6/16/1999	Quarterly Monitoring (Spring)	North Branch Park River	NPR1	4404	downstream	Albany Avenue	Hartford	22248290	7
74	6/16/1999	Quarterly Monitoring (Spring)	North Branch Park River	NPR1	4404	downstream	Albany Avenue	Hartford	22248290	8
74	6/16/1999	Quarterly Monitoring (Spring)	North Branch Park River	NPR1	4404	downstream	Albany Avenue	Hartford	22248290	9
74	6/16/1999	Quarterly Monitoring (Spring)	North Branch Park River	NPR1	4404	downstream	Albany Avenue	Hartford	22248290	10
74	6/16/1999	Quarterly Monitoring (Spring)	North Branch Park River	NPR1	4404	downstream	Albany Avenue	Hartford	22248290	11
74	6/16/1999	Quarterly Monitoring (Spring)	North Branch Park River	NPR1	4404	downstream	Albany Avenue	Hartford	22248290	29
74	6/16/1999	Quarterly Monitoring (Spring)	North Branch Park River	NPR1	4404	downstream	Albany Avenue	Hartford	8171327	180
74	6/16/1999	Quarterly Monitoring (Spring)	North Branch Park River	NPR1	4404	downstream	Albany Avenue	Hartford	8171327	181
74	6/16/1999	Quarterly Monitoring (Spring)	North Branch Park River	NPR1	4404	downstream	Albany Avenue	Hartford	8171327	182
74	6/16/1999	Quarterly Monitoring (Spring)	North Branch Park River	NPR1	4404	downstream	Albany Avenue	Hartford	8171328	180
74	6/16/1999	Quarterly Monitoring (Spring)	North Branch Park River	NPR1	4404	downstream	Albany Avenue	Hartford	8171328	181
74	6/16/1999	Quarterly Monitoring (Spring)	North Branch Park River	NPR1	4404	downstream	Albany Avenue	Hartford	8171328	182
74	6/16/1999	Quarterly Monitoring (Spring)	North Branch Park River	NPR2	4404	downstream	upper campus road at University of Hartford	Hartford	22248278	1
74	6/16/1999	Quarterly Monitoring (Spring)	North Branch Park River	NPR2	4404	downstream	upper campus road at University of Hartford	Hartford	22248278	2
74	6/16/1999	Quarterly Monitoring (Spring)	North Branch Park River	NPR2	4404	downstream	upper campus road at University of Hartford	Hartford	22248278	3
74	6/16/1999	Quarterly Monitoring (Spring)	North Branch Park River	NPR2	4404	downstream	upper campus road at University of Hartford	Hartford	22248278	4
74	6/16/1999	Quarterly Monitoring (Spring)	North Branch Park River	NPR2	4404	downstream	upper campus road at University of Hartford	Hartford	22248278	12
74	6/16/1999	Quarterly Monitoring (Spring)	North Branch Park River	NPR2	4404	downstream	upper campus road at University of Hartford	Hartford	22248278	13
74	6/16/1999	Quarterly Monitoring (Spring)	North Branch Park River	NPR2	4404	downstream	upper campus road at University of Hartford	Hartford	22248278	14
74	6/16/1999	Quarterly Monitoring (Spring)	North Branch Park River	NPR2	4404	downstream	upper campus road at University of Hartford	Hartford	22248278	15
74	6/16/1999	Quarterly Monitoring (Spring)	North Branch Park River	NPR2	4404	downstream	upper campus road at University of Hartford	Hartford	22248278	16
74	6/16/1999	Quarterly Monitoring (Spring)	North Branch Park River	NPR2	4404	downstream	upper campus road at University of Hartford	Hartford	22248278	17
74	6/16/1999	Quarterly Monitoring (Spring)	North Branch Park River	NPR2	4404	downstream	upper campus road at University of Hartford	Hartford	22248278	18
74	6/16/1999	Quarterly Monitoring (Spring)	North Branch Park River	NPR2	4404	downstream	upper campus road at University of Hartford	Hartford	22248278	19
74	6/16/1999	Quarterly Monitoring (Spring)	North Branch Park River	NPR2	4404	downstream	upper campus road at University of Hartford	Hartford	22248278	20
74	6/16/1999	Quarterly Monitoring (Spring)	North Branch Park River	NPR2	4404	downstream	upper campus road at University of Hartford	Hartford	22248278	21
74	6/16/1999	Quarterly Monitoring (Spring)	North Branch Park River	NPR2	4404	downstream	upper campus road at University of Hartford	Hartford	22248278	22
74	6/16/1999	Quarterly Monitoring (Spring)	North Branch Park River	NPR2	4404	downstream	upper campus road at University of Hartford	Hartford	22248278	24
74	6/16/1999	Quarterly Monitoring (Spring)	North Branch Park River	NPR2	4404	downstream	upper campus road at University of Hartford	Hartford	22248278	25
74	6/16/1999	Quarterly Monitoring (Spring)	North Branch Park River	NPR2	4404	downstream	upper campus road at University of Hartford	Hartford	22248278	26
74	6/16/1999	Quarterly Monitoring (Spring)	North Branch Park River	NPR2	4404	downstream	upper campus road at University of Hartford	Hartford	22248278	27
74	6/16/1999	Quarterly Monitoring (Spring)	North Branch Park River	NPR2	4404	downstream	upper campus road at University of Hartford	Hartford	22248278	28
74	6/16/1999	Quarterly Monitoring (Spring)	North Branch Park River	NPR2	4404	downstream	upper campus road at University of Hartford	Hartford	22248278	30
74	6/16/1999	Quarterly Monitoring (Spring)	North Branch Park River	NPR2	4404	downstream	upper campus road at University of Hartford	Hartford	22248278	31
74	6/16/1999	Quarterly Monitoring (Spring)	North Branch Park River	NPR2	4404	downstream	upper campus road at University of Hartford	Hartford	22248288	5
74	6/16/1999	Quarterly Monitoring (Spring)	North Branch Park River	NPR2	4404	downstream	upper campus road at University of Hartford	Hartford	22248288	6
74	6/16/1999	Quarterly Monitoring (Spring)	North Branch Park River	NPR2	4404	downstream	upper campus road at University of Hartford	Hartford	22248288	7
74	6/16/1999	Quarterly Monitoring (Spring)	North Branch Park River	NPR2	4404	downstream	upper campus road at University of Hartford	Hartford	22248288	8
74	6/16/1999	Quarterly Monitoring (Spring)	North Branch Park River	NPR2	4404	downstream	upper campus road at University of Hartford	Hartford	22248288	9
74	6/16/1999	Quarterly Monitoring (Spring)	North Branch Park River	NPR2	4404	downstream	upper campus road at University of Hartford	Hartford	22248288	10
74	6/16/1999	Quarterly Monitoring (Spring)	North Branch Park River	NPR2	4404	downstream	upper campus road at University of Hartford	Hartford	22248288	11
74	6/16/1999	Quarterly Monitoring (Spring)	North Branch Park River	NPR2	4404	downstream	upper campus road at University of Hartford	Hartford	22248288	29
74	6/16/1999	Quarterly Monitoring (Spring)	North Branch Park River	NPR2	4404	downstream	upper campus road at University of Hartford	Hartford	8171326	180
74	6/16/1999	Quarterly Monitoring (Spring)	North Branch Park River	NPR2	4404	downstream	upper campus road at University of Hartford	Hartford	8171326	181
74	6/16/1999	Quarterly Monitoring (Spring)	North Branch Park River	NPR2	4404	downstream	upper campus road at University of Hartford	Hartford	8171326	182
29	3/30/1999	Quarterly Monitoring (Winter)	North Branch Park River	NPR1	4404	downstream	Albany Avenue	Hartford	22245018	1
29	3/30/1999	Quarterly Monitoring (Winter)	North Branch Park River	NPR1	4404	downstream	Albany Avenue	Hartford	22245018	2
29	3/30/1999	Quarterly Monitoring (Winter)	North Branch Park River	NPR1	4404	downstream	Albany Avenue	Hartford	22245018	3
29	3/30/1999	Quarterly Monitoring (Winter)	North Branch Park River	NPR1	4404	downstream	Albany Avenue	Hartford	22245018	4
29	3/30/1999	Quarterly Monitoring (Winter)	North Branch Park River	NPR1	4404	downstream	Albany Avenue	Hartford	22245018	12

29	3/30/1999	Quarterly Monitoring (Winter)	North Branch Park River	NPR1	4404	downstream	Albany Avenue	Hartford	22245018	13
29	3/30/1999	Quarterly Monitoring (Winter)	North Branch Park River	NPR1	4404	downstream	Albany Avenue	Hartford	22245018	14
29	3/30/1999	Quarterly Monitoring (Winter)	North Branch Park River	NPR1	4404	downstream	Albany Avenue	Hartford	22245018	15
29	3/30/1999	Quarterly Monitoring (Winter)	North Branch Park River	NPR1	4404	downstream	Albany Avenue	Hartford	22245018	16
29	3/30/1999	Quarterly Monitoring (Winter)	North Branch Park River	NPR1	4404	downstream	Albany Avenue	Hartford	22245018	17
29	3/30/1999	Quarterly Monitoring (Winter)	North Branch Park River	NPR1	4404	downstream	Albany Avenue	Hartford	22245018	18
29	3/30/1999	Quarterly Monitoring (Winter)	North Branch Park River	NPR1	4404	downstream	Albany Avenue	Hartford	22245018	19
29	3/30/1999	Quarterly Monitoring (Winter)	North Branch Park River	NPR1	4404	downstream	Albany Avenue	Hartford	22245018	20
29	3/30/1999	Quarterly Monitoring (Winter)	North Branch Park River	NPR1	4404	downstream	Albany Avenue	Hartford	22245018	21
29	3/30/1999	Quarterly Monitoring (Winter)	North Branch Park River	NPR1	4404	downstream	Albany Avenue	Hartford	22245018	22
29	3/30/1999	Quarterly Monitoring (Winter)	North Branch Park River	NPR1	4404	downstream	Albany Avenue	Hartford	22245018	24
29	3/30/1999	Quarterly Monitoring (Winter)	North Branch Park River	NPR1	4404	downstream	Albany Avenue	Hartford	22245018	25
29	3/30/1999	Quarterly Monitoring (Winter)	North Branch Park River	NPR1	4404	downstream	Albany Avenue	Hartford	22245018	26
29	3/30/1999	Quarterly Monitoring (Winter)	North Branch Park River	NPR1	4404	downstream	Albany Avenue	Hartford	22245018	27
29	3/30/1999	Quarterly Monitoring (Winter)	North Branch Park River	NPR1	4404	downstream	Albany Avenue	Hartford	22245018	28
29	3/30/1999	Quarterly Monitoring (Winter)	North Branch Park River	NPR1	4404	downstream	Albany Avenue	Hartford	22245018	30
29	3/30/1999	Quarterly Monitoring (Winter)	North Branch Park River	NPR1	4404	downstream	Albany Avenue	Hartford	22245030	5
29	3/30/1999	Quarterly Monitoring (Winter)	North Branch Park River	NPR1	4404	downstream	Albany Avenue	Hartford	22245030	6
29	3/30/1999	Quarterly Monitoring (Winter)	North Branch Park River	NPR1	4404	downstream	Albany Avenue	Hartford	22245030	7
29	3/30/1999	Quarterly Monitoring (Winter)	North Branch Park River	NPR1	4404	downstream	Albany Avenue	Hartford	22245030	8
29	3/30/1999	Quarterly Monitoring (Winter)	North Branch Park River	NPR1	4404	downstream	Albany Avenue	Hartford	22245030	9
29	3/30/1999	Quarterly Monitoring (Winter)	North Branch Park River	NPR1	4404	downstream	Albany Avenue	Hartford	22245030	10
29	3/30/1999	Quarterly Monitoring (Winter)	North Branch Park River	NPR1	4404	downstream	Albany Avenue	Hartford	22245030	11
29	3/30/1999	Quarterly Monitoring (Winter)	North Branch Park River	NPR1	4404	downstream	Albany Avenue	Hartford	8169192	180
29	3/30/1999	Quarterly Monitoring (Winter)	North Branch Park River	NPR1	4404	downstream	Albany Avenue	Hartford	8169192	181
29	3/30/1999	Quarterly Monitoring (Winter)	North Branch Park River	NPR1	4404	downstream	Albany Avenue	Hartford	8169192	182
29	3/30/1999	Quarterly Monitoring (Winter)	North Branch Park River	NPR2	4404	downstream	upper campus road at University of Hartford	Hartford	22245019	1
29	3/30/1999	Quarterly Monitoring (Winter)	North Branch Park River	NPR2	4404	downstream	upper campus road at University of Hartford	Hartford	22245019	2
29	3/30/1999	Quarterly Monitoring (Winter)	North Branch Park River	NPR2	4404	downstream	upper campus road at University of Hartford	Hartford	22245019	3
29	3/30/1999	Quarterly Monitoring (Winter)	North Branch Park River	NPR2	4404	downstream	upper campus road at University of Hartford	Hartford	22245019	4
29	3/30/1999	Quarterly Monitoring (Winter)	North Branch Park River	NPR2	4404	downstream	upper campus road at University of Hartford	Hartford	22245019	12
29	3/30/1999	Quarterly Monitoring (Winter)	North Branch Park River	NPR2	4404	downstream	upper campus road at University of Hartford	Hartford	22245019	13
29	3/30/1999	Quarterly Monitoring (Winter)	North Branch Park River	NPR2	4404	downstream	upper campus road at University of Hartford	Hartford	22245019	14
29	3/30/1999	Quarterly Monitoring (Winter)	North Branch Park River	NPR2	4404	downstream	upper campus road at University of Hartford	Hartford	22245019	15
29	3/30/1999	Quarterly Monitoring (Winter)	North Branch Park River	NPR2	4404	downstream	upper campus road at University of Hartford	Hartford	22245019	16
29	3/30/1999	Quarterly Monitoring (Winter)	North Branch Park River	NPR2	4404	downstream	upper campus road at University of Hartford	Hartford	22245019	17
29	3/30/1999	Quarterly Monitoring (Winter)	North Branch Park River	NPR2	4404	downstream	upper campus road at University of Hartford	Hartford	22245019	18
29	3/30/1999	Quarterly Monitoring (Winter)	North Branch Park River	NPR2	4404	downstream	upper campus road at University of Hartford	Hartford	22245019	19
29	3/30/1999	Quarterly Monitoring (Winter)	North Branch Park River	NPR2	4404	downstream	upper campus road at University of Hartford	Hartford	22245019	20
29	3/30/1999	Quarterly Monitoring (Winter)	North Branch Park River	NPR2	4404	downstream	upper campus road at University of Hartford	Hartford	22245019	21
29	3/30/1999	Quarterly Monitoring (Winter)	North Branch Park River	NPR2	4404	downstream	upper campus road at University of Hartford	Hartford	22245019	22
29	3/30/1999	Quarterly Monitoring (Winter)	North Branch Park River	NPR2	4404	downstream	upper campus road at University of Hartford	Hartford	22245019	24
29	3/30/1999	Quarterly Monitoring (Winter)	North Branch Park River	NPR2	4404	downstream	upper campus road at University of Hartford	Hartford	22245019	25
29	3/30/1999	Quarterly Monitoring (Winter)	North Branch Park River	NPR2	4404	downstream	upper campus road at University of Hartford	Hartford	22245019	26
29	3/30/1999	Quarterly Monitoring (Winter)	North Branch Park River	NPR2	4404	downstream	upper campus road at University of Hartford	Hartford	22245019	27
29	3/30/1999	Quarterly Monitoring (Winter)	North Branch Park River	NPR2	4404	downstream	upper campus road at University of Hartford	Hartford	22245019	28
29	3/30/1999	Quarterly Monitoring (Winter)	North Branch Park River	NPR2	4404	downstream	upper campus road at University of Hartford	Hartford	22245019	30
29	3/30/1999	Quarterly Monitoring (Winter)	North Branch Park River	NPR2	4404	downstream	upper campus road at University of Hartford	Hartford	22245031	5
29	3/30/1999	Quarterly Monitoring (Winter)	North Branch Park River	NPR2	4404	downstream	upper campus road at University of Hartford	Hartford	22245031	6
29	3/30/1999	Quarterly Monitoring (Winter)	North Branch Park River	NPR2	4404	downstream	upper campus road at University of Hartford	Hartford	22245031	7
29	3/30/1999	Quarterly Monitoring (Winter)	North Branch Park River	NPR2	4404	downstream	upper campus road at University of Hartford	Hartford	22245031	8
29	3/30/1999	Quarterly Monitoring (Winter)	North Branch Park River	NPR2	4404	downstream	upper campus road at University of Hartford	Hartford	22245031	9
29	3/30/1999	Quarterly Monitoring (Winter)	North Branch Park River	NPR2	4404	downstream	upper campus road at University of Hartford	Hartford	22245031	10
29	3/30/1999	Quarterly Monitoring (Winter)	North Branch Park River	NPR2	4404	downstream	upper campus road at University of Hartford	Hartford	22245031	11
29	3/30/1999	Quarterly Monitoring (Winter)	North Branch Park River	NPR2	4404	downstream	upper campus road at University of Hartford	Hartford	8169193	180
29	3/30/1999	Quarterly Monitoring (Winter)	North Branch Park River	NPR2	4404	downstream	upper campus road at University of Hartford	Hartford	8169193	181
29	3/30/1999	Quarterly Monitoring (Winter)	North Branch Park River	NPR2	4404	downstream	upper campus road at University of Hartford	Hartford	8169193	182

ChemParameter	value	lessthan	greaterthan	Expr1015	StationID	method	unit	media	analytical l	mdl	sambysite	depth of sa	YLat	XLong
Ammonia Nitrogen	0.045	FALSE	FALSE	ppm	2274	EPA 350.1	ppm	Water	CESE	0.002	14006	0.1	41.76723	-72.70327
Nitrate as Nitrogen	0.49	FALSE	FALSE	ppm	2274	Calculation	ppm	Water	CESE		14006	0.1	41.76723	-72.70327
Nitrite as Nitrogen	0.006	FALSE	FALSE	ppm	2274	EPA 353.2	ppm	Water	CESE	0.003	14006	0.1	41.76723	-72.70327
pH lab	7.62	FALSE	FALSE	units	2274	EPA 150.1	units	Water	CESE		14006	0.1	41.76723	-72.70327
Solids, Total Suspended	3	TRUE	FALSE	ppm	2274	EPA 160.2	ppm	Water	CESE	3	14006	0.1	41.76723	-72.70327
TKN	0.239	FALSE	FALSE	ppm	2274	Calculation	ppm	Water	CESE		14006	0.1	41.76723	-72.70327
Solids, Total	272	FALSE	FALSE	ppm	2274	EPA 160.3	ppm	Water	CESE	22	14006	0.1	41.76723	-72.70327
Turbidity	2.4	FALSE	FALSE	NTU	2274	EPA 180.1	NTU	Water	CESE	0.1	14006	0.1	41.76723	-72.70327
Nitrogen, Nitrate and Nitrite-Nox	0.496	FALSE	FALSE	ppm	2274	EPA 353.2	ppm	Water	CESE	0.002	14006	0.1	41.76723	-72.70327
Organic Nitrogen	0.194	FALSE	FALSE	ppm	2274	Calculation	ppm	Water	CESE		14006	0.1	41.76723	-72.70327
Calcium, Total	30600	FALSE	FALSE	ppb	2274	EPA 200.7	ppb	Water	CESE	25	14006	0.1	41.76723	-72.70327
Magnesium, Total	9590	FALSE	FALSE	ppb	2274	EPA 200.7	ppb	Water	CESE	25	14006	0.1	41.76723	-72.70327
Orthophosphate	0.017	FALSE	FALSE	ppm	2274	EPA 365.1	ppm	Water	CESE	0.001	14006	0.1	41.76723	-72.70327
Alkalinity	84	FALSE	FALSE	ppm	2274	EPA 310.1	ppm	Water	CESE	2	14006	0.1	41.76723	-72.70327
Chloride	49.7	FALSE	FALSE	ppm	2274	EPA 300.0	ppm	Water	CESE	0.2	14006	0.1	41.76723	-72.70327
Phosphate, Total	0.035	FALSE	FALSE	ppm	2274	EPA 365.4	ppm	Water	CESE	0.002	14006	0.1	41.76723	-72.70327
Nitrogen, Total	0.735	FALSE	FALSE	ppm	2274	EPA 353.2	ppm	Water	CESE	0.004	14006	0.1	41.76723	-72.70327
Hardness	115.9	FALSE	FALSE	ppm	2274	SM2340B	ppm	Water	CESE	0.2	14006	0.1	41.76723	-72.70327
Ammonia Nitrogen	0.027	FALSE	FALSE	ppm	2274	EPA 350.1	ppm	Water	cese	0.002	13944	0	41.76723	-72.70327
Nitrate as Nitrogen	0.48	FALSE	FALSE	ppm	2274	Calculation	ppm	Water	CESE		13944	0	41.76723	-72.70327
Nitrite as Nitrogen	0.006	FALSE	FALSE	ppm	2274	EPA 353.2	ppm	Water	CESE	0.003	13944	0	41.76723	-72.70327
pH lab	7.77	FALSE	FALSE		2274	EPA 150.1		Water	CESE		13944	0	41.76723	-72.70327
Solids, Total Suspended	3	TRUE	FALSE	ppm	2274	EPA 160.2	ppm	Water	CESE	3	13944	0	41.76723	-72.70327
Solids, Total	324	FALSE	FALSE	ppm	2274	EPA 160.3	ppm	Water	CESE	22	13944	0	41.76723	-72.70327
Turbidity	3.3	FALSE	FALSE	NTU	2274	EPA 180.1	NTU	Water	CESE	0.1	13944	0	41.76723	-72.70327
Nitrogen, Nitrate and Nitrite-Nox	0.486	FALSE	FALSE	ppm	2274	EPA 353.2	ppm	Water	CESE	0.002	13944	0	41.76723	-72.70327
Calcium, Total	37270	FALSE	FALSE	ppb	2274	EPA 200.7	ppb	Water	cese	25	13944	0	41.76723	-72.70327
Magnesium, Total	11280	FALSE	FALSE	ppb	2274	EPA 200.7	ppb	Water	CESE	25	13944	0	41.76723	-72.70327
Organic Carbon, Total	4.5	FALSE	FALSE	ppm	2274	EPA 415.1	ppm	Water	CESE	0.5	13944	0	41.76723	-72.70327
Orthophosphate	0.028	FALSE	FALSE	ppm	2274	EPA 365.1	ppm	Water	CESE	0.001	13944	0	41.76723	-72.70327
Alkalinity	98	FALSE	FALSE	ppm	2274	EPA 310.1	ppm	Water	cese	2	13944	0	41.76723	-72.70327
Chloride	60.2	FALSE	FALSE	ppm	2274	EPA 300.0	ppm	Water	cese	0.2	13944	0	41.76723	-72.70327
Phosphate, Total	0.061	FALSE	FALSE	ppm	2274	EPA 365.4	ppm	Water	CESE	0.002	13944	0	41.76723	-72.70327
Nitrogen, Total	0.732	FALSE	FALSE	ppm	2274	EPA 353.2	ppm	Water	CESE	0.004	13944	0	41.76723	-72.70327
Hardness	140	FALSE	FALSE	ppm	2274	SM2340B	ppm	Water	CESE	0.2	13944	0	41.76723	-72.70327
Ammonia Nitrogen	0.064	FALSE	FALSE	ppm	2274	EPA 350.1	ppm	Water	CESE	0.002	13737	0	41.76723	-72.70327
Nitrate as Nitrogen	0.362	FALSE	FALSE	ppm	2274	Calculation	ppm	Water	CESE		13737	0	41.76723	-72.70327
Nitrite as Nitrogen	0.01	FALSE	FALSE	ppm	2274	EPA 353.2	ppm	Water	CESE	0.003	13737	0	41.76723	-72.70327
Solids, Total Suspended	5	FALSE	FALSE	ppm	2274	EPA 160.2	ppm	Water	CESE	3	13737	0	41.76723	-72.70327
TKN	0.254	FALSE	FALSE	ppm	2274	Calculation	ppm	Water	CESE		13737	0	41.76723	-72.70327
Solids, Total	348	FALSE	FALSE	ppm	2274	EPA 160.3	ppm	Water	CESE	22	13737	0	41.76723	-72.70327
Turbidity	4.7	FALSE	FALSE	NTU	2274	EPA 180.1	NTU	Water	CESE	0.1	13737	0	41.76723	-72.70327
Nitrogen, Nitrate and Nitrite-Nox	0.372	FALSE	FALSE	ppm	2274	EPA 353.2	ppm	Water	CESE	0.002	13737	0	41.76723	-72.70327
Organic Nitrogen	0.19	FALSE	FALSE	ppm	2274	Calculation	ppm	Water	CESE		13737	0	41.76723	-72.70327
Calcium, Total	38400	FALSE	FALSE	ppb	2274	EPA 200.7	ppb	Water	CESE	25	13737	0	41.76723	-72.70327
Magnesium, Total	11000	FALSE	FALSE	ppb	2274	EPA 200.7	ppb	Water	CESE	25	13737	0	41.76723	-72.70327
BROMOBENZENE	0.036	FALSE	FALSE	ppm	2274	EPA 365.1	ppm	Water	CESE	0.001	13737	0	41.76723	-72.70327
Alkalinity	90	FALSE	FALSE	ppm	2274	EPA 310.1	ppm	Water	CESE	2	13737	0	41.76723	-72.70327
Chloride	65.6	FALSE	FALSE	ppm	2274	EPA 300.0	ppm	Water	CESE	0.2	13737	0	41.76723	-72.70327
Phosphate, Total	0.065	FALSE	FALSE	ppm	2274	EPA 365.4	ppm	Water	CESE	0.002	13737	0	41.76723	-72.70327
Nitrogen, Total	0.626	FALSE	FALSE	ppm	2274	EPA 353.2	ppm	Water	CESE	0.004	13737	0	41.76723	-72.70327
Hardness	141	FALSE	FALSE	ppm	2274	SM2340B	ppm	Water	CESE	0.2	13737	0	41.76723	-72.70327
Sulfate	37.5	FALSE	FALSE	ppm	2274	EPA 300.0	ppm	Water	CESE	0.1	13737	0	41.76723	-72.70327
Escherichia coli	190	FALSE	FALSE	MPN colonies per 100 mls	2274	COLILERT MMO-MUG FLUORESC	MPN colonies per 100 mls	water	DPH		13737	0	41.76723	-72.70327
Ammonia Nitrogen	0.07	FALSE	FALSE	ppm	2274	EPA 350.1	ppm	Water	CESE	0.002	13720	0	41.76723	-72.70327
Nitrate as Nitrogen	0.357	FALSE	FALSE	ppm	2274	Calculation	ppm	Water	CESE		13720	0	41.76723	-72.70327
Nitrite as Nitrogen	0.01	FALSE	FALSE	ppm	2274	EPA 353.2	ppm	Water	CESE	0.003	13720	0	41.76723	-72.70327

Solids, Total Suspended	24	FALSE	FALSE	ppm	2274	EPA 160.2	ppm	Water	CESE	3	13720	0	41.76723	-72.70327
TKN	0.295	FALSE	FALSE	ppm	2274	Calculation	ppm	Water	CESE		13720	0	41.76723	-72.70327
Solids, Total	302	FALSE	FALSE	ppm	2274	EPA 160.3	ppm	Water	CESE	22	13720	0	41.76723	-72.70327
Turbidity	1.6	FALSE	FALSE	NTU	2274	EPA 180.1	NTU	Water	CESE	0.1	13720	0	41.76723	-72.70327
Nitrogen, Nitrate and Nitrite-Nox	0.367	FALSE	FALSE	ppm	2274	EPA 353.2	ppm	Water	CESE	0.002	13720	0	41.76723	-72.70327
Organic Nitrogen	0.225	FALSE	FALSE	ppm	2274	Calculation	ppm	Water	CESE		13720	0	41.76723	-72.70327
Calcium, Total	34800	FALSE	FALSE	ppb	2274	EPA 200.7	ppb	Water	CESE	25	13720	0	41.76723	-72.70327
Magnesium, Total	10600	FALSE	FALSE	ppb	2274	EPA 200.7	ppb	Water	CESE	25	13720	0	41.76723	-72.70327
BROMOBENZENE	0.032	FALSE	FALSE	ppm	2274	EPA 365.1	ppm	Water	CESE	0.001	13720	0	41.76723	-72.70327
Alkalinity	73	FALSE	FALSE	ppm	2274	EPA 310.1	ppm	Water	CESE	2	13720	0	41.76723	-72.70327
Chloride	55.2	FALSE	FALSE	ppm	2274	EPA 300.0	ppm	Water	CESE	0.2	13720	0	41.76723	-72.70327
Phosphate, Total	0.094	FALSE	FALSE	ppm	2274	EPA 365.4	ppm	Water	CESE	0.002	13720	0	41.76723	-72.70327
Nitrogen, Total	0.662	FALSE	FALSE	ppm	2274	EPA 353.2	ppm	Water	CESE	0.004	13720	0	41.76723	-72.70327
Hardness	130	FALSE	FALSE	ppm	2274	SM2340B	ppm	Water	CESE	0.2	13720	0	41.76723	-72.70327
Sulfate	23.1	FALSE	FALSE	ppm	2274	EPA 300.0	ppm	Water	CESE	0.1	13720	0	41.76723	-72.70327
Escherichia coli	410	FALSE	FALSE	MPN colonies per 100 mls	2274	COLILERT MMO-MUG FLUORESC	MPN colonies per 100 mls	water	DPH		13720	0	41.76723	-72.70327
Escherichia coli	400	FALSE	FALSE	MPN colonies per 100 mls	2274	COLILERT MMO-MUG FLUORESC	MPN colonies per 100 mls	water	DPH	10	13237	0	41.76723	-72.70327
Ammonia Nitrogen	0.074	FALSE	FALSE	ppm	2274	EPA 350.1	ppm	Water	cese	0.002	13101	0	41.76723	-72.70327
Nitrate as Nitrogen	0.254	FALSE	FALSE	ppm	2274	Calculation	ppm	Water	cese		13101	0	41.76723	-72.70327
Nitrite as Nitrogen	0.01	FALSE	FALSE	ppm	2274	EPA 353.2	ppm	Water	cese	0.003	13101	0	41.76723	-72.70327
pH lab	7	FALSE	FALSE	units	2274	EPA 150.1	units	Water	cese		13101	0	41.76723	-72.70327
Solids, Total Suspended	3	FALSE	FALSE	ppm	2274	EPA 160.2	ppm	Water	cese	3	13101	0	41.76723	-72.70327
TKN	0.437	FALSE	FALSE	ppm	2274	Calculation	ppm	Water	cese		13101	0	41.76723	-72.70327
Solids, Total	190	FALSE	FALSE	ppm	2274	EPA 160.3	ppm	Water	cese	22	13101	0	41.76723	-72.70327
Turbidity	4.2	FALSE	FALSE	NTU	2274	EPA 180.1	NTU	Water	cese	0.1	13101	0	41.76723	-72.70327
Nitrogen, Nitrate and Nitrite-Nox	0.264	FALSE	FALSE	ppm	2274	EPA 353.2	ppm	Water	cese	0.002	13101	0	41.76723	-72.70327
Organic Nitrogen	0.363	FALSE	FALSE	ppm	2274	Calculation	ppm	Water	cese		13101	0	41.76723	-72.70327
Calcium, Total	22700	FALSE	FALSE	ppb	2274	EPA 200.7	ppb	Water	cese	25	13101	0	41.76723	-72.70327
Magnesium, Total	6440	FALSE	FALSE	ppb	2274	EPA 200.7	ppb	Water	cese	25	13101	0	41.76723	-72.70327
Organic Carbon, Total	5	FALSE	FALSE	ppm	2274	EPA 415.1	ppm	Water	cese	0.5	13101	0	41.76723	-72.70327
Orthophosphate	0.061	FALSE	FALSE	ppm	2274	EPA 365.1	ppm	Water	cese	0.001	13101	0	41.76723	-72.70327
Alkalinity	53	FALSE	FALSE	ppm	2274	EPA 310.1	ppm	Water	cese	2	13101	0	41.76723	-72.70327
Chloride	28.6	FALSE	FALSE	ppm	2274	EPA 300.0	ppm	Water	cese	0.2	13101	0	41.76723	-72.70327
Phosphate, Total	0.101	FALSE	FALSE	ppm	2274	EPA 365.4	ppm	Water	cese	0.002	13101	0	41.76723	-72.70327
Nitrogen, Total	0.701	FALSE	FALSE	ppm	2274	EPA 353.2	ppm	Water	cese	0.004	13101	0	41.76723	-72.70327
Hardness	83.3	FALSE	FALSE	ppm	2274	SM2340B	ppm	Water	cese	0.2	13101	0	41.76723	-72.70327
Escherichia coli	370	FALSE	FALSE	MPN colonies per 100 mls	2274	COLILERT MMO-MUG FLUORESC	MPN colonies per 100 mls	water	DPH	10	13101	0	41.76723	-72.70327
Ammonia Nitrogen	0.089	FALSE	FALSE	ppm	2274	EPA 350.1	ppm	Water	cese	0.002	12910	0	41.76723	-72.70327
Nitrate as Nitrogen	0.247	FALSE	FALSE	ppm	2274	Calculation	ppm	Water	cese		12910	0	41.76723	-72.70327
Nitrite as Nitrogen	0.005	FALSE	FALSE	ppm	2274	EPA 353.2	ppm	Water	cese	0.003	12910	0	41.76723	-72.70327
pH lab	7	FALSE	FALSE	units	2274	EPA 150.1	units	Water	cese		12910	0	41.76723	-72.70327
Solids, Total Suspended	4	FALSE	FALSE	ppm	2274	EPA 160.2	ppm	Water	cese	3	12910	0	41.76723	-72.70327
TKN	0.396	FALSE	FALSE	ppm	2274	Calculation	ppm	Water	cese		12910	0	41.76723	-72.70327
Solids, Total	202	FALSE	FALSE	ppm	2274	EPA 160.3	ppm	Water	cese	22	12910	0	41.76723	-72.70327
Turbidity	5.3	FALSE	FALSE	NTU	2274	EPA 180.1	NTU	Water	cese	0.1	12910	0	41.76723	-72.70327
Nitrogen, Nitrate and Nitrite-Nox	0.252	FALSE	FALSE	ppm	2274	EPA 353.2	ppm	Water	cese	0.002	12910	0	41.76723	-72.70327
Organic Nitrogen	0.307	FALSE	FALSE	ppm	2274	Calculation	ppm	Water	cese		12910	0	41.76723	-72.70327
Calcium, Total	18100	FALSE	FALSE	ppb	2274	EPA 200.7	ppb	Water	cese	25	12910	0	41.76723	-72.70327
Magnesium, Total	4920	FALSE	FALSE	ppb	2274	EPA 200.7	ppb	Water	cese	25	12910	0	41.76723	-72.70327
Organic Carbon, Total	5.6	FALSE	FALSE	ppm	2274	EPA 415.1	ppm	Water	cese	0.5	12910	0	41.76723	-72.70327
Orthophosphate	0.057	FALSE	FALSE	ppm	2274	EPA 365.1	ppm	Water	cese	0.001	12910	0	41.76723	-72.70327
Alkalinity	45	FALSE	FALSE	ppm	2274	EPA 310.1	ppm	Water	cese	2	12910	0	41.76723	-72.70327
Chloride	27.9	FALSE	FALSE	ppm	2274	EPA 300.0	ppm	Water	cese	0.2	12910	0	41.76723	-72.70327
Phosphate, Total	0.102	FALSE	FALSE	ppm	2274	EPA 365.4	ppm	Water	cese	0.002	12910	0	41.76723	-72.70327
Nitrogen, Total	0.648	FALSE	FALSE	ppm	2274	EPA 353.2	ppm	Water	cese	0.004	12910	0	41.76723	-72.70327
Hardness	65.5	FALSE	FALSE	ppm	2274	SM2340B	ppm	Water	cese	0.2	12910	0	41.76723	-72.70327
Escherichia coli	330	FALSE	FALSE	MPN colonies per 100 mls	2274	COLILERT MMO-MUG FLUORESC	MPN colonies per 100 mls	water	DPH	10	12910	0	41.76723	-72.70327
Ammonia Nitrogen	0.114	FALSE	FALSE	ppm	2274	EPA 350.1	ppm	Water	cese	0.002	12753	0	41.76723	-72.70327

Nitrate as Nitrogen	0.33	FALSE	FALSE	ppm	2274	Calculation	ppm	Water	cese		12753	0	41.76723	-72.70327
Nitrite as Nitrogen	0.025	FALSE	FALSE	ppm	2274	EPA 353.2	ppm	Water	cese	0.003	12753	0	41.76723	-72.70327
pH lab	7.41	FALSE	FALSE	units	2274	EPA 150.1	units	Water	cese		12753	0	41.76723	-72.70327
Solids, Total Suspended	4	FALSE	FALSE	ppm	2274	EPA 160.2	ppm	Water	cese	3	12753	0	41.76723	-72.70327
TKN	0.464	FALSE	FALSE	ppm	2274	Calculation	ppm	Water	cese		12753	0	41.76723	-72.70327
Solids, Total	284	FALSE	FALSE	ppm	2274	EPA 160.3	ppm	Water	cese	22	12753	0	41.76723	-72.70327
Turbidity	3.4	FALSE	FALSE	NTU	2274	EPA 180.1	NTU	Water	cese	0.1	12753	0	41.76723	-72.70327
Nitrogen, Nitrate and Nitrite-Nox	0.355	FALSE	FALSE	ppm	2274	EPA 353.2	ppm	Water	cese	0.002	12753	0	41.76723	-72.70327
Organic Nitrogen	0.35	FALSE	FALSE	ppm	2274	Calculation	ppm	Water	cese		12753	0	41.76723	-72.70327
Calcium, Total	39000	FALSE	FALSE	ppb	2274	EPA 200.7	ppb	Water	cese	25	12753	0	41.76723	-72.70327
Magnesium, Total	11200	FALSE	FALSE	ppb	2274	EPA 200.7	ppb	Water	cese	25	12753	0	41.76723	-72.70327
Organic Carbon, Total	5.4	FALSE	FALSE	ppm	2274	EPA 415.1	ppm	Water	cese	0.5	12753	0	41.76723	-72.70327
Orthophosphate	0.062	FALSE	FALSE	ppm	2274	EPA 365.1	ppm	Water	cese	0.001	12753	0	41.76723	-72.70327
Alkalinity	97	FALSE	FALSE	ppm	2274	EPA 310.1	ppm	Water	cese	2	12753	0	41.76723	-72.70327
Chloride	71.9	FALSE	FALSE	ppm	2274	EPA 300.0	ppm	Water	cese	0.2	12753	0	41.76723	-72.70327
Phosphate, Total	0.113	FALSE	FALSE	ppm	2274	EPA 365.4	ppm	Water	cese	0.002	12753	0	41.76723	-72.70327
Nitrogen, Total	0.819	FALSE	FALSE	ppm	2274	EPA 353.2	ppm	Water	cese	0.004	12753	0	41.76723	-72.70327
Hardness	143	FALSE	FALSE	ppm	2274	SM2340B	ppm	Water	cese	0.2	12753	0	41.76723	-72.70327
Sulfate	21.7	FALSE	FALSE	ppm	2274	EPA 300.0	ppm	Water	cese	0.1	12753	0	41.76723	-72.70327
Ammonia Nitrogen	0.119	FALSE	FALSE	ppm	2274	EPA 350.1	ppm	Water	cese	0.002	12753	0	41.76723	-72.70327
Nitrate as Nitrogen	0.328	FALSE	FALSE	ppm	2274	Calculation	ppm	Water	cese		12753	0	41.76723	-72.70327
Nitrite as Nitrogen	0.025	FALSE	FALSE	ppm	2274	EPA 353.2	ppm	Water	cese	0.003	12753	0	41.76723	-72.70327
pH lab	7.39	FALSE	FALSE	units	2274	EPA 150.1	units	Water	cese		12753	0	41.76723	-72.70327
Solids, Total Suspended	2	FALSE	FALSE	ppm	2274	EPA 160.2	ppm	Water	cese	3	12753	0	41.76723	-72.70327
TKN	0.465	FALSE	FALSE	ppm	2274	Calculation	ppm	Water	cese		12753	0	41.76723	-72.70327
Solids, Total	292	FALSE	FALSE	ppm	2274	EPA 160.3	ppm	Water	cese	22	12753	0	41.76723	-72.70327
Turbidity	3.3	FALSE	FALSE	NTU	2274	EPA 180.1	NTU	Water	cese	0.1	12753	0	41.76723	-72.70327
Nitrogen, Nitrate and Nitrite-Nox	0.353	FALSE	FALSE	ppm	2274	EPA 353.2	ppm	Water	cese	0.002	12753	0	41.76723	-72.70327
Organic Nitrogen	0.346	FALSE	FALSE	ppm	2274	Calculation	ppm	Water	cese		12753	0	41.76723	-72.70327
Calcium, Total	38100	FALSE	FALSE	ppb	2274	EPA 200.7	ppb	Water	cese	25	12753	0	41.76723	-72.70327
Magnesium, Total	10900	FALSE	FALSE	ppb	2274	EPA 200.7	ppb	Water	cese	25	12753	0	41.76723	-72.70327
Organic Carbon, Total	5	FALSE	FALSE	ppm	2274	EPA 415.1	ppm	Water	cese	0.5	12753	0	41.76723	-72.70327
Orthophosphate	0.065	FALSE	FALSE	ppm	2274	EPA 365.1	ppm	Water	cese	0.001	12753	0	41.76723	-72.70327
Alkalinity	97	FALSE	FALSE	ppm	2274	EPA 310.1	ppm	Water	cese	2	12753	0	41.76723	-72.70327
Chloride	71.5	FALSE	FALSE	ppm	2274	EPA 300.0	ppm	Water	cese	0.2	12753	0	41.76723	-72.70327
Phosphate, Total	0.113	FALSE	FALSE	ppm	2274	EPA 365.4	ppm	Water	cese	0.002	12753	0	41.76723	-72.70327
Nitrogen, Total	0.818	FALSE	FALSE	ppm	2274	EPA 353.2	ppm	Water	cese	0.004	12753	0	41.76723	-72.70327
Hardness	140	FALSE	FALSE	ppm	2274	SM2340B	ppm	Water	cese	0.2	12753	0	41.76723	-72.70327
Sulfate	21.8	FALSE	FALSE	ppm	2274	EPA 300.0	ppm	Water	cese	0.1	12753	0	41.76723	-72.70327
Escherichia coli	700	FALSE	FALSE	MPN colonies per 100 mls	2274	COLILERT MMO-MUG FLUORESC	MPN colonies per 100 mls	water	DPH	10	12753	0	41.76723	-72.70327
Escherichia coli	570	FALSE	FALSE	MPN colonies per 100 mls	2274	COLILERT MMO-MUG FLUORESC	MPN colonies per 100 mls	water	DPH	10	12753	0	41.76723	-72.70327
Ammonia Nitrogen	0.059	FALSE	FALSE	ppm	1004	EPA 350.1	ppm	Water	cese	0.002	12686	0.2	41.81698	-72.73766
Nitrate as Nitrogen	0.268	FALSE	FALSE	ppm	1004	Calculation	ppm	Water	cese		12686	0.2	41.81698	-72.73766
Nitrite as Nitrogen	0.017	FALSE	FALSE	ppm	1004	EPA 353.2	ppm	Water	cese	0.003	12686	0.2	41.81698	-72.73766
pH lab	7.79	FALSE	FALSE	units	1004	EPA 150.1	units	Water	cese		12686	0.2	41.81698	-72.73766
Solids, Total Suspended	6	FALSE	FALSE	ppm	1004	EPA 160.2	ppm	Water	cese	3	12686	0.2	41.81698	-72.73766
TKN	0.366	FALSE	FALSE	ppm	1004	Calculation	ppm	Water	cese		12686	0.2	41.81698	-72.73766
Solids, Total	266	FALSE	FALSE	ppm	1004	EPA 160.3	ppm	Water	cese	22	12686	0.2	41.81698	-72.73766
Turbidity	2.7	FALSE	FALSE	NTU	1004	EPA 180.1	NTU	Water	cese	0.1	12686	0.2	41.81698	-72.73766
Nitrogen, Nitrate and Nitrite-Nox	0.285	FALSE	FALSE	ppm	1004	EPA 353.2	ppm	Water	cese	0.002	12686	0.2	41.81698	-72.73766
Organic Nitrogen	0.307	FALSE	FALSE	ppm	1004	Calculation	ppm	Water	cese		12686	0.2	41.81698	-72.73766
Calcium, Total	32500	FALSE	FALSE	ppb	1004	EPA 200.7	ppb	Water	cese	25	12686	0.2	41.81698	-72.73766
Magnesium, Total	9980	FALSE	FALSE	ppb	1004	EPA 200.7	ppb	Water	cese	25	12686	0.2	41.81698	-72.73766
Orthophosphate	0.054	FALSE	FALSE	ppm	1004	EPA 365.1	ppm	Water	cese	0.001	12686	0.2	41.81698	-72.73766
Alkalinity	89	FALSE	FALSE	ppm	1004	EPA 310.1	ppm	Water	cese	2	12686	0.2	41.81698	-72.73766
Chloride	56	FALSE	FALSE	ppm	1004	EPA 300.0	ppm	Water	cese	0.2	12686	0.2	41.81698	-72.73766
Phosphate, Total	0.111	FALSE	FALSE	ppm	1004	EPA 365.4	ppm	Water	cese	0.002	12686	0.2	41.81698	-72.73766
Potassium	1880	FALSE	FALSE	ppb	1004	EPA 200.7	ppb	Water	cese	25	12686	0.2	41.81698	-72.73766

Sodium, Total	25100	FALSE	FALSE	ppb	1004	EPA 200.7	ppb	Water	cese	25	12686	0.2	41.81698	-72.73766
Nitrogen, Total	0.651	FALSE	FALSE	ppm	1004	EPA 353.2	ppm	Water	cese	0.004	12686	0.2	41.81698	-72.73766
Hardness	122	FALSE	FALSE	ppm	1004	SM2340B	ppm	Water	cese	0.2	12686	0.2	41.81698	-72.73766
Sulfate	12.7	FALSE	FALSE	ppm	1004	EPA 300.0	ppm	Water	cese	0.1	12686	0.2	41.81698	-72.73766
Alkalinity	69	FALSE	FALSE	ppm	377	EPA 310.2	ppm	water	DPH	10	680		41.78496	-72.70786
Ammonia Nitrogen	0.1	TRUE	FALSE	ppm	377	EPA 350.1	ppm	water	dph	0.1	680		41.78496	-72.70786
BOD 5 day	1	TRUE	FALSE	ppm	377	EPA 405.1	ppm	water	dph	1	680		41.78496	-72.70786
Chloride	65	FALSE	FALSE	ppm	377	EPA 325.2	ppm	water	DPH	1	680		41.78496	-72.70786
Hardness	150	FALSE	FALSE	ppm	377	EPA 130.1	ppm	water	DPH	10	680		41.78496	-72.70786
Nitrate as Nitrogen	0.7	FALSE	FALSE	ppm	377	EPA 353.2	ppm	water	DPH	0.1	680		41.78496	-72.70786
Nitrite as Nitrogen	0.05	TRUE	FALSE	ppm	377	EPA 353.2	ppm	water	dph	0.05	680		41.78496	-72.70786
Organic Nitrogen	0.6	FALSE	FALSE	ppm	377	EPA 351.1	ppm	water	DPH	0.1	680		41.78496	-72.70786
pH lab	7.3	FALSE	FALSE	pH unit	377	EPA 150.1	pH unit	water	DPH	1	680		41.78496	-72.70786
Solids, Total Suspended	11	FALSE	FALSE	ppm	377	EPA 160.2	ppm	water	dph	1	680		41.78496	-72.70786
TKN	0.6	FALSE	FALSE	ppm	377	EPA 351.2	ppm	water	DPH	0.1	680		41.78496	-72.70786
Cadmium, Total	0.001	TRUE	FALSE	ppm	377	EPA 200.7	ppm	water	dph	0.001	680		41.78496	-72.70786
Chromium, Total	0.001	TRUE	FALSE	ppm	377	EPA 200.7	ppm	water	dph	0.001	680		41.78496	-72.70786
Copper, Total	0.007	FALSE	FALSE	ppm	377	EPA 200.7	ppm	water	dph	0.001	680		41.78496	-72.70786
Lead, Total	0.002	FALSE	FALSE	ppm	377	EPA 200.9	ppm	water	DPH	0.001	680		41.78496	-72.70786
Nickel, Total	0.001	FALSE	FALSE	ppm	377	EPA 200.7	ppm	water	dph	0.001	680		41.78496	-72.70786
Phosphate as P, Total	0.04	FALSE	FALSE	ppm	377	EPA 365.1	ppm	water	DPH	0.01	680		41.78496	-72.70786
Solids, Total	270	FALSE	FALSE	ppm	377	EPA 160.3	ppm	water	dph	1	680		41.78496	-72.70786
Zinc, Total	0.006	FALSE	FALSE	ppm	377	EPA 200.7	ppm	water	dph	0.002	680		41.78496	-72.70786
Turbidity	3	FALSE	FALSE	NTU	377	EPA 180.1	NTU	water	dph	0.1	680		41.78496	-72.70786
Iron, Total	0.277	FALSE	FALSE	ppm	377	Stnd Meth 3111B	ppm	water	dph	0.004	680		41.78496	-72.70786
Aluminum, Total	0.089	FALSE	FALSE	ppm	377	EPA 200.7	ppm	water	dph	0.002	680		41.78496	-72.70786
Cadmium, Dissolved	0.001	TRUE	FALSE	ppm	377	EPA 200.7	ppm	water	dph	0.001	680		41.78496	-72.70786
Chromium, Dissolved	0.001	TRUE	FALSE	ppm	377	EPA 200.7	ppm	water	dph	0.001	680		41.78496	-72.70786
Copper, Dissolved	0.005	FALSE	FALSE	ppm	377	EPA 200.7	ppm	water	DPH	0.001	680		41.78496	-72.70786
Iron, Dissolved	0.223	FALSE	FALSE	ppm	377	EPA 200.7	ppm	water	DPH	0.004	680		41.78496	-72.70786
Lead, Dissolved	0.001	TRUE	FALSE	ppm	377	EPA 200.9	ppm	water	DPH	0.001	680		41.78496	-72.70786
Nickel, Dissolved	0.001	TRUE	FALSE	ppm	377	EPA 200.7	ppm	water	DPH	0.001	680		41.78496	-72.70786
Zinc, Dissolved	0.004	FALSE	FALSE	ppm	377	EPA 200.7	ppm	water	dph	0.002	680		41.78496	-72.70786
Aluminum, Dissolved	0.069	FALSE	FALSE	ppm	377	EPA 200.7	ppm	water	dph	0.002	680		41.78496	-72.70786
Total Coliform	10000	FALSE	FALSE	MPN colonies per 100 mls	377	Standard Method 9223B	MPN colonies per 100 mls	water	DPH	10	680		41.78496	-72.70786
Enterococci	110	FALSE	FALSE	MPN colonies per 100 mls	377	ASTM D6503	MPN colonies per 100 mls	water	DPH	10	680		41.78496	-72.70786
Escherichia coli	250	FALSE	FALSE	MPN colonies per 100 mls	377	Standard Method 9223B	MPN colonies per 100 mls	water	DPH	10	680		41.78496	-72.70786
Alkalinity	89	FALSE	FALSE	ppm	378	EPA 310.2	ppm	water	DPH	10	681		41.799	-72.71767
Ammonia Nitrogen	0.1	TRUE	FALSE	ppm	378	EPA 350.1	ppm	water	dph	0.1	681		41.799	-72.71767
BOD 5 day	1	TRUE	FALSE	ppm	378	EPA 405.1	ppm	water	dph	1	681		41.799	-72.71767
Chloride	30	FALSE	FALSE	ppm	378	EPA 325.2	ppm	water	DPH	1	681		41.799	-72.71767
Hardness	120	FALSE	FALSE	ppm	378	EPA 130.1	ppm	water	DPH	10	681		41.799	-72.71767
Nitrate as Nitrogen	0.6	FALSE	FALSE	ppm	378	EPA 353.2	ppm	water	DPH	0.1	681		41.799	-72.71767
Nitrite as Nitrogen	0.05	TRUE	FALSE	ppm	378	EPA 353.2	ppm	water	dph	0.05	681		41.799	-72.71767
Organic Nitrogen	0.8	FALSE	FALSE	ppm	378	EPA 351.1	ppm	water	DPH	0.1	681		41.799	-72.71767
pH lab	7.7	FALSE	FALSE	pH unit	378	EPA 150.1	pH unit	water	DPH	1	681		41.799	-72.71767
Solids, Total Suspended	5	FALSE	FALSE	ppm	378	EPA 160.2	ppm	water	dph	1	681		41.799	-72.71767
TKN	0.8	FALSE	FALSE	ppm	378	EPA 351.2	ppm	water	DPH	0.1	681		41.799	-72.71767
Cadmium, Total	0.001	TRUE	FALSE	ppm	378	EPA 200.7	ppm	water	dph	0.001	681		41.799	-72.71767
Chromium, Total	0.001	TRUE	FALSE	ppm	378	EPA 200.7	ppm	water	dph	0.001	681		41.799	-72.71767
Copper, Total	0.007	FALSE	FALSE	ppm	378	EPA 200.7	ppm	water	dph	0.001	681		41.799	-72.71767
Lead, Total	0.001	TRUE	FALSE	ppm	378	EPA 200.9	ppm	water	DPH	0.001	681		41.799	-72.71767
Nickel, Total	0.001	FALSE	FALSE	ppm	378	EPA 200.7	ppm	water	dph	0.001	681		41.799	-72.71767
Phosphate as P, Total	0.04	FALSE	FALSE	ppm	378	EPA 365.1	ppm	water	DPH	0.01	681		41.799	-72.71767
Solids, Total	250	FALSE	FALSE	ppm	378	EPA 160.3	ppm	water	dph	1	681		41.799	-72.71767
Zinc, Total	0.003	FALSE	FALSE	ppm	378	EPA 200.7	ppm	water	dph	0.002	681		41.799	-72.71767
Turbidity	1.5	FALSE	FALSE	NTU	378	EPA 180.1	NTU	water	dph	0.1	681		41.799	-72.71767
Iron, Total	0.174	FALSE	FALSE	ppm	378	Stnd Meth 3111B	ppm	water	dph	0.004	681		41.799	-72.71767

Aluminum, Total	0.047	FALSE	FALSE	ppm	378	EPA 200.7	ppm	water	dph	0.002	681	41.799	-72.71767
Cadmium, Dissolved	0.001	TRUE	FALSE	ppm	378	EPA 200.7	ppm	water	dph	0.001	681	41.799	-72.71767
Chromium, Dissolved	0.001	TRUE	FALSE	ppm	378	EPA 200.7	ppm	water	dph	0.001	681	41.799	-72.71767
Copper, Dissolved	0.005	FALSE	FALSE	ppm	378	EPA 200.7	ppm	water	DPH	0.001	681	41.799	-72.71767
Iron, Dissolved	0.134	FALSE	FALSE	ppm	378	EPA 200.7	ppm	water	DPH	0.004	681	41.799	-72.71767
Lead, Dissolved	0.001	TRUE	FALSE	ppm	378	EPA 200.9	ppm	water	DPH	0.001	681	41.799	-72.71767
Nickel, Dissolved	0.001	FALSE	FALSE	ppm	378	EPA 200.7	ppm	water	DPH	0.001	681	41.799	-72.71767
Zinc, Dissolved	0.003	FALSE	FALSE	ppm	378	EPA 200.7	ppm	water	dph	0.002	681	41.799	-72.71767
Aluminum, Dissolved	0.033	FALSE	FALSE	ppm	378	EPA 200.7	ppm	water	dph	0.002	681	41.799	-72.71767
Total Coliform	7700	FALSE	FALSE	MPN colonies per 100 mls	378	Standard Method 9223B	MPN colonies per 100 mls	water	DPH	10	681	41.799	-72.71767
Enterococci	63	FALSE	FALSE	MPN colonies per 100 mls	378	ASTM D6503	MPN colonies per 100 mls	water	DPH	10	681	41.799	-72.71767
Escherichia coli	97	FALSE	FALSE	MPN colonies per 100 mls	378	Standard Method 9223B	MPN colonies per 100 mls	water	DPH	10	681	41.799	-72.71767
Alkalinity	110	FALSE	FALSE	ppm	377	EPA 310.2	ppm	water	DPH	10	276	41.78496	-72.70786
Ammonia Nitrogen	0.1	TRUE	FALSE	ppm	377	EPA 350.1	ppm	water	dph	0.1	276	41.78496	-72.70786
BOD 5 day	1	TRUE	FALSE	ppm	377	EPA 405.1	ppm	water	dph	1	276	41.78496	-72.70786
Chloride	42	FALSE	FALSE	ppm	377	EPA 325.2	ppm	water	DPH	1	276	41.78496	-72.70786
Hardness	120	FALSE	FALSE	ppm	377	EPA 130.1	ppm	water	DPH	10	276	41.78496	-72.70786
Nitrate as Nitrogen	0.4	FALSE	FALSE	ppm	377	EPA 353.2	ppm	water	DPH	0.1	276	41.78496	-72.70786
Nitrite as Nitrogen	0.05	TRUE	FALSE	ppm	377	EPA 353.2	ppm	water	dph	0.05	276	41.78496	-72.70786
Organic Nitrogen	0.6	FALSE	FALSE	ppm	377	EPA 351.1	ppm	water	DPH	0.1	276	41.78496	-72.70786
pH lab	7.8	FALSE	FALSE	pH unit	377	EPA 150.1	pH unit	water	DPH	1	276	41.78496	-72.70786
Solids, Total Suspended	10	FALSE	FALSE	ppm	377	EPA 160.2	ppm	water	dph	1	276	41.78496	-72.70786
TKN	0.6	FALSE	FALSE	ppm	377	EPA 351.2	ppm	water	DPH	0.1	276	41.78496	-72.70786
Cadmium, Total	0.001	TRUE	FALSE	ppm	377	EPA 200.7	ppm	water	dph	0.001	276	41.78496	-72.70786
Chromium, Total	0.001	TRUE	FALSE	ppm	377	EPA 200.7	ppm	water	dph	0.001	276	41.78496	-72.70786
Copper, Total	0.002	FALSE	FALSE	ppm	377	EPA 200.7	ppm	water	dph	0.001	276	41.78496	-72.70786
Lead, Total	0.001	TRUE	FALSE	ppm	377	EPA 200.9	ppm	water	DPH	0.001	276	41.78496	-72.70786
Nickel, Total	0.001	TRUE	FALSE	ppm	377	EPA 200.7	ppm	water	dph	0.001	276	41.78496	-72.70786
Phosphate as P, Total	0.05	FALSE	FALSE	ppm	377	EPA 365.1	ppm	water	DPH	0.01	276	41.78496	-72.70786
Solids, Total	250	FALSE	FALSE	ppm	377	EPA 160.3	ppm	water	dph	1	276	41.78496	-72.70786
Zinc, Total	0.002	FALSE	FALSE	ppm	377	EPA 200.7	ppm	water	dph	0.002	276	41.78496	-72.70786
Turbidity	4.2	FALSE	FALSE	NTU	377	EPA 180.1	NTU	water	dph	0.1	276	41.78496	-72.70786
Iron, Total	0.046	FALSE	FALSE	ppm	377	Stnd Meth 3111B	ppm	water	dph	0.004	276	41.78496	-72.70786
Aluminum, Total	0.035	FALSE	FALSE	ppm	377	EPA 200.7	ppm	water	dph	0.002	276	41.78496	-72.70786
Alkalinity	120	FALSE	FALSE	ppm	377	EPA 310.2	ppm	water	DPH	10	276	41.78496	-72.70786
Ammonia Nitrogen	0.1	TRUE	FALSE	ppm	377	EPA 350.1	ppm	water	dph	0.1	276	41.78496	-72.70786
BOD 5 day	1	TRUE	FALSE	ppm	377	EPA 405.1	ppm	water	dph	1	276	41.78496	-72.70786
Chloride	42	FALSE	FALSE	ppm	377	EPA 325.2	ppm	water	DPH	1	276	41.78496	-72.70786
Hardness	120	FALSE	FALSE	ppm	377	EPA 130.1	ppm	water	DPH	10	276	41.78496	-72.70786
Nitrate as Nitrogen	0.4	FALSE	FALSE	ppm	377	EPA 353.2	ppm	water	DPH	0.1	276	41.78496	-72.70786
Nitrite as Nitrogen	0.05	TRUE	FALSE	ppm	377	EPA 353.2	ppm	water	dph	0.05	276	41.78496	-72.70786
Organic Nitrogen	0.6	FALSE	FALSE	ppm	377	EPA 351.1	ppm	water	DPH	0.1	276	41.78496	-72.70786
pH lab	7.6	FALSE	FALSE	pH unit	377	EPA 150.1	pH unit	water	DPH	1	276	41.78496	-72.70786
Solids, Total Suspended	7	FALSE	FALSE	ppm	377	EPA 160.2	ppm	water	dph	1	276	41.78496	-72.70786
TKN	0.6	FALSE	FALSE	ppm	377	EPA 351.2	ppm	water	DPH	0.1	276	41.78496	-72.70786
Cadmium, Total	0.001	TRUE	FALSE	ppm	377	EPA 200.7	ppm	water	dph	0.001	276	41.78496	-72.70786
Chromium, Total	0.001	TRUE	FALSE	ppm	377	EPA 200.7	ppm	water	dph	0.001	276	41.78496	-72.70786
Copper, Total	0.002	FALSE	FALSE	ppm	377	EPA 200.7	ppm	water	dph	0.001	276	41.78496	-72.70786
Lead, Total	0.001	FALSE	FALSE	ppm	377	EPA 200.9	ppm	water	DPH	0.001	276	41.78496	-72.70786
Nickel, Total	0.001	TRUE	FALSE	ppm	377	EPA 200.7	ppm	water	dph	0.001	276	41.78496	-72.70786
Phosphate as P, Total	0.05	FALSE	FALSE	ppm	377	EPA 365.1	ppm	water	DPH	0.01	276	41.78496	-72.70786
Solids, Total	250	FALSE	FALSE	ppm	377	EPA 160.3	ppm	water	dph	1	276	41.78496	-72.70786
Zinc, Total	0.002	FALSE	FALSE	ppm	377	EPA 200.7	ppm	water	dph	0.002	276	41.78496	-72.70786
Turbidity	4.6	FALSE	FALSE	NTU	377	EPA 180.1	NTU	water	dph	0.1	276	41.78496	-72.70786
Iron, Total	0.044	FALSE	FALSE	ppm	377	Stnd Meth 3111B	ppm	water	dph	0.004	276	41.78496	-72.70786
Aluminum, Total	0.034	FALSE	FALSE	ppm	377	EPA 200.7	ppm	water	dph	0.002	276	41.78496	-72.70786
Cadmium, Dissolved	0.001	TRUE	FALSE	ppm	377	EPA 200.7	ppm	water	dph	0.001	276	41.78496	-72.70786
Chromium, Dissolved	0.001	TRUE	FALSE	ppm	377	EPA 200.7	ppm	water	dph	0.001	276	41.78496	-72.70786

Copper, Dissolved	0.002	FALSE	FALSE	ppm	377	EPA 200.7	ppm	water	DPH	0.001	276	41.78496	-72.70786
Iron, Dissolved	0.046	FALSE	FALSE	ppm	377	EPA 200.7	ppm	water	dph	0.004	276	41.78496	-72.70786
Lead, Dissolved	0.001	TRUE	FALSE	ppm	377	EPA 200.9	ppm	water	DPH	0.001	276	41.78496	-72.70786
Nickel, Dissolved	0.001	TRUE	FALSE	ppm	377	EPA 200.7	ppm	water	DPH	0.001	276	41.78496	-72.70786
Zinc, Dissolved	0.002	FALSE	FALSE	ppm	377	EPA 200.7	ppm	water	dph	0.002	276	41.78496	-72.70786
Aluminum, Dissolved	0.035	FALSE	FALSE	ppm	377	EPA 200.7	ppm	water	dph	0.002	276	41.78496	-72.70786
Cadmium, Dissolved	0.001	TRUE	FALSE	ppm	377	EPA 200.7	ppm	water	dph	0.001	276	41.78496	-72.70786
Chromium, Dissolved	0.001	TRUE	FALSE	ppm	377	EPA 200.7	ppm	water	dph	0.001	276	41.78496	-72.70786
Copper, Dissolved	0.002	FALSE	FALSE	ppm	377	EPA 200.7	ppm	water	DPH	0.001	276	41.78496	-72.70786
Iron, Dissolved	0.044	FALSE	FALSE	ppm	377	EPA 200.7	ppm	water	dph	0.004	276	41.78496	-72.70786
Lead, Dissolved	0.001	TRUE	FALSE	ppm	377	EPA 200.9	ppm	water	DPH	0.001	276	41.78496	-72.70786
Nickel, Dissolved	0.001	TRUE	FALSE	ppm	377	EPA 200.7	ppm	water	DPH	0.001	276	41.78496	-72.70786
Zinc, Dissolved	0.002	FALSE	FALSE	ppm	377	EPA 200.7	ppm	water	dph	0.002	276	41.78496	-72.70786
Aluminum, Dissolved	0.034	FALSE	FALSE	ppm	377	EPA 200.7	ppm	water	dph	0.002	276	41.78496	-72.70786
Total Coliform	10000	FALSE	FALSE	MPN colonies per 100 mls	377	Standard Method 9223B	MPN colonies per 100 mls	water	DPH	10	276	41.78496	-72.70786
Enterococci	74	FALSE	FALSE	mpn per 100 mls	377	ASTM D6503	mpn per 100 mls	water	DPH	10	276	41.78496	-72.70786
Escherichia coli	290	FALSE	FALSE	MPN colonies per 100 mls	377	Standard Method 9223B	MPN colonies per 100 mls	water	DPH	10	276	41.78496	-72.70786
Total Coliform	8700	FALSE	FALSE	MPN colonies per 100 mls	377	Standard Method 9223B	MPN colonies per 100 mls	water	DPH	10	276	41.78496	-72.70786
Enterococci	10	FALSE	FALSE	mpn per 100 mls	377	ASTM D6503	mpn per 100 mls	water	DPH	10	276	41.78496	-72.70786
Escherichia coli	480	FALSE	FALSE	MPN colonies per 100 mls	377	Standard Method 9223B	MPN colonies per 100 mls	water	DPH	10	276	41.78496	-72.70786
Alkalinity	120	FALSE	FALSE	ppm	378	EPA 310.2	ppm	water	DPH	10	277	41.799	-72.71767
Ammonia Nitrogen	0.1	TRUE	FALSE	ppm	378	EPA 350.1	ppm	water	dph	0.1	277	41.799	-72.71767
BOD 5 day	1	TRUE	FALSE	ppm	378	EPA 405.1	ppm	water	dph	1	277	41.799	-72.71767
Chloride	37	FALSE	FALSE	ppm	378	EPA 325.2	ppm	water	DPH	1	277	41.799	-72.71767
Hardness	110	FALSE	FALSE	ppm	378	EPA 130.1	ppm	water	DPH	10	277	41.799	-72.71767
Nitrate as Nitrogen	0.4	FALSE	FALSE	ppm	378	EPA 353.2	ppm	water	DPH	0.1	277	41.799	-72.71767
Nitrite as Nitrogen	0.05	TRUE	FALSE	ppm	378	EPA 353.2	ppm	water	dph	0.05	277	41.799	-72.71767
Organic Nitrogen	0.7	FALSE	FALSE	ppm	378	EPA 351.1	ppm	water	DPH	0.1	277	41.799	-72.71767
pH lab	8.3	FALSE	FALSE	pH unit	378	EPA 150.1	pH unit	water	DPH	1	277	41.799	-72.71767
Solids, Total Suspended	4	FALSE	FALSE	ppm	378	EPA 160.2	ppm	water	dph	1	277	41.799	-72.71767
TKN	0.7	FALSE	FALSE	ppm	378	EPA 351.2	ppm	water	DPH	0.1	277	41.799	-72.71767
Cadmium, Total	0.001	TRUE	FALSE	ppm	378	EPA 200.7	ppm	water	dph	0.001	277	41.799	-72.71767
Chromium, Total	0.001	TRUE	FALSE	ppm	378	EPA 200.7	ppm	water	dph	0.001	277	41.799	-72.71767
Copper, Total	0.003	FALSE	FALSE	ppm	378	EPA 200.7	ppm	water	dph	0.001	277	41.799	-72.71767
Lead, Total	0.001	TRUE	FALSE	ppm	378	EPA 200.9	ppm	water	DPH	0.001	277	41.799	-72.71767
Nickel, Total	0.001	TRUE	FALSE	ppm	378	EPA 200.7	ppm	water	dph	0.001	277	41.799	-72.71767
Phosphate as P, Total	0.05	FALSE	FALSE	ppm	378	EPA 365.1	ppm	water	DPH	0.01	277	41.799	-72.71767
Solids, Total	250	FALSE	FALSE	ppm	378	EPA 160.3	ppm	water	dph	1	277	41.799	-72.71767
Zinc, Total	0.004	FALSE	FALSE	ppm	378	EPA 200.7	ppm	water	dph	0.002	277	41.799	-72.71767
Turbidity	0.9	FALSE	FALSE	NTU	378	EPA 180.1	NTU	water	dph	0.1	277	41.799	-72.71767
Iron, Total	0.136	FALSE	FALSE	ppm	378	Stnd Meth 3111B	ppm	water	dph	0.004	277	41.799	-72.71767
Aluminum, Total	0.048	FALSE	FALSE	ppm	378	EPA 200.7	ppm	water	dph	0.002	277	41.799	-72.71767
Cadmium, Dissolved	0.001	TRUE	FALSE	ppm	378	EPA 200.7	ppm	water	dph	0.001	277	41.799	-72.71767
Chromium, Dissolved	0.001	TRUE	FALSE	ppm	378	EPA 200.7	ppm	water	dph	0.001	277	41.799	-72.71767
Copper, Dissolved	0.002	FALSE	FALSE	ppm	378	EPA 200.7	ppm	water	DPH	0.001	277	41.799	-72.71767
Iron, Dissolved	0.096	FALSE	FALSE	ppm	378	EPA 200.7	ppm	water	dph	0.004	277	41.799	-72.71767
Lead, Dissolved	0.001	TRUE	FALSE	ppm	378	EPA 200.9	ppm	water	DPH	0.001	277	41.799	-72.71767
Nickel, Dissolved	0.001	TRUE	FALSE	ppm	378	EPA 200.7	ppm	water	DPH	0.001	277	41.799	-72.71767
Zinc, Dissolved	0.002	FALSE	FALSE	ppm	378	EPA 200.7	ppm	water	dph	0.002	277	41.799	-72.71767
Aluminum, Dissolved	0.048	FALSE	FALSE	ppm	378	EPA 200.7	ppm	water	dph	0.002	277	41.799	-72.71767
Total Coliform	5500	FALSE	FALSE	MPN colonies per 100 mls	378	Standard Method 9223B	MPN colonies per 100 mls	water	DPH	10	277	41.799	-72.71767
Enterococci	10	TRUE	FALSE	mpn per 100 mls	378	ASTM D6503	mpn per 100 mls	water	DPH	10	277	41.799	-72.71767
Escherichia coli	1400	FALSE	FALSE	MPN colonies per 100 mls	378	Standard Method 9223B	MPN colonies per 100 mls	water	DPH	10	277	41.799	-72.71767
Alkalinity	88	FALSE	FALSE	ppm	377	EPA 310.2	ppm	water	DPH	10	99	41.78496	-72.70786
Ammonia Nitrogen	0.1	TRUE	FALSE	ppm	377	EPA 350.1	ppm	water	dph	0.1	99	41.78496	-72.70786
BOD 5 day	1	TRUE	FALSE	ppm	377	EPA 405.1	ppm	water	dph	1	99	41.78496	-72.70786
Chloride	37	FALSE	FALSE	ppm	377	EPA 325.2	ppm	water	DPH	1	99	41.78496	-72.70786
Hardness	84	FALSE	FALSE	ppm	377	EPA 130.1	ppm	water	DPH	10	99	41.78496	-72.70786

Nitrate as Nitrogen	0.1	TRUE	FALSE	ppm	377	EPA 353.2	ppm	water	DPH	0.1	99	41.78496	-72.70786
Nitrite as Nitrogen	0.05	TRUE	FALSE	ppm	377	EPA 353.2	ppm	water	dph	0.05	99	41.78496	-72.70786
Organic Nitrogen	0.9	FALSE	FALSE	ppm	377	EPA 351.1	ppm	water	DPH	0.1	99	41.78496	-72.70786
pH lab	7.8	FALSE	FALSE	pH unit	377	EPA 150.1	pH unit	water	DPH	1	99	41.78496	-72.70786
Solids, Total Suspended	3	FALSE	FALSE	ppm	377	EPA 160.2	ppm	water	dph	1	99	41.78496	-72.70786
TKN	0.9	FALSE	FALSE	ppm	377	EPA 351.2	ppm	water	DPH	0.1	99	41.78496	-72.70786
Cadmium, Total	0.001	TRUE	FALSE	ppm	377	EPA 200.7	ppm	water	dph	0.001	99	41.78496	-72.70786
Chromium, Total	0.003	FALSE	FALSE	ppm	377	EPA 200.7	ppm	water	dph	0.001	99	41.78496	-72.70786
Copper, Total	0.025	FALSE	FALSE	ppm	377	EPA 200.7	ppm	water	dph	0.001	99	41.78496	-72.70786
Lead, Total	0.001	TRUE	FALSE	ppm	377	EPA 200.9	ppm	water	DPH	0.001	99	41.78496	-72.70786
Nickel, Total	0.002	FALSE	FALSE	ppm	377	EPA 200.7	ppm	water	dph	0.001	99	41.78496	-72.70786
Phosphate as P, Total	0.03	FALSE	FALSE	ppm	377	EPA 365.1	ppm	water	DPH	0.01	99	41.78496	-72.70786
Solids, Total	210	FALSE	FALSE	ppm	377	EPA 160.3	ppm	water	dph	1	99	41.78496	-72.70786
Zinc, Total	0.013	FALSE	FALSE	ppm	377	EPA 200.7	ppm	water	dph	0.002	99	41.78496	-72.70786
Turbidity	2.1	FALSE	FALSE	NTU	377	EPA 180.1	NTU	water	dph	0.1	99	41.78496	-72.70786
Iron, Total	0.26	FALSE	FALSE	ppm	377	Stnd Meth 3111B	ppm	water	dph	0.004	99	41.78496	-72.70786
Cadmium, Dissolved	0.001	TRUE	FALSE	ppm	377	EPA 200.7	ppm	water	dph	0.001	99	41.78496	-72.70786
Chromium, Dissolved	0.003	FALSE	FALSE	ppm	377	EPA 200.7	ppm	water	dph	0.001	99	41.78496	-72.70786
Copper, Dissolved	0.024	FALSE	FALSE	ppm	377	EPA 200.7	ppm	water	DPH	0.001	99	41.78496	-72.70786
Iron, Dissolved	0.2	FALSE	FALSE	ppm	377	EPA 200.7	ppm	water	dph	0.004	99	41.78496	-72.70786
Lead, Dissolved	0.001	FALSE	FALSE	ppm	377	EPA 200.9	ppm	water	DPH	0.001	99	41.78496	-72.70786
Nickel, Dissolved	0.001	FALSE	FALSE	ppm	377	EPA 200.7	ppm	water	DPH	0.001	99	41.78496	-72.70786
Zinc, Dissolved	0.011	FALSE	FALSE	ppm	377	EPA 200.7	ppm	water	dph	0.002	99	41.78496	-72.70786
Total Coliform	410	FALSE	FALSE	MPN colonies per 100 mls	377	Standard Method 9223B	MPN colonies per 100 mls	water	DPH	10	99	41.78496	-72.70786
Enterococci	10	TRUE	FALSE	mpn per 100 mls	377	ASTM D6503	mpn per 100 mls	water	DPH	10	99	41.78496	-72.70786
Escherichia coli	41	FALSE	FALSE	MPN colonies per 100 mls	377	Standard Method 9223B	MPN colonies per 100 mls	water	DPH	10	99	41.78496	-72.70786
Alkalinity	75	FALSE	FALSE	ppm	378	EPA 310.2	ppm	water	DPH	10	100	41.799	-72.71767
Ammonia Nitrogen	0.1	TRUE	FALSE	ppm	378	EPA 350.1	ppm	water	dph	0.1	100	41.799	-72.71767
BOD 5 day	1	TRUE	FALSE	ppm	378	EPA 405.1	ppm	water	dph	1	100	41.799	-72.71767
Chloride	37	FALSE	FALSE	ppm	378	EPA 325.2	ppm	water	DPH	1	100	41.799	-72.71767
Hardness	84	FALSE	FALSE	ppm	378	EPA 130.1	ppm	water	DPH	10	100	41.799	-72.71767
Nitrate as Nitrogen	0.1	TRUE	FALSE	ppm	378	EPA 353.2	ppm	water	DPH	0.1	100	41.799	-72.71767
Nitrite as Nitrogen	0.05	TRUE	FALSE	ppm	378	EPA 353.2	ppm	water	dph	0.05	100	41.799	-72.71767
Organic Nitrogen	0.8	FALSE	FALSE	ppm	378	EPA 351.1	ppm	water	DPH	0.1	100	41.799	-72.71767
pH lab	8	FALSE	FALSE	pH unit	378	EPA 150.1	pH unit	water	DPH	1	100	41.799	-72.71767
Solids, Total Suspended	6	FALSE	FALSE	ppm	378	EPA 160.2	ppm	water	dph	1	100	41.799	-72.71767
TKN	0.8	FALSE	FALSE	ppm	378	EPA 351.2	ppm	water	DPH	0.1	100	41.799	-72.71767
Cadmium, Total	0.001	TRUE	FALSE	ppm	378	EPA 200.7	ppm	water	dph	0.001	100	41.799	-72.71767
Chromium, Total	0.003	FALSE	FALSE	ppm	378	EPA 200.7	ppm	water	dph	0.001	100	41.799	-72.71767
Copper, Total	0.019	FALSE	FALSE	ppm	378	EPA 200.7	ppm	water	dph	0.001	100	41.799	-72.71767
Lead, Total	0.001	TRUE	FALSE	ppm	378	EPA 200.9	ppm	water	DPH	0.001	100	41.799	-72.71767
Nickel, Total	0.001	FALSE	FALSE	ppm	378	EPA 200.7	ppm	water	dph	0.001	100	41.799	-72.71767
Phosphate as P, Total	0.02	FALSE	FALSE	ppm	378	EPA 365.1	ppm	water	DPH	0.01	100	41.799	-72.71767
Solids, Total	200	FALSE	FALSE	ppm	378	EPA 160.3	ppm	water	dph	1	100	41.799	-72.71767
Zinc, Total	0.008	FALSE	FALSE	ppm	378	EPA 200.7	ppm	water	dph	0.002	100	41.799	-72.71767
Turbidity	2.6	FALSE	FALSE	NTU	378	EPA 180.1	NTU	water	dph	0.1	100	41.799	-72.71767
Iron, Total	0.223	FALSE	FALSE	ppm	378	Stnd Meth 3111B	ppm	water	dph	0.004	100	41.799	-72.71767
Cadmium, Dissolved	0.001	TRUE	FALSE	ppm	378	EPA 200.7	ppm	water	dph	0.001	100	41.799	-72.71767
Chromium, Dissolved	0.003	FALSE	FALSE	ppm	378	EPA 200.7	ppm	water	dph	0.001	100	41.799	-72.71767
Copper, Dissolved	0.019	FALSE	FALSE	ppm	378	EPA 200.7	ppm	water	DPH	0.001	100	41.799	-72.71767
Iron, Dissolved	0.178	FALSE	FALSE	ppm	378	EPA 200.7	ppm	water	dph	0.004	100	41.799	-72.71767
Lead, Dissolved	0.001	TRUE	FALSE	ppm	378	EPA 200.9	ppm	water	DPH	0.001	100	41.799	-72.71767
Nickel, Dissolved	0.001	FALSE	FALSE	ppm	378	EPA 200.7	ppm	water	DPH	0.001	100	41.799	-72.71767
Zinc, Dissolved	0.008	FALSE	FALSE	ppm	378	EPA 200.7	ppm	water	dph	0.002	100	41.799	-72.71767
Total Coliform	710	FALSE	FALSE	MPN colonies per 100 mls	378	Standard Method 9223B	MPN colonies per 100 mls	water	DPH	10	100	41.799	-72.71767
Enterococci	10	TRUE	FALSE	mpn per 100 mls	378	ASTM D6503	mpn per 100 mls	water	DPH	10	100	41.799	-72.71767
Escherichia coli	74	FALSE	FALSE	MPN colonies per 100 mls	378	Standard Method 9223B	MPN colonies per 100 mls	water	DPH	10	100	41.799	-72.71767

Tripid	tripdate	run name	samplebysit	station id	StreamName/FacilityName	sitenumber	basinid	proximity	landmark/facility name	Municipality	instream loc	parameterid	parameter	value	unit	method	time
2893	10/8/2008	abm fall macros-2008	14006	2274	North Branch Park River		4404	at	Farmington Avenue (Route 4) behind # 19 Woodland street	Hartford	3	131	water temperature	10.61	degrees C	multi-parameter meter	13:22:34
2893	10/8/2008	abm fall macros-2008	14006	2274	North Branch Park River		4404	at	Farmington Avenue (Route 4) behind # 19 Woodland street	Hartford	3	132	pH	7.63	s.u.	multi-parameter meter	13:22:34
2893	10/8/2008	abm fall macros-2008	14006	2274	North Branch Park River		4404	at	Farmington Avenue (Route 4) behind # 19 Woodland street	Hartford	3	133	dissolved oxygen	10.25	mg/l	multi-parameter meter	13:22:34
2893	10/8/2008	abm fall macros-2008	14006	2274	North Branch Park River		4404	at	Farmington Avenue (Route 4) behind # 19 Woodland street	Hartford	3	134	specific conductance	0.38	ms/cm	multi-parameter meter	13:22:34
2893	10/8/2008	abm fall macros-2008	14006	2274	North Branch Park River		4404	at	Farmington Avenue (Route 4) behind # 19 Woodland street	Hartford	3	162	oxygen saturation	92.2	percent	multi-parameter meter	13:22:34
2893	10/8/2008	abm fall macros-2008	14006	2274	North Branch Park River		4404	at	Farmington Avenue (Route 4) behind # 19 Woodland street	Hartford	3	165	water depth	1.16	feet	multi-parameter meter	13:22:34
2893	10/8/2008	abm fall macros-2008	14006	2274	North Branch Park River		4404	at	Farmington Avenue (Route 4) behind # 19 Woodland street	Hartford	3	169	total dissolved solids	0.247	g/l	multi-parameter meter	13:22:34
2872	9/17/2008	abm fall macros-2008	13863	2741	North Branch Park River		4404	at	Sunny Reach Drive	Bloomfield	3	131	water temperature	17.02	degrees C	multi-parameter meter	8:59:57
2872	9/17/2008	abm fall macros-2008	13863	2741	North Branch Park River		4404	at	Sunny Reach Drive	Bloomfield	3	132	pH	7.33	s.u.	multi-parameter meter	8:59:57
2872	9/17/2008	abm fall macros-2008	13863	2741	North Branch Park River		4404	at	Sunny Reach Drive	Bloomfield	3	133	dissolved oxygen	9.76	mg/l	multi-parameter meter	8:59:57
2872	9/17/2008	abm fall macros-2008	13863	2741	North Branch Park River		4404	at	Sunny Reach Drive	Bloomfield	3	134	specific conductance	0.336	ms/cm	multi-parameter meter	8:59:57
2872	9/17/2008	abm fall macros-2008	13863	2741	North Branch Park River		4404	at	Sunny Reach Drive	Bloomfield	3	162	oxygen saturation	101.1	percent	multi-parameter meter	8:59:57
2872	9/17/2008	abm fall macros-2008	13863	2741	North Branch Park River		4404	at	Sunny Reach Drive	Bloomfield	3	165	water depth	0.897	feet	multi-parameter meter	8:59:57
2872	9/17/2008	abm fall macros-2008	13863	2741	North Branch Park River		4404	at	Sunny Reach Drive	Bloomfield	3	169	total dissolved solids	0.218	g/l	multi-parameter meter	8:59:57
150	9/27/1999	Quarterly Monitoring (Summer)	680	377	North Branch Park River	NPR1	4404	downstream	Albany Avenue	Hartford	3	131	Water Temperature	13.99	degrees C	multi-parameter meter	8:35:00 AM
150	9/27/1999	Quarterly Monitoring (Summer)	680	377	North Branch Park River	NPR1	4404	downstream	Albany Avenue	Hartford	3	132	pH	6.1	pH unit	multi-parameter meter	8:35:00 AM
150	9/27/1999	Quarterly Monitoring (Summer)	680	377	North Branch Park River	NPR1	4404	downstream	Albany Avenue	Hartford	3	133	Dissolved Oxygen	9.22	mg/l	multi-parameter meter	8:35:00 AM
150	9/27/1999	Quarterly Monitoring (Summer)	680	377	North Branch Park River	NPR1	4404	downstream	Albany Avenue	Hartford	3	134	Specific Conductance	0.352	ms/cm	multi-parameter meter	8:35:00 AM
150	9/27/1999	Quarterly Monitoring (Summer)	680	377	North Branch Park River	NPR1	4404	downstream	Albany Avenue	Hartford	3	162	oxygen saturation	89.3	Percent	multi-parameter meter	8:35:00 AM
150	9/27/1999	Quarterly Monitoring (Summer)	681	378	North Branch Park River	NPR2	4404	downstream	upper campus road at University of Hartford	Hartford	3	131	Water Temperature	14.2	degrees C	multi-parameter meter	9:10:00 AM
150	9/27/1999	Quarterly Monitoring (Summer)	681	378	North Branch Park River	NPR2	4404	downstream	upper campus road at University of Hartford	Hartford	3	132	pH	7.27	pH unit	multi-parameter meter	9:10:00 AM
150	9/27/1999	Quarterly Monitoring (Summer)	681	378	North Branch Park River	NPR2	4404	downstream	upper campus road at University of Hartford	Hartford	3	133	Dissolved Oxygen	10.51	mg/l	multi-parameter meter	9:10:00 AM
150	9/27/1999	Quarterly Monitoring (Summer)	681	378	North Branch Park River	NPR2	4404	downstream	upper campus road at University of Hartford	Hartford	3	134	Specific Conductance	0.34	ms/cm	multi-parameter meter	9:10:00 AM
150	9/27/1999	Quarterly Monitoring (Summer)	681	378	North Branch Park River	NPR2	4404	downstream	upper campus road at University of Hartford	Hartford	3	162	oxygen saturation	102.2	Percent	multi-parameter meter	9:10:00 AM
74	6/16/1999	Quarterly Monitoring (Spring)	276	377	North Branch Park River	NPR1	4404	downstream	Albany Avenue	Hartford	3	131	Water Temperature	20.6	degrees C	multi-parameter meter	12:00:00 PM
74	6/16/1999	Quarterly Monitoring (Spring)	276	377	North Branch Park River	NPR1	4404	downstream	Albany Avenue	Hartford	3	132	pH	7.52	pH unit	multi-parameter meter	12:00:00 PM
74	6/16/1999	Quarterly Monitoring (Spring)	276	377	North Branch Park River	NPR1	4404	downstream	Albany Avenue	Hartford	3	133	Dissolved Oxygen	6.33	mg/l	multi-parameter meter	12:00:00 PM
74	6/16/1999	Quarterly Monitoring (Spring)	276	377	North Branch Park River	NPR1	4404	downstream	Albany Avenue	Hartford	3	134	Specific Conductance	0.392	ms/cm	multi-parameter meter	12:00:00 PM
74	6/16/1999	Quarterly Monitoring (Spring)	276	377	North Branch Park River	NPR1	4404	downstream	Albany Avenue	Hartford	3	135	ORP	0.214	mv	multi-parameter meter	12:00:00 PM
74	6/16/1999	Quarterly Monitoring (Spring)	276	377	North Branch Park River	NPR1	4404	downstream	Albany Avenue	Hartford	3	165	water depth	1	feet	estimate	12:00:00 PM
74	6/16/1999	Quarterly Monitoring (Spring)	277	378	North Branch Park River	NPR2	4404	downstream	upper campus road at University of Hartford	Hartford	3	131	Water Temperature	18.92	degrees C	multi-parameter meter	11:45:00 AM
74	6/16/1999	Quarterly Monitoring (Spring)	277	378	North Branch Park River	NPR2	4404	downstream	upper campus road at University of Hartford	Hartford	3	132	pH	8.27	pH unit	multi-parameter meter	11:45:00 AM
74	6/16/1999	Quarterly Monitoring (Spring)	277	378	North Branch Park River	NPR2	4404	downstream	upper campus road at University of Hartford	Hartford	3	133	Dissolved Oxygen	10.95	mg/l	multi-parameter meter	11:45:00 AM
74	6/16/1999	Quarterly Monitoring (Spring)	277	378	North Branch Park River	NPR2	4404	downstream	upper campus road at University of Hartford	Hartford	3	134	Specific Conductance	0.393	ms/cm	multi-parameter meter	11:45:00 AM
74	6/16/1999	Quarterly Monitoring (Spring)	277	378	North Branch Park River	NPR2	4404	downstream	upper campus road at University of Hartford	Hartford	3	135	ORP	0.185	mv	multi-parameter meter	11:45:00 AM
74	6/16/1999	Quarterly Monitoring (Spring)	277	378	North Branch Park River	NPR2	4404	downstream	upper campus road at University of Hartford	Hartford	3	165	water depth	1	feet	estimate	11:45:00 AM
29	3/30/1999	Quarterly Monitoring (Winter)	99	377	North Branch Park River	NPR1	4404	downstream	Albany Avenue	Hartford	3	131	Water Temperature	8.17	degrees C	multi-parameter meter	8:45:00 AM
29	3/30/1999	Quarterly Monitoring (Winter)	99	377	North Branch Park River	NPR1	4404	downstream	Albany Avenue	Hartford	3	133	Dissolved Oxygen	13.19	mg/l	multi-parameter meter	8:45:00 AM
29	3/30/1999	Quarterly Monitoring (Winter)	99	377	North Branch Park River	NPR1	4404	downstream	Albany Avenue	Hartford	3	134	Specific Conductance	0.313	ms/cm	multi-parameter meter	8:45:00 AM
29	3/30/1999	Quarterly Monitoring (Winter)	99	377	North Branch Park River	NPR1	4404	downstream	Albany Avenue	Hartford	3	135	ORP	0.294	mv	multi-parameter meter	8:45:00 AM
29	3/30/1999	Quarterly Monitoring (Winter)	99	377	North Branch Park River	NPR1	4404	downstream	Albany Avenue	Hartford	3	165	water depth	1	feet	estimate	8:45:00 AM
29	3/30/1999	Quarterly Monitoring (Winter)	100	378	North Branch Park River	NPR2	4404	downstream	upper campus road at University of Hartford	Hartford	5	131	Water Temperature	8.36	degrees C	multi-parameter meter	9:15:00 AM
29	3/30/1999	Quarterly Monitoring (Winter)	100	378	North Branch Park River	NPR2	4404	downstream	upper campus road at University of Hartford	Hartford	5	132	pH	6.89	pH unit	multi-parameter meter	9:15:00 AM
29	3/30/1999	Quarterly Monitoring (Winter)	100	378	North Branch Park River	NPR2	4404	downstream	upper campus road at University of Hartford	Hartford	5	133	Dissolved Oxygen	13.47	mg/l	multi-parameter meter	9:15:00 AM
29	3/30/1999	Quarterly Monitoring (Winter)	100	378	North Branch Park River	NPR2	4404	downstream	upper campus road at University of Hartford	Hartford	5	134	Specific Conductance	0.303	ms/cm	multi-parameter meter	9:15:00 AM
29	3/30/1999	Quarterly Monitoring (Winter)	100	378	North Branch Park River	NPR2	4404	downstream	upper campus road at University of Hartford	Hartford	5	135	ORP	0.249	mv	multi-parameter meter	9:15:00 AM
29	3/30/1999	Quarterly Monitoring (Winter)	100	378	North Branch Park River	NPR2	4404	downstream	upper campus road at University of Hartford	Hartford	5	165	water depth	0.5	feet	estimate	9:15:00 AM

name	DEPstationid	collectiondate	sitenumber	StreamName/FacilityName	basinid	proximity	landmark/facility name	Municipality	organism	common name	category	panelnumber	YLat	XLong	305b segment
Park River Assessment Program	2274	9/20/2008		North Branch Park River	4404	at	Farmington Avenue (Route 4) behind # 19 Woodland street	Hartford	Amphipod	Amphipod, Scud	least wanted	15A	41.76722631	-72.70326783	CT4404-00_02
Park River Assessment Program	2274	9/20/2008		North Branch Park River	4404	at	Farmington Avenue (Route 4) behind # 19 Woodland street	Hartford	Bivalves	Freshwater clams and mussels	other	Other	41.76722631	-72.70326783	CT4404-00_02
Park River Assessment Program	2274	9/20/2008		North Branch Park River	4404	at	Farmington Avenue (Route 4) behind # 19 Woodland street	Hartford	Chimarra	Orange Head Caddisfly	moderately wanted	10	41.76722631	-72.70326783	CT4404-00_02
Park River Assessment Program	2274	9/20/2008		North Branch Park River	4404	at	Farmington Avenue (Route 4) behind # 19 Woodland street	Hartford	Crayfish	Crayfish	other	Other	41.76722631	-72.70326783	CT4404-00_02
Park River Assessment Program	2274	9/20/2008		North Branch Park River	4404	at	Farmington Avenue (Route 4) behind # 19 Woodland street	Hartford	Elmids	Riffle Beetles	other	Other	41.76722631	-72.70326783	CT4404-00_02
Park River Assessment Program	2274	9/20/2008		North Branch Park River	4404	at	Farmington Avenue (Route 4) behind # 19 Woodland street	Hartford	Hydropsychidae	Common Net Spinner	moderately wanted	9	41.76722631	-72.70326783	CT4404-00_02
Park River Assessment Program	2274	9/20/2008		North Branch Park River	4404	at	Farmington Avenue (Route 4) behind # 19 Woodland street	Hartford	Isopod	Aquatic Sowbug	least wanted	15B	41.76722631	-72.70326783	CT4404-00_02
Park River Assessment Program	2274	9/20/2008		North Branch Park River	4404	at	Farmington Avenue (Route 4) behind # 19 Woodland street	Hartford	Leech	Leech	least wanted	15C	41.76722631	-72.70326783	CT4404-00_02
Park River Assessment Program	2274	9/20/2008		North Branch Park River	4404	at	Farmington Avenue (Route 4) behind # 19 Woodland street	Hartford	Midge	Midge	least wanted	15D	41.76722631	-72.70326783	CT4404-00_02
Park River Assessment Program	2274	9/20/2008		North Branch Park River	4404	at	Farmington Avenue (Route 4) behind # 19 Woodland street	Hartford	Odonata	Dragonfly and Damselfly Nymphs	moderately wanted	14	41.76722631	-72.70326783	CT4404-00_02
Park River Assessment Program	2274	9/20/2008		North Branch Park River	4404	at	Farmington Avenue (Route 4) behind # 19 Woodland street	Hartford	Planaria	Flat worm	other	Other	41.76722631	-72.70326783	CT4404-00_02
Park River Assessment Program	2274	9/20/2008		North Branch Park River	4404	at	Farmington Avenue (Route 4) behind # 19 Woodland street	Hartford	Snail	Snail	least wanted	15F	41.76722631	-72.70326783	CT4404-00_02
Park River Assessment Program	2274	9/20/2008		North Branch Park River	4404	at	Farmington Avenue (Route 4) behind # 19 Woodland street	Hartford	Stenonema	Flat Headed Mayfly	moderately wanted	11	41.76722631	-72.70326783	CT4404-00_02
Park River Assessment Program	2783	9/20/2008		North Branch Park River	4404	behind	Watkinson School	Hartford	Amphipod	Amphipod, Scud	least wanted	15A	41.79368	-72.71084	Needs
Park River Assessment Program	2783	9/20/2008		North Branch Park River	4404	behind	Watkinson School	Hartford	Bivalves	Freshwater clams and mussels	other	Other	41.79368	-72.71084	Needs
Park River Assessment Program	2783	9/20/2008		North Branch Park River	4404	behind	Watkinson School	Hartford	Elmids	Riffle Beetles	other	Other	41.79368	-72.71084	Needs
Park River Assessment Program	2783	9/20/2008		North Branch Park River	4404	behind	Watkinson School	Hartford	Leech	Leech	least wanted	15C	41.79368	-72.71084	Needs
Park River Assessment Program	2783	9/20/2008		North Branch Park River	4404	behind	Watkinson School	Hartford	Psephenus	Water Penny Beetle Larva	moderately wanted	12	41.79368	-72.71084	Needs
Park River Assessment Program	2783	9/20/2008		North Branch Park River	4404	behind	Watkinson School	Hartford	Snail	Snail	least wanted	15F	41.79368	-72.71084	Needs
Park River Assessment Program	2783	9/20/2008		North Branch Park River	4404	behind	Watkinson School	Hartford	Stenonema	Flat Headed Mayfly	moderately wanted	11	41.79368	-72.71084	Needs
Park River Assessment Program	2783	9/20/2008		North Branch Park River	4404	behind	Watkinson School	Hartford	Worm	Aquatic Earthworm	least wanted	15G	41.79368	-72.71084	Needs

FUSS & O'NEILL

Appendix D

Trinity College Water Quality Monitoring Results

TRINITY COLLEGE ENVIRONMENTAL SCIENCE PROGRAM

Baseline Water Quality Analysis of the North Branch of the Park River Watershed

Summer 2008

Project Supervisor: Dr. Jonathan R. Gourley

Student summer researchers
Victoria Done
Andrew Kennedy
Caroline Lewis
Jeffrey McNamara
Lucy Schiffman

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TRINITY COLLEGE ENVIRONMENTAL SCIENCE PROGRAM

Executive Summary

For the North Branch Park River and Tributaries

Dr. Jonathan R. Gourley

7/24/2008

This report presents the results of water quality data collected by five undergraduate research students from Trinity College in the North Branch sub-basin of the Park River Watershed (Fig. 1-A). The sampling period was between May 19, 2008 and July 14, 2008 and covered twelve sites from the headwaters of the watershed to the main trunk of the North Branch of the Park River. This sampling was conducted as an in-kind service to Fuss & O'Neill and the Farmington River Watershed Association for the North Branch of the Park River Watershed Management Plan. The report is designed to provide the management team with baseline data of several basic water quality parameters for the purpose of understanding the expected conditions of the watershed in general and to highlight potential locations for further in-depth study. The reported data include: temperature, pH, conductivity, total dissolved solids (TDS), salinity, dissolved oxygen (DO), hardness, major anions (chloride, nitrates and sulfates), fecal coliform, and macroinvertebrates.

Our overall assessment of the watershed during the study period is good, especially when comparing results to similar water analyses in the South Branch of the Park River. The majority of the sub-basin's area drains rural to suburban landscapes with only the most downstream reaches flowing though urban neighborhoods.

We present all of our data with respect to both location and time. In order to make spatial plots useful to the reader, all sites were given a numeric position relative to its location with respect to the headwaters. The position assignments are listed in Table A-1 along with site code names. These positions are used throughout the report when plotting data from upstream to downstream. In addition we have standardized the plot symbols for each tributary so that the reader may quickly recognize data from a particular section of the river. For example all Wash Brook data is plotted with green triangles. Some storm water was collected throughout the summer using a flow triggered auto-sampler. These results are distinguished from baseline data using a different color scheme.

In general, pH values are consistent over the study period but conductivity, TDS and salinity data decrease steadily. However anions such as a chloride, nitrate and sulfate clearly increase spatially from the headwaters to the main trunk of the North Branch. Anions concentrations in the Tumble Brook just downstream of the Tumble Brook and Wampanoag golf course (site ETB 6) show higher values compared to the overall trend. These results are not surprising considering the assumed run-off of fertilizers from the golf courses.

We would like to recommend further study of Filley Brook, a small yet noticeably and consistently more polluted section of the watershed than the other tributaries. Macroinvertebrates were not collected successfully at this site due to stagnant flows and a deep muddy bottom. However, chemical parameters of the site EFB 11 returned values higher than expected. It is not clear at the moment what the source(s) of pollution are in Filley Brook.

All questions or comment about this report should be directed to:

Dr. Jonathan R. Gourley, Trinity College Environmental Science Program
300 Summit Street, Hartford, CT 06106 (860) 297-4128 jonathan.gourley@trincoll.edu

Table A-1. Key to Site locations and downstream position (for the purpose of graphing data) of sampling locations on the North Branch of the Park River at its tributaries. See Map (Fig. A-1) for spatial reference.

Name of Site	Position	Code Name
Top of Park River	**5**	**TNBPR 1**
Middle of Park River	**6**	**MNBPR 2**
Middle of Park River	**7**	**MNBPR 3**
End of Park River	**8**	**ENBPR 4**
Top of Tumble Brook	**1**	**TTB 5**
Middle of Tumble Brook	**2**	**MTB 5.5**
End of Tumble Brook	**3**	**ETB 6**
Top of Wash Brook	**2**	**TWB 7**
End of Wash Brook	**3.5**	**EWB 8**
Top of Beamans Brook	**2**	**TBB 9**
End of Beamans Brook	**3**	**EBB 10**
End of Filley Brook	**4**	**EFB 11**

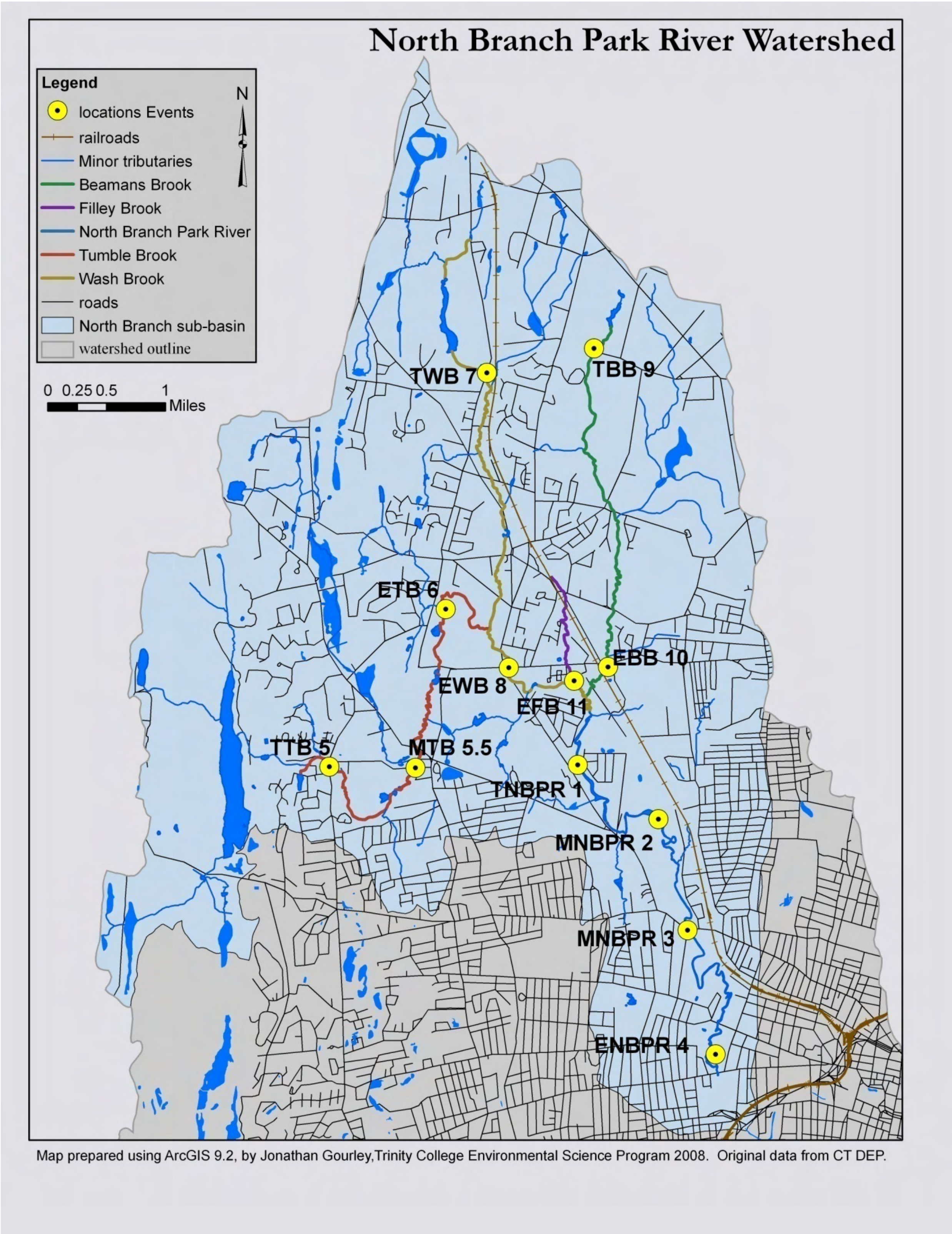


Figure A-1. Sampling site locations for North Branch or the Park River and its tributaries.

TRINITY COLLEGE ENVIRONMENTAL SCIENCE PROGRAM

Part I: A Chemical Water Quality Assessment

For the North Branch Park River and Tributaries

Data Preparer: Victoria Doñé
Assistants: Lucy Schiffman, Jeffrey McNamara, Caroline Lewis, Andrew Kennedy
Project Supervisor: Dr. Jonathan Gourley
7/24/2008

Discussion

After data collection was finished, the three readings were averaged together and standard deviation was derived. The data was then graphed in two different ways. The first graph of each parameter portrays the data by tributary and its location in the watershed so it is possible to observe how data changes along the watershed. Each site has its own position number according to how far upstream or downstream it is in the watershed. For example, the most upstream site has a value of 1 and the most downstream site has a value of 8. The second graph of each parameter portrays the changes over time. All of the raw data is in the form of data tables by tributary. Graphs 1 and 2 show the pH values graphed both ways. Both have a general trend of not showing any change over time or along the watershed. There are no clear outliers present. Therefore the results show that there are not any abnormalities concerning pH values in any of the tributaries.

Graphs 3 and 4 illustrate temperature readings for the tributaries. Graph 3 has a slight decreasing trend but when the data is graphed over time, there is an upward trend over the study period. Graphs 5, 7, 9, and 11 are the graphs for TDS, salinity, conductivity, and hardness respectively and show how these parameters change through the watershed. None of these graphs really have very strong consistent trends. Salinity is the only parameter with a trend. It has a slightly increasing trend across the watershed which could be due to the fact that the Park River is a more urban setting than its tributaries. However when these parameters are graphed over time, there is an obvious decreasing trend. This is illustrated in graphs 6, 8, 10, and 12.

However, Filley Brook site's data shows an increasing trend in these graphs. This site seems to be the most polluted; the water is very turbid and it has a pungent odor. It is located between parking lots and a large apartment complex whose storm water runoff could be contributing to the condition of the site. This also may account for the abnormal increasing trends. Also there is an outlier present in the TDS, conductivity, and salinity graphs. According to tables 11, 16, and 21, this data was collected on June 16th at site MNBPR 2 which is located in the University Hartford. This site is adjacent to several parking lots and a road so perhaps that could have influenced these high readings. This data could also be a result of the equipment malfunctioning on that particular day because the rest of the data for the site is normal.

The last four graphs show dissolved oxygen in both % air saturation and in mg/L. Graphs 13 and 15, which show the dissolved oxygen readings across the watershed, do not have a clear trend. When graphed over time (graphs 14 and 16) the results show a trend that decreases and then instantly increases. In fact DO readings are dependent on the temperature of the water (EPA, 2006) because warm water holds less dissolved oxygen than cold water. Graphs 14 and 16 should look like the TDS, conductivity, salinity, and hardness graphs and have a clear decreasing trend. This could be something significant in the quality of the water or the DO meter could have malfunctioned during that period of testing. Also some of the DO readings are very low when they should not be. For example, table 39 shows that the readings for TBB 9 change from 2.6 to 6.77 in one week which does not seem plausible because the most of the other readings are more or less stable. The meter constantly flashed error messages and despite some of our attempts to try and clean the probe, it would still malfunction and take long periods of time to stabilize.

The results and data convey that the water quality of the North Branch Park River watershed is good. The results all fall within the normal range of good water quality set forth by the EPA. These standards encompass both the Drinking Water Standard and the Biological Standards. The EPA standard for pH is between 6.5 – 8.5 and all of the sites fall within this range (EPA, 2006). The EPA standard for conductivity is between 150 – 500 µS/cm and most of the sites fall within this range or close to it, therefore the conductivity is normal for the watershed (EPA, 2006). This also can be said about the EPA standard for TDS (total dissolved solids). The maximum contaminant level for TDS is 500 ppm and none of the values for the site come close to the MCL (EPA, 2006). The salinity values also do not show any abnormalities. The normal temperature standards are more difficult to determine than the other parameters because different species of fish and macroinvertebrates can thrive in different temperatures but none of the temperature readings are high enough to cause alarm (EPA, 2006). Out of all of the data the dissolved oxygen readings are among the least reliable. Most of the readings do fall within the range or are close to the range that the EPA set forth which is 6 – 15 mg/L (EPA, 2007). However the Filley Brook site falls well below the EPA standard (see table 40) but this was expected because it is believed to be polluted. Other sites like ETB 6 had one of the largest macroinvertebrate populations but it had a DO reading of 0.76 mg/L but this could be due to improper instrument calibration.

Results

Sample Graph

This graph shows a complete legend that is consistent with the other graphs.

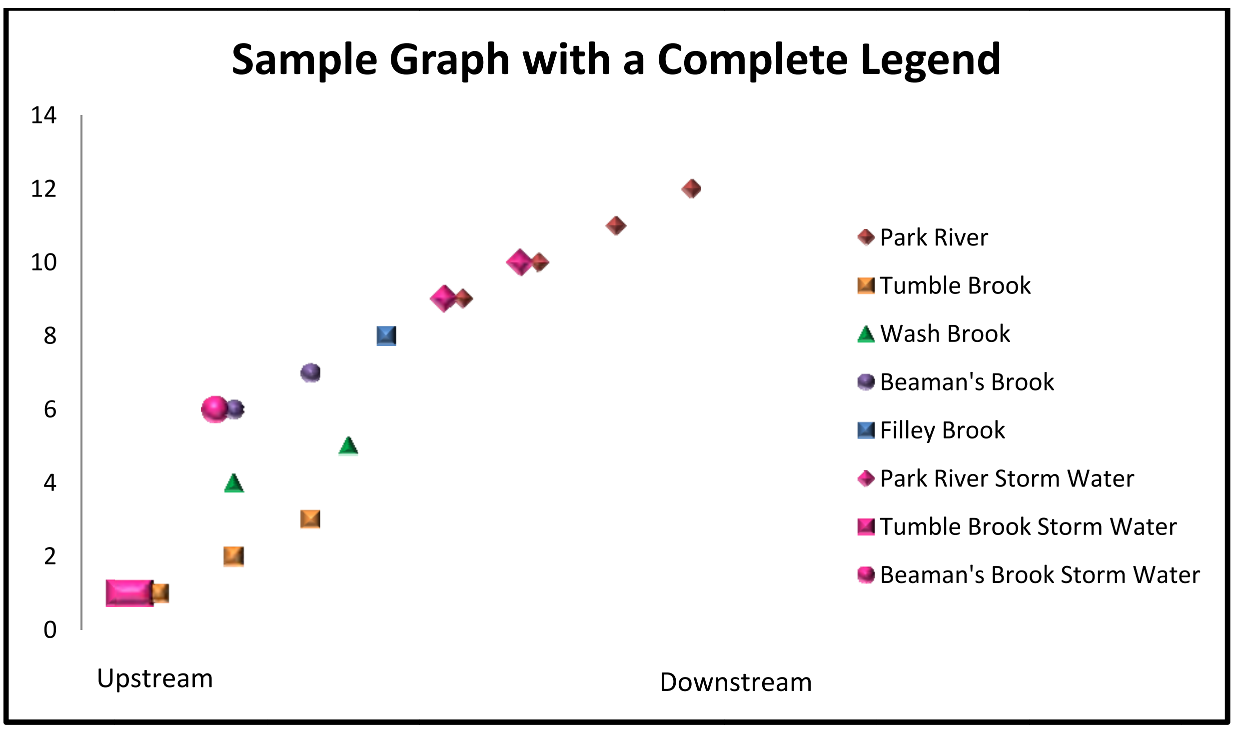
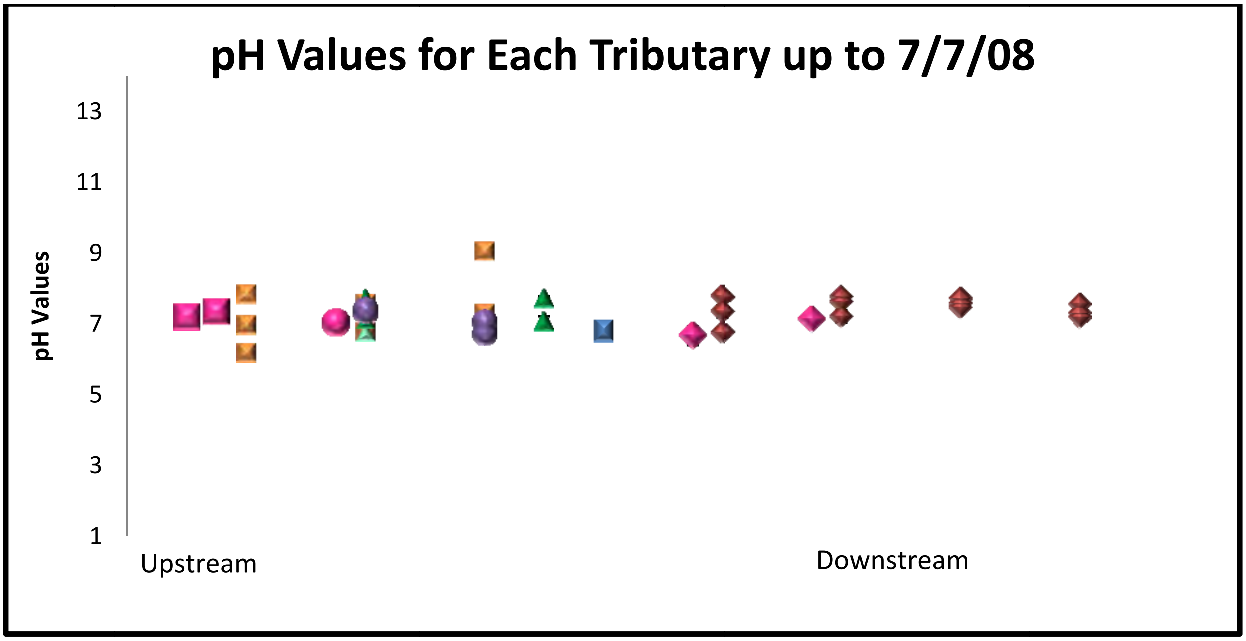


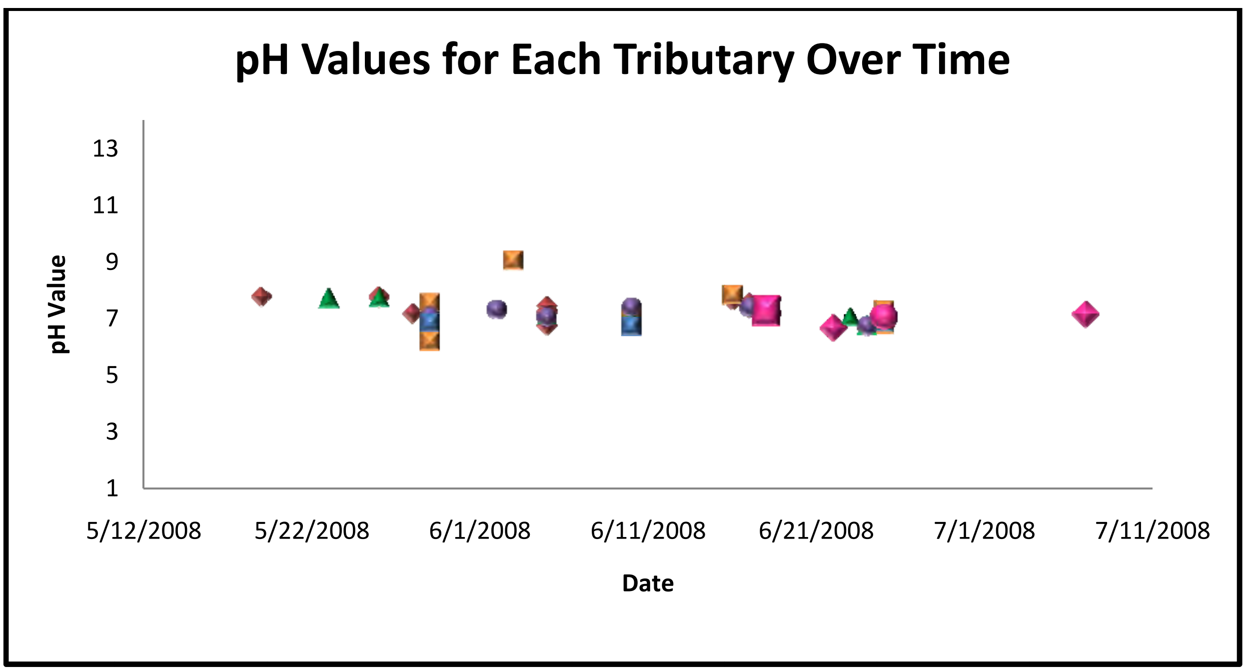
Table Information

Position refers to how upstream or downstream a site is in the watershed. The positions can run from 1 to 8. For example, a site with a position of 1 is at the top of the watershed while a position of 8 means the site is at the very end of the watershed.

Graphs and Tables for pH Values



Graph 1: This graph shows the pH values by tributary.



Graph 2: This graph shows the pH values over time for each site.

Table 1: pH values for the North Branch of the Park River

Date	Site	Position	Average pH	SD
5/19/2008	TNBPR 1	5	7.77	0.05
5/26/2008	MNBPR 2	6	7.78	0.1
5/26/2008	MNBPR 3	7	7.72	0.09
5/28/2008	ENBPR 4	8	7.18	0.01
5/29/2008	TNBPR 1	5	7.34	0.17
6/5/2008	TNBPR 1	5	6.75	0.05
6/5/2008	ENBPR 4	8	7.29	0.01
6/5/2008	MNBPR 3	7	7.46	0.06
6/5/2008	MNBPR 2	6	7.21	0.18
6/16/2008	MNBPR 2	6	7.64	0.05
6/17/2008	TNBPR 1	5	7.35	0.03
6/17/2008	MNBPR 3	7	7.57	0.01
6/17/2008	ENBPR 4	8	7.55	0.03
Storm Water				
6/22/2008	TNBPR 1	4.75	6.66	0.26
7/7/2008	MNBPR 2	5.75	7.13	0.01

Table 2: pH values for Tumble Brook

Date	Site	Position	Average pH	SD
5/29/2008	TTB 5	1	6.19	0.11
5/29/2008	MTB 5.5	2	7.56	0.05
6/3/2008	ETB 6	3	9.06	0.06
6/10/2008	MTB 5.5	2	6.78	0.16
6/10/2008	TTB 5	1	6.97	0.4
6/10/2008	ETB 6	3	7.13	0.06
6/16/2008	TTB 5	1	7.84	0.02
6/25/2008	MTB 5.5	2	6.77	0.15
6/25/2008	ETB 6	3	7.3	0.17
Storm Water				
6/18/2008	TTB Storm 1	0.5	7.19	0.08
6/18/2008	TTB Storm 2	0.75	7.33	0.01

Table 3: pH values for Wash Brook

Date	Site	Position	Average pH	SD
5/23/2008	TWB 7	2	7.71	0.03
5/26/2008	EWB 8	3.5	7.73	0.05
6/5/2008	EWB 8	3.5	7.1	0.12
6/10/2008	TWB 7	2	7.1	0
6/23/2008	EWB 8	3.5	7.06	0.05
6/24/2008	TWB 7	2	6.77	0.04

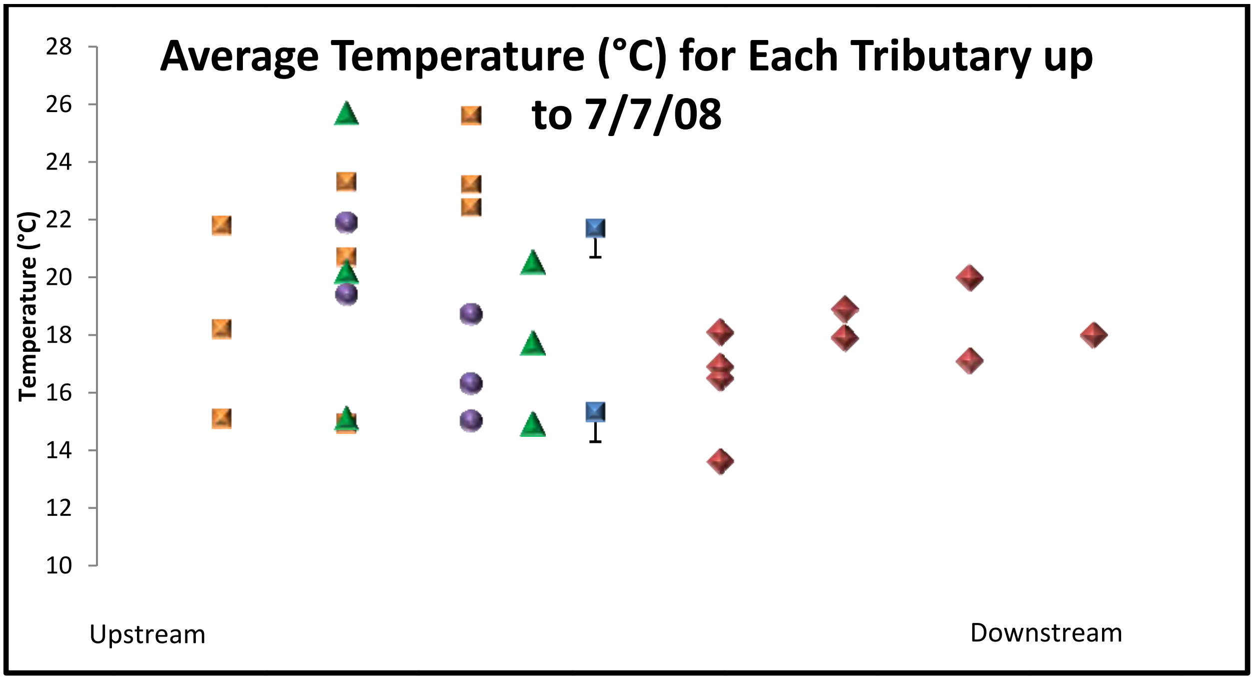
Table 4: pH values for Beaman's Brook

Date	Site	Position	Average pH	SD
5/29/2008	EBB 10	3	7.07	0.02
6/2/2008	TBB 9	2	7.32	0.13
6/5/2008	EBB 10	3	7.04	0.13
6/10/2008	TBB 9	2	7.4	0
6/17/2008	TBB 9	2	7.4	0.02
6/24/2008	EBB 10	3	6.73	0.1
Storm Water				
6/25/2008	TBB 9	1.75	7.04	0.05

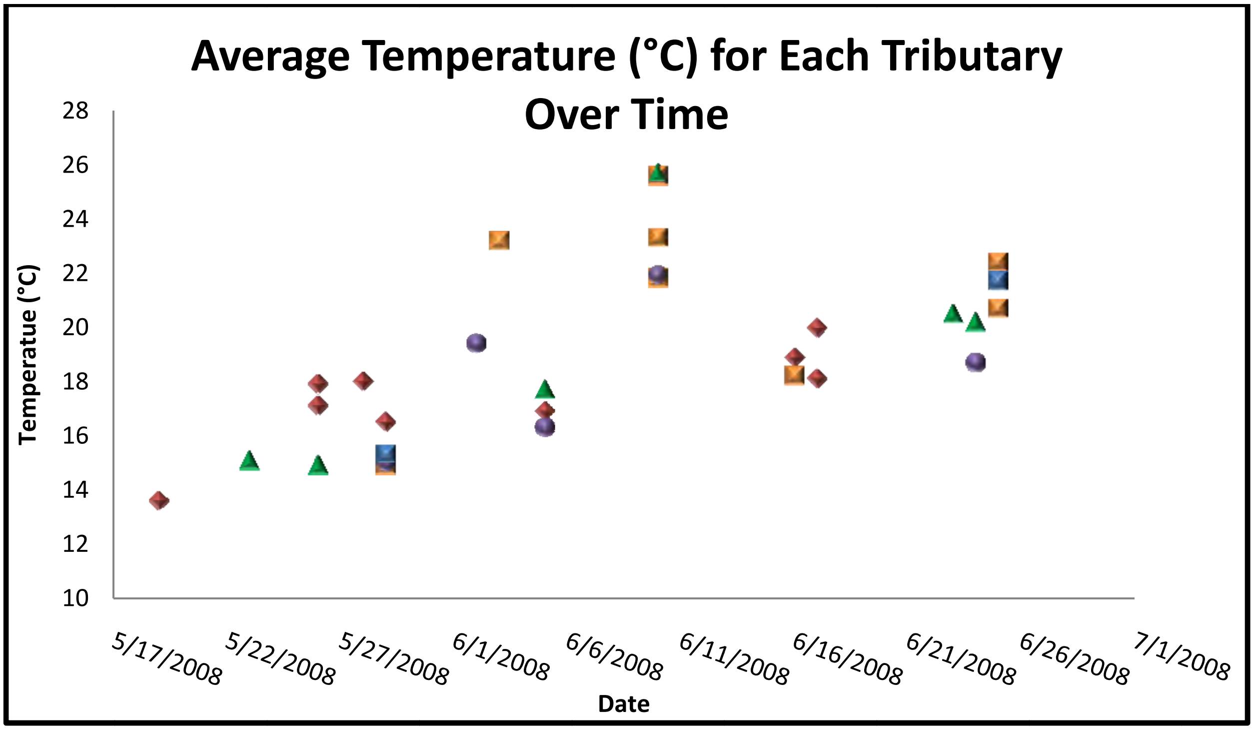
Table 5: pH values for Filley Brook

Date	Site	Position	Average pH	SD
5/29/2008	EFB 11	4	6.84	0.03
6/10/2008	EFB 11	4	6.73	0.06
6/25/2008	EFB 11	4	6.83	0.06

Graphs and Tables for the Average Temperatures



Graph 3: This graph shows the temperature in °C for each tributary.



Graph 4: This graph shows the temperature in °C of each tributary over time.

Table 6: Average temperature values in °C for the North Branch of the Park River

Date	Site	Position	Average T	SD
5/19/2008	TNBPR 1	5	13.6	0.1
5/26/2008	MNBPR 2	6	17.9	0.1
5/26/2008	MNBPR 3	7	17.1	0.1
5/28/2008	ENBPR 4	8	18	0
5/29/2008	TNBPR 1	5	16.5	0.1
6/5/2008	TNBPR 1	5	16.9	0.1
6/16/2008	MNBPR 2	6	18.9	0.1
6/17/2008	TNBPR 1	5	18.1	0.1
6/17/2008	MNBPR 3	7	20	0

Table 7: Average temperature values in °C for Tumble Brook

Date	Site	Position	Average T	SD
5/29/2008	TTB 5	1	15.1	0.1
5/29/2008	MTB 5.5	2	14.9	0.1
6/3/2008	ETB 6	3	23.2	0.1
6/10/2008	MTB 5.5	2	23.3	0.1
6/10/2008	TTB 5	1	21.8	0
6/10/2008	ETB 6	3	25.6	0
6/16/2008	TTB 5	1	18.2	0.1
6/25/2008	MTB 5.5	2	20.7	0.1
6/25/2008	ETB 6	3	22.4	0.1

Table 8: Average temperature values in °C for Wash Brook

Date	Site	Position	Average T	SD
5/23/2008	TWB 7	2	15.1	0.1
5/26/2008	EWB 8	3.5	14.9	0.1
6/5/2008	EWB 8	3.5	17.7	0.1
6/10/2008	TWB 7	2	25.7	0
6/23/2008	EWB 8	3.5	20.5	0.1
6/24/2008	TWB 7	2	20.2	0

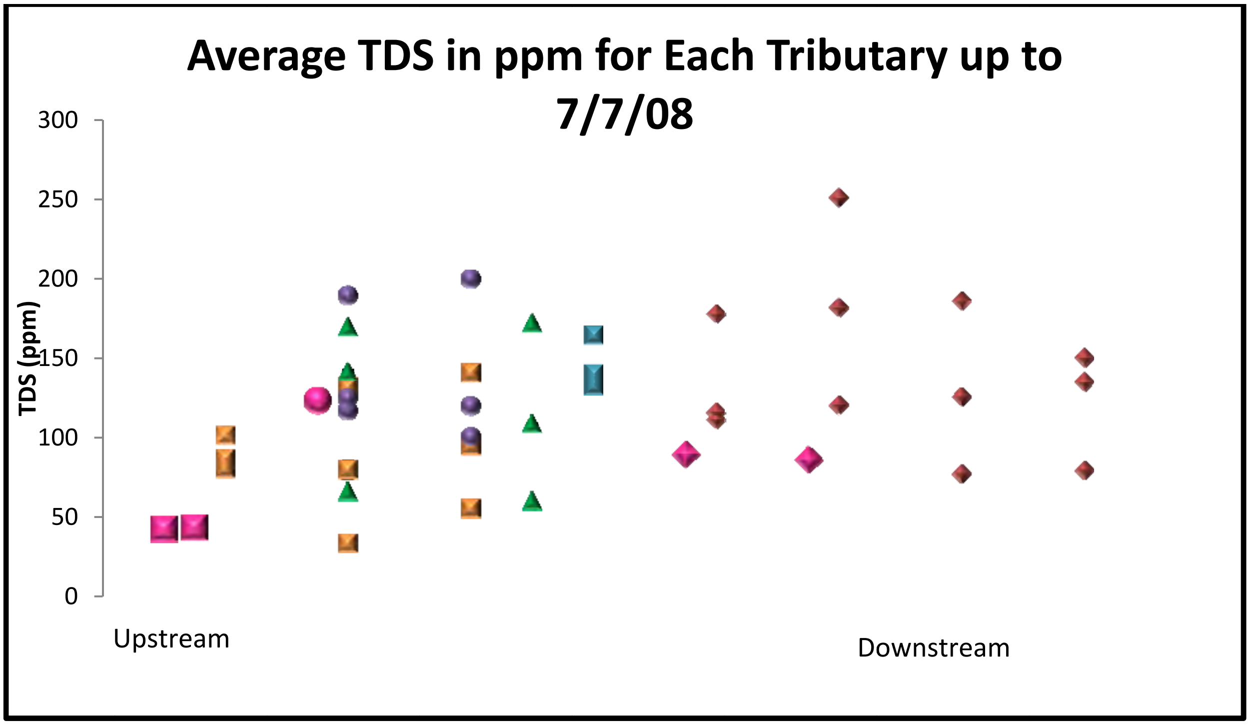
Table 9: Average temperature values in °C for Beaman's Brook

Date	Site	Position	Average T	SD
5/29/2008	EBB 10	3	15	0
6/2/2008	TBB 9	2	19.4	0.1
6/5/2008	EBB 10	3	16.3	0
6/10/2008	TBB 9	2	21.9	0
6/24/2008	EBB 10	3	18.7	0.1

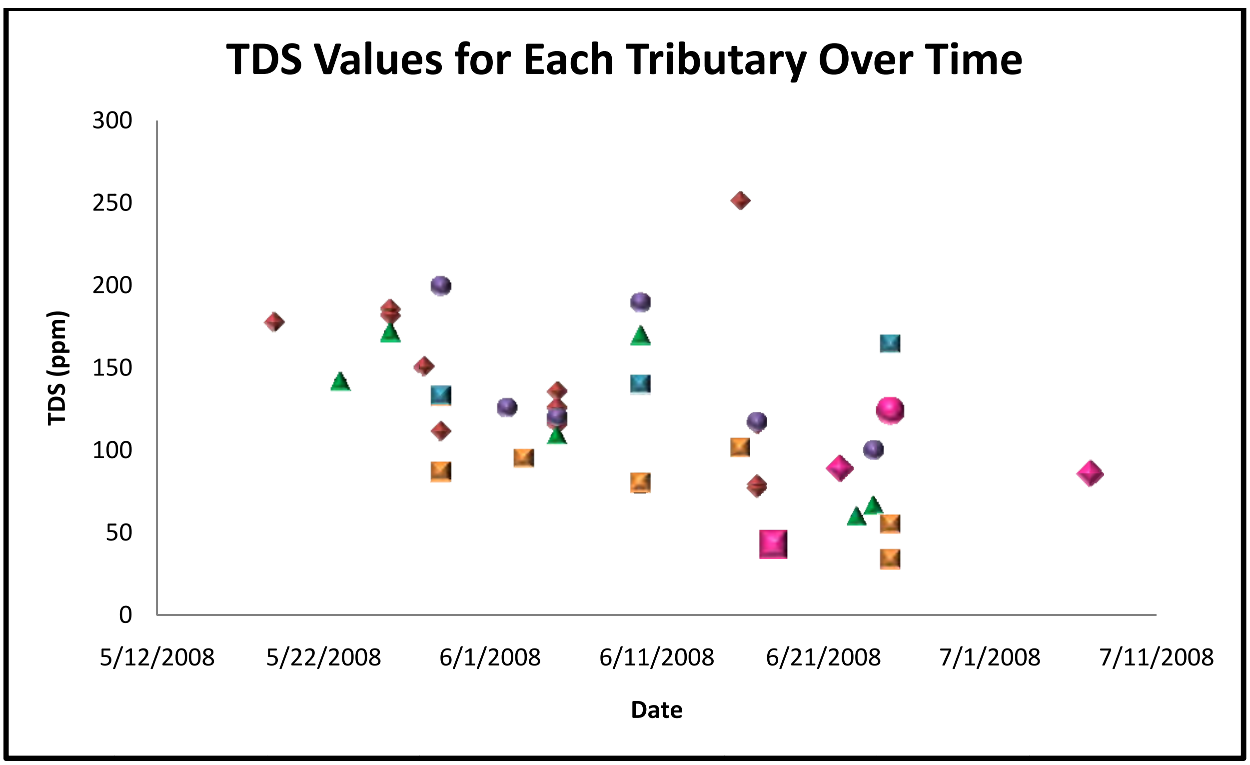
Table 10: Average temperatures in °C for Filley Brook

Date	Site	Position	Average T	SD
5/29/2008	EFB 11	4	15.3	0.2
6/25/2008	EFB 11	4	21.7	0.3

Graphs and Tables for the Total Dissolved Solids



Graph 5: This graph shows the total dissolved solids in ppm in each tributary.



Graph 6: This graph shows the amount of total dissolved solids in ppm in each tributary over time.

Table 11: Total dissolved solids value in ppm for the North Branch of the Park River

Date	Site	Position	Average TDS	SD
5/19/2008	TNBPR 1	5	177.7	0.3
5/26/2008	MNBPR 2	6	181.9	1.6
5/26/2008	MNBPR 3	7	185.8	0.3
5/28/2008	ENBPR 4	8	150.6	0.6
5/29/2008	TNBPR 1	5	111	0.3
6/5/2008	TNBPR 1	5	115.5	0.3
6/5/2008	ENBPR 4	8	135.3	0.1
6/5/2008	MNBPR 3	7	125.4	0.2
6/5/2008	MNBPR 2	6	120.4	0.2
6/16/2008	MNBPR 2	6	251.3	0.6
6/17/2008	TNBPR 1	5	115.4	0.2
6/17/2008	MNBPR 3	7	76.9	0
6/17/2008	ENBPR 4	8	79.3	0.3
Storm Water				
6/22/2008	TNBPR 1	4.75	88.8	0.1
7/7/2008	MNBPR 2	5.75	85.9	0.2

Table 12: Total dissolved solids value in ppm for Tumble Brook

Date	Site	Position	Average TDS	SD
5/29/2008	TTB 5	1	86.4	0.1
5/29/2008	MTB 5.5	2	132	0.1
6/3/2008	ETB 6	3	94.5	0.4
6/10/2008	MTB 5.5	2	80	5.4
6/10/2008	TTB 5	1	80	0
6/10/2008	ETB 6	3	140	0
6/16/2008	TTB 5	1	101.4	0.1
6/25/2008	MTB 5.5	2	33.4	0.1
6/25/2008	ETB 6	3	54.8	0.1
Storm Water				
6/18/2008	TTB Storm 1	0.5	42.2	0.3
6/18/2008	TTB Storm 2	0.75	43	0.1

Table 13: Total dissolved solids value in ppm for Wash Brook

Date	Site	Position	Average TDS	SD
5/23/2008	TWB 7	2	141.7	0.9
5/26/2008	EWB 8	3.5	171.7	0.2
6/5/2008	EWB 8	3.5	108.4	0.4
6/10/2008	TWB 7	2	170	0
6/23/2008	EWB 8	3.5	59.9	0.1
6/24/2008	TWB 7	2	66.5	0

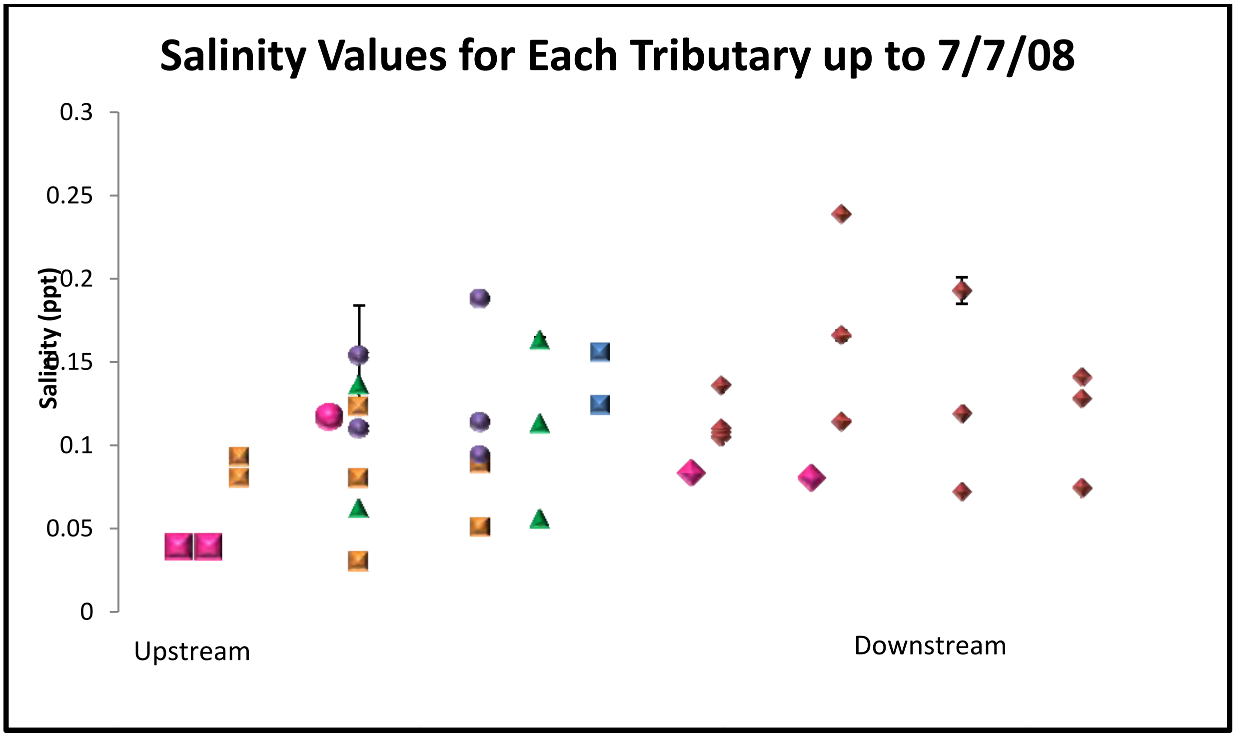
Table 14: Total dissolved solids value in ppm for Beaman's Brook

Date	Site	Position	Average TDS	SD
5/29/2008	EBB 10	3	199.6	0.4
6/2/2008	TBB 9	2	125.4	2.9
6/5/2008	EBB 10	3	119.5	0.4
6/10/2008	TBB 9	2	190	0
6/17/2008	TBB 9	2	117.2	0.1
6/24/2008	EBB 10	3	100	0.2
Storm Water				
6/25/2008	TBB 9	1.75	123.8	1.6

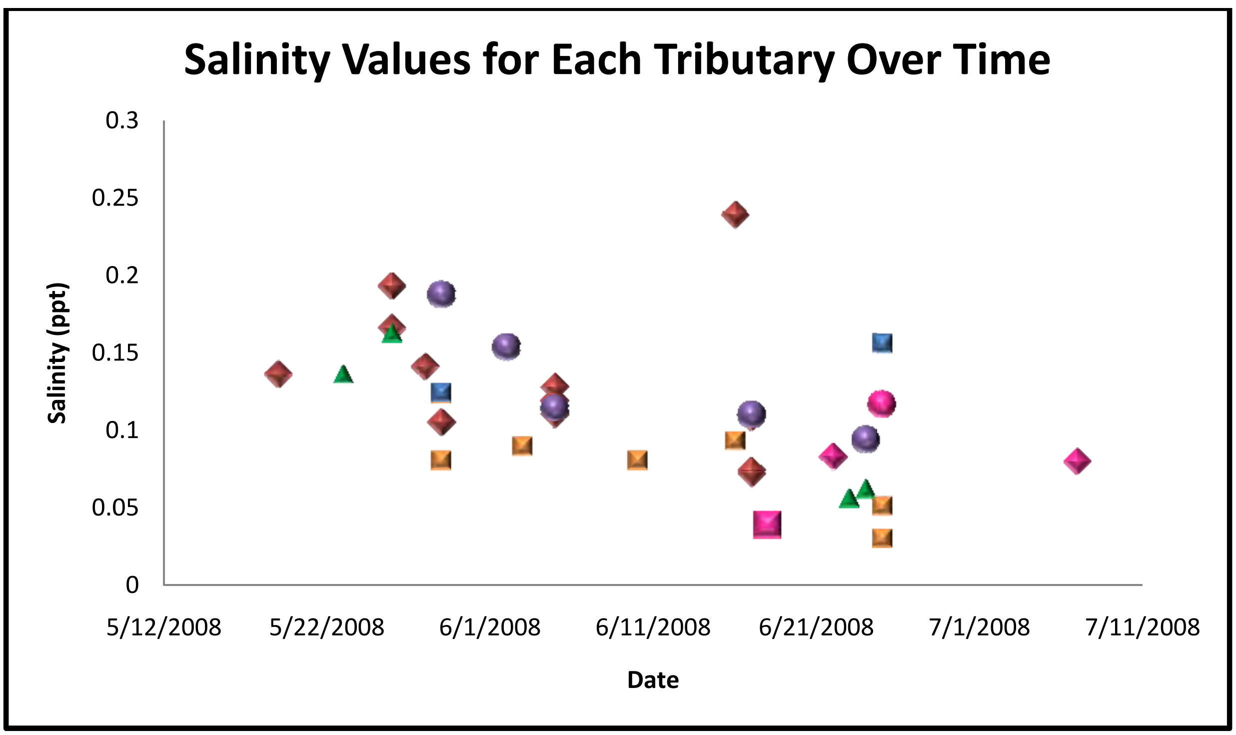
Table 15: Total dissolved solids value in ppm for Filley Brook

Date	Site	Position	Average TDS	SD
5/29/2008	EFB 11	4	132.6	0.4
6/10/2008	EFB 11	4	140	0
6/25/2008	EFB 11	4	164.2	0.9

Graphs and Tables for Salinity Values



Graph 7: This graph shows the salinity values in ppt for each tributary.



Graph 8: This graph shows the salinity values in ppt for each tributary over time.

Table 16: Salinity values in ppt for the North Branch of the Park River

Date	Site	Position	Average Salinity	SD
5/19/2008	TNBPR 1	5	0.136	0
5/26/2008	MNBPR 2	6	0.166	0.003
5/26/2008	MNBPR 3	7	0.193	0.008
5/28/2008	ENBPR 4	8	0.141	0.001
5/29/2008	TNBPR 1	5	0.105	0
6/5/2008	TNBPR 1	5	0.11	0.001
6/5/2008	ENBPR 4	8	0.128	0
6/5/2008	MNBPR 3	7	0.119	0.001
6/5/2008	MNBPR 2	6	0.114	0.001
6/16/2008	MNBPR 2	6	0.239	0.002
6/17/2008	TNBPR 1	5	0.108	0
6/17/2008	MNBPR 3	7	0.072	0
6/17/2008	ENBPR 4	8	0.074	0
Storm Water				
6/23/2008	TNBPR 1	4.75	0.083	0
7/7/2008	MNBPR 2	5.75	0.08	0

Table 17: Salinity values in ppt for Tumble Brook

Date	Site	Position	Average S	SD
5/29/2008	TTB 5	1	0.08	0.001
5/29/2008	MTB 5.5	2	0.123	0.001
6/3/2008	ETB 6	3	0.089	0
6/10/2008	MTB 5.5	2	0.08	0
6/16/2008	TTB 5	1	0.093	0.002
6/25/2008	MTB 5.5	2	0.03	0
6/25/2008	ETB 6	3	0.051	0
Storm Water				
6/18/2008	TTB Storm 1	0.5	0.039	0.001
6/18/2008	TTB Storm 2	0.75	0.039	0

Table 18: Salinity values in ppt for Wash Brook

Date	Site	Position	Average S	SD
5/23/2008	TWB 7	2	0.136	0
5/26/2008	EWB 8	3.5	0.163	0.002
6/5/2008	EWB 8	3.5	0.113	0
6/23/2008	EWB 8	3.5	0.056	0
6/24/2008	TWB 7	2	0.062	0

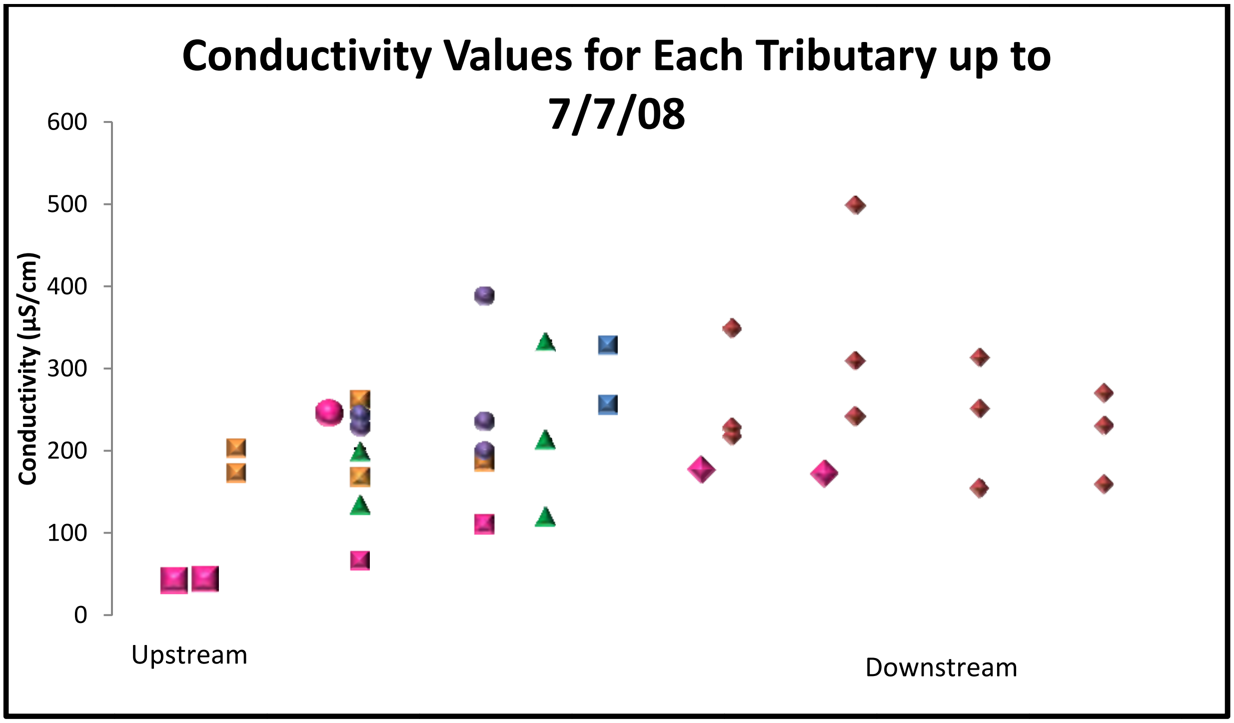
Table 19: Salinity values in ppt for Beaman's Brook

Date	Site	Position	Average S	SD
5/29/2008	EBB 10	3	0.188	0.001
6/2/2008	TBB 9	2	0.154	0.03
6/5/2008	EBB 10	3	0.114	0
6/17/2008	TBB 9	2	0.11	0.001
6/24/2008	EBB 10	3	0.094	0
Storm Water				
6/25/2008	TBB 9	1.75	0.117	0.002

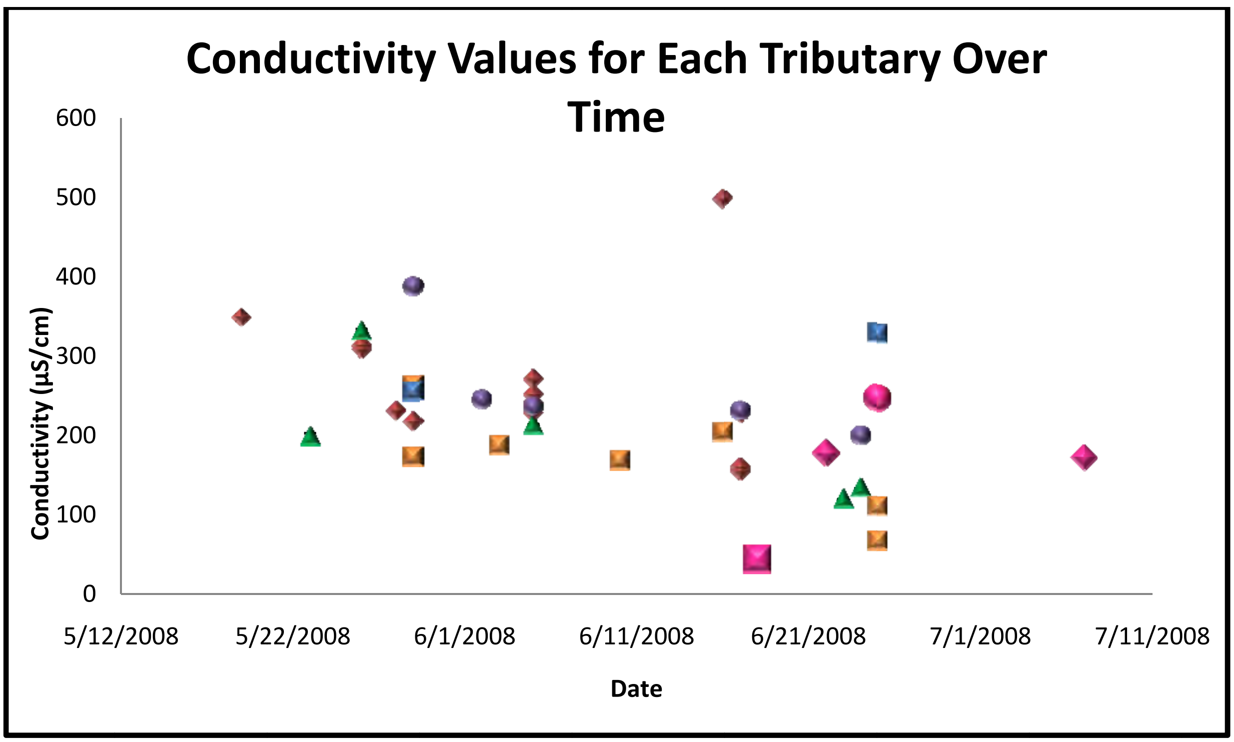
Table 20: Salinity values in ppt for Filley Brook

Date	Site	Position	Average S	SD
5/29/2008	EFB 11	4	0.124	0
6/25/2008	EFB 11	4	0.156	0.001

Graphs and Tables for Conductivity Values



Graph 9: This graph shows the conductivity values in µS/cm for each tributary.



Graph 10: This graph shows the conductivity values in µS/cm for each tributary over time.

Table 21: Conductivity values in µS/cm for the North Branch of the Park River

Date	Site	Position	Average Conductivity	S.D.
5/19/2008	TNBPR 1	5	348.3	4
5/26/2008	MNBPR 2	6	308.7	1.2
5/26/2008	MNBPR 3	7	313.3	1.5
5/28/2008	ENBPR 4	8	230.7	0.6
5/29/2008	TNBPR 1	5	217.3	1.5
6/5/2008	TNBPR 1	5	228	1
6/5/2008	ENBPR 4	8	270.7	0.6
6/5/2008	MNBPR 3	7	251	0
6/5/2008	MNBPR 2	6	241	0
6/16/2008	MNBPR 2	6	498.3	4.7
6/17/2008	TNBPR 1	5	227	1
6/17/2008	MNBPR 3	7	153.8	0.1
6/17/2008	ENBPR 4	8	158.6	0.1
Storm Water				
6/22/2008	TNBPR 1	4.75	176.4	1.3
7/7/2007	MNBPR 2	5.75	171.3	0.4

Table 22: Conductivity values in µS/cm for Tumble Brook

Date	Site	Position	Average conductivity	S.D.
5/29/2008	TTB 5	1	172.2	0.3
5/29/2008	MTB 5.5	2	262.3	0.6
6/3/2008	ETB 6	3	186.5	1
6/10/2008	MTB 5.5	2	167.4	0.8
6/16/2008	TTB 5	1	203.3	0.6
6/25/2008	MTB 5.5	2	66.2	0.3
6/25/2008	ETB 6	3	109.6	0.2
Storm Water				
6/18/2008	TTB Storm 1	0.5	42.2	0.3
6/18/2008	TTB Storm 2	0.75	43	0.1

Table 23: Conductivity values in µS/cm for Wash Brook

Date	Site	Position	Average conductivity	S.D.
5/23/2008	TWB 7	2	198.7	4
5/26/2008	EWB 8	3.5	332	2
6/5/2008	EWB 8	3.5	213	1
6/23/2008	EWB 8	3.5	119.2	0.3
6/24/2008	TWB 7	2	133.2	0.1

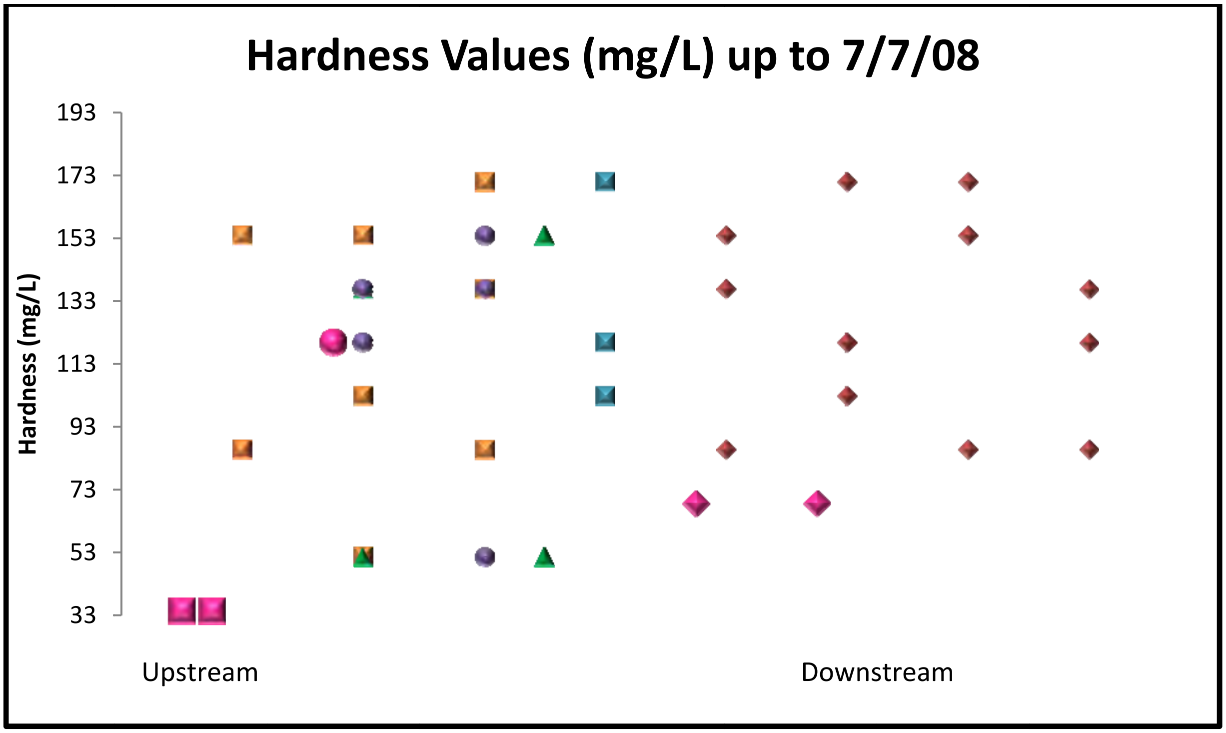
Table 24: Conductivity values in µS/cm for Beaman's Brook

Date	Site	Position	Average conductivity	S.D.
5/29/2008	EBB 10	3	388.3	3.1
6/2/2008	TBB 9	2	244.7	1.5
6/5/2008	EBB 10	3	235.3	1.5
6/17/2008	TBB 9	2	230	1
6/24/2008	EBB 10	3	198.7	0.5
Storm Water				
6/25/2008	TBB 9	1.75	246.7	4.2

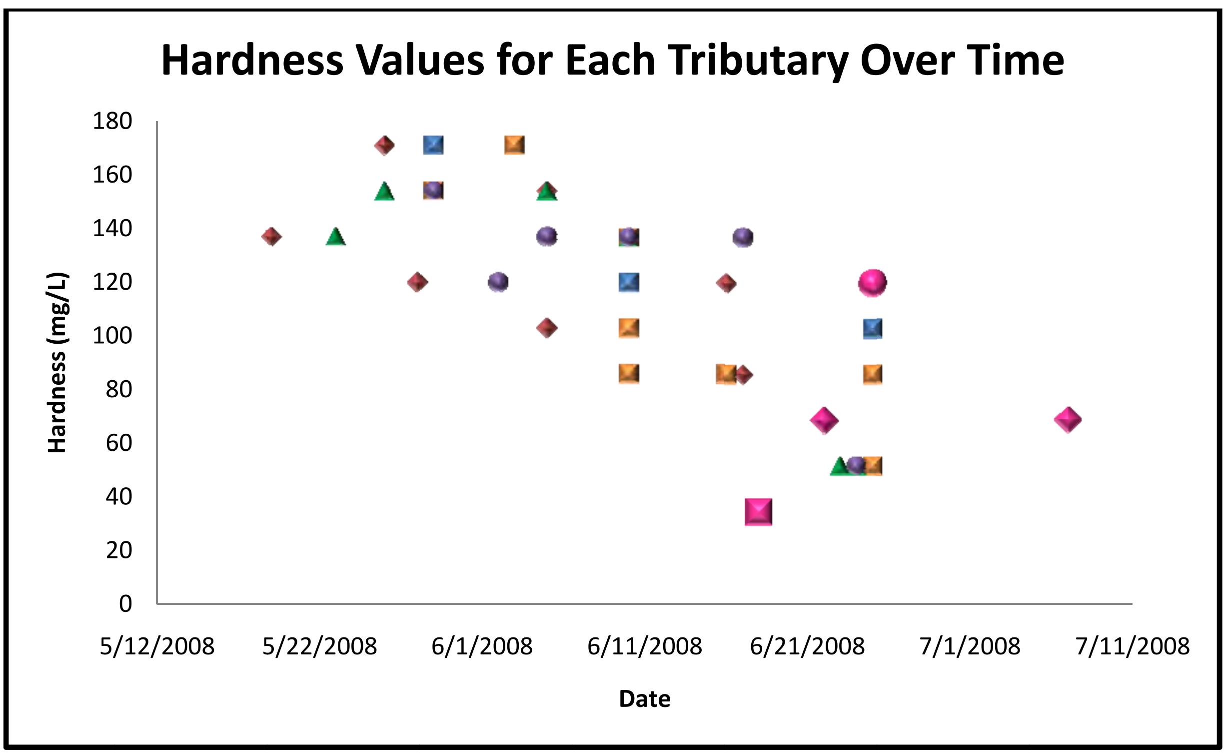
Table 25: Conductivity values in µS/cm for Filley Brook

Date	Site	Position	Average conductivity	S.D.
5/29/2008	EFB 11	4	255.3	3.1
6/25/2008	EFB 11	4	328.3	1.5

Graphs and Tables for Hardness Values



Graph 11: This graph shows the hardness values in mg/L for each tributary.



Graph 12: This graph shows the hardness values in mg/L for each tributary over time.

Table 26: Hardness values in mg/L for the North Branch of the Park River

Date	Site	Position	Hardness
5/19/2008	TNBPR 1	5	136.8
5/26/2008	MNBPR 2	6	171
5/26/2008	MNBPR 3	7	171
5/28/2008	ENBPR 4	8	119.7
5/29/2008	TNBPR 1	5	153.9
6/5/2008	TNBPR 1	5	136.8
6/5/2008	ENBPR 4	8	136.8
6/5/2008	MNBPR 3	7	153.9
6/5/2008	MNBPR 2	6	102.6
6/16/2008	MNBPR 2	6	119.7
6/17/2008	TNBPR 1	5	85.5
6/17/2008	MNBPR 3	7	85.5
6/17/2008	ENBPR 4	8	85.5
Storm Water			
6/22/2008	TNBPR 1	4.75	68.4
7/7/2008	MNBPR 2	5.75	68.4

Table 27: Hardness values in mg/L for Tumble Brook

Date	Site	Position	Hardness
5/29/2008	TTB 5	1	153.9
5/29/2008	MTB 5.5	2	153.9
6/3/2008	ETB 6	3	171
6/10/2008	MTB 5.5	2	102.6
6/10/2008	TTB 5	1	85.5
6/10/2008	ETB 6	3	136.8
6/16/2008	TTB 5	1	85.5
6/25/2008	MTB 5.5	2	51.3
6/25/2008	ETB 6	3	85.5
Storm Water			
6/18/2008	TTB Storm 1	0.5	34.2
6/18/2008	TTB Storm 2	0.75	34.2

Table 28: Hardness values in mg/L for Wash Brook

Date	Site	Position	Hardness
5/23/2008	TWB 7	2	136.8
5/26/2008	EWB 8	3.5	153.9
6/5/2008	EWB 8	3.5	153.9
6/10/2008	TWB 7	2	136.8
6/23/2008	EWB 8	3.5	51.3
6/24/2008	TWB 7	2	51.3

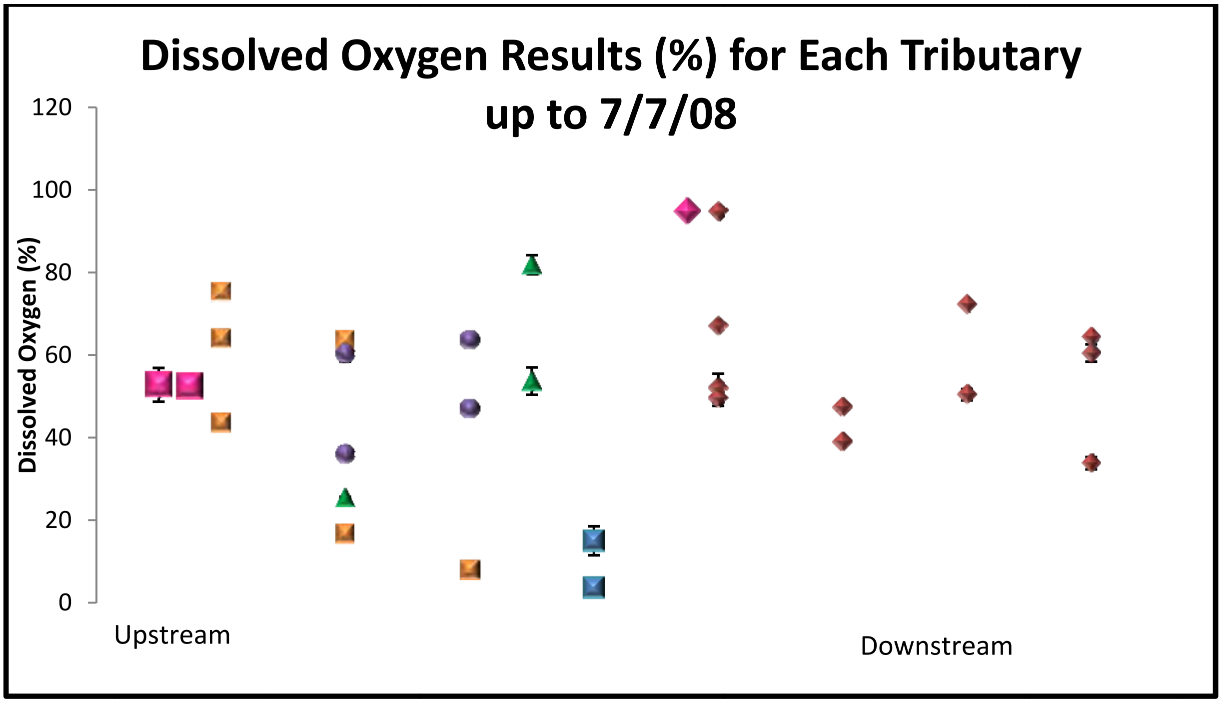
Table 29: Hardness values in mg/L for Beaman's Brook

Date	Site	Position	Hardness
5/29/2008	EBB 10	3	153.9
6/2/2008	TBB 9	2	119.7
6/5/2008	EBB 10	3	136.8
6/10/2008	TBB 9	2	136.8
6/17/2008	TBB 9	2	136.8
6/24/2008	EBB 10	3	51.3
Storm Water			
6/25/2008	TBB 9	1.75	119.7

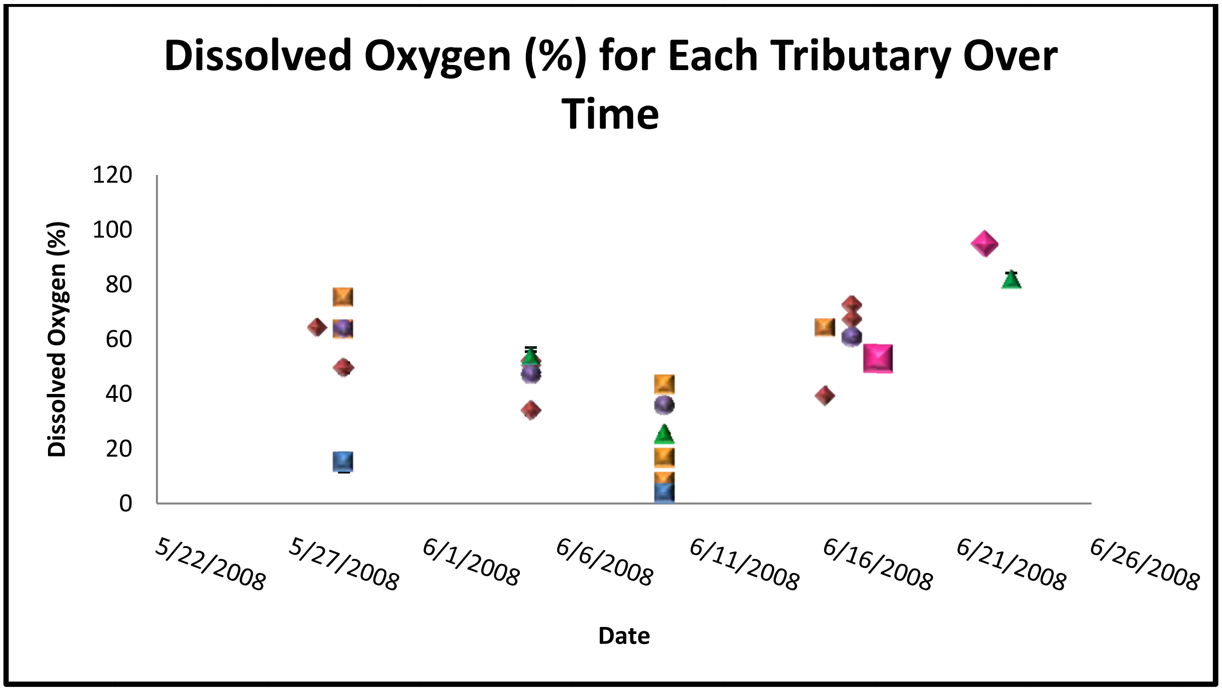
Table 30: Hardness values in mg/L for Filley Brook

Date	Site	Position	Hardness
5/29/2008	EFB 11	4	171
6/10/2008	EFB 11	4	119.7
6/25/2008	EFB 11	4	102.6

Graphs and Tables for Dissolved Oxygen % Air Saturation Results



Graph 13: This graph shows dissolved oxygen readings in % air saturation for each tributary.



Graph 14: This graph shows the dissolved oxygen readings in % air saturation for each tributary over time.

Table 31: Dissolved oxygen in % air saturation for the North Branch of the Park River

Date	Site	Position	Average DO	S.D.
5/28/2008	ENBPR 4	8	64.4	0
5/29/2008	TNBPR 1	5	49.6	1.9
6/5/2008	TNBPR 1	5	52	3.5
6/5/2008	ENBPR 4	8	33.8	1.5
6/5/2008	MNBPR 3	7	50.4	1.4
6/5/2008	MNBPR 2	6	47.4	0.8
6/16/2008	MNBPR 2	6	39	0
6/17/2008	TNBPR 1	5	67.1	0.1
6/17/2008	MNBPR 3	7	72.4	0.6
6/17/2008	ENBPR 4	8	60.5	2.1
Storm Water				
6/22/2008	TNBPR 1	4.75	94.9	0.8

Table 32: Dissolved oxygen in % air saturation for Tumble Brook

Date	Site	Position	Average DO	S.D.
5/29/2008	TTB 5	1	75.3	0
5/29/2008	MTB 5.5	2	63.7	0
6/10/2008	MTB 5.5	2	16.6	0.1
6/10/2008	TTB 5	1	43.5	1.9
6/10/2008	ETB 6	3	7.8	0.1
6/16/2008	TTB 5	1	63.9	0
Storm Water				
6/18/2008	TTB 5	0.5	52.8	4.1
6/18/2008	TTB 5	0.75	52.5	0.6

Table 33: Dissolved oxygen in % air saturation for Wash Brook

Date	Site	Position	Average DO	S.D.
6/5/2008	EWB 8	3.5	53.7	3.3
6/10/2008	TWB 7	2	25.4	0.3
6/23/2008	EWB 8	3.5	81.9	2.3

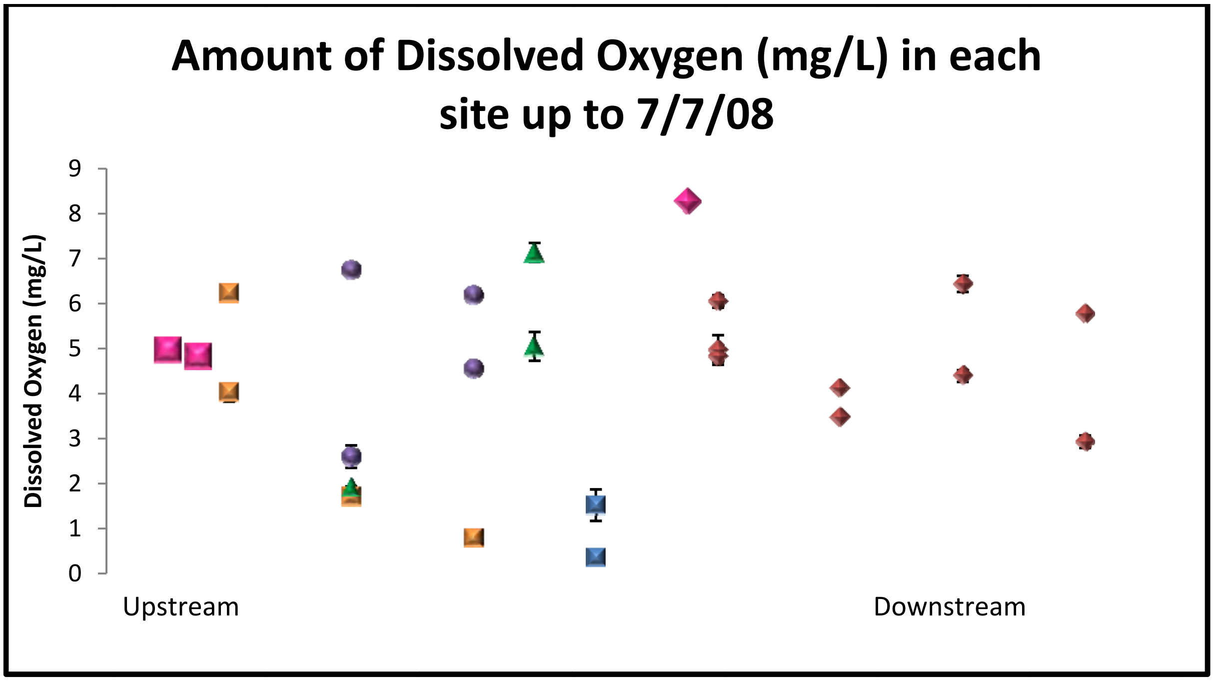
Table 34: Dissolved oxygen in % air saturation for Beaman's Brook

Date	Site	Position	Average DO	S.D.
5/29/2008	EBB 10	3	63.8	0
6/5/2008	EBB 10	3	47.1	1.6
6/10/2008	TBB 9	2	36	0.7
6/17/2008	TBB 9	2	60.5	2.1

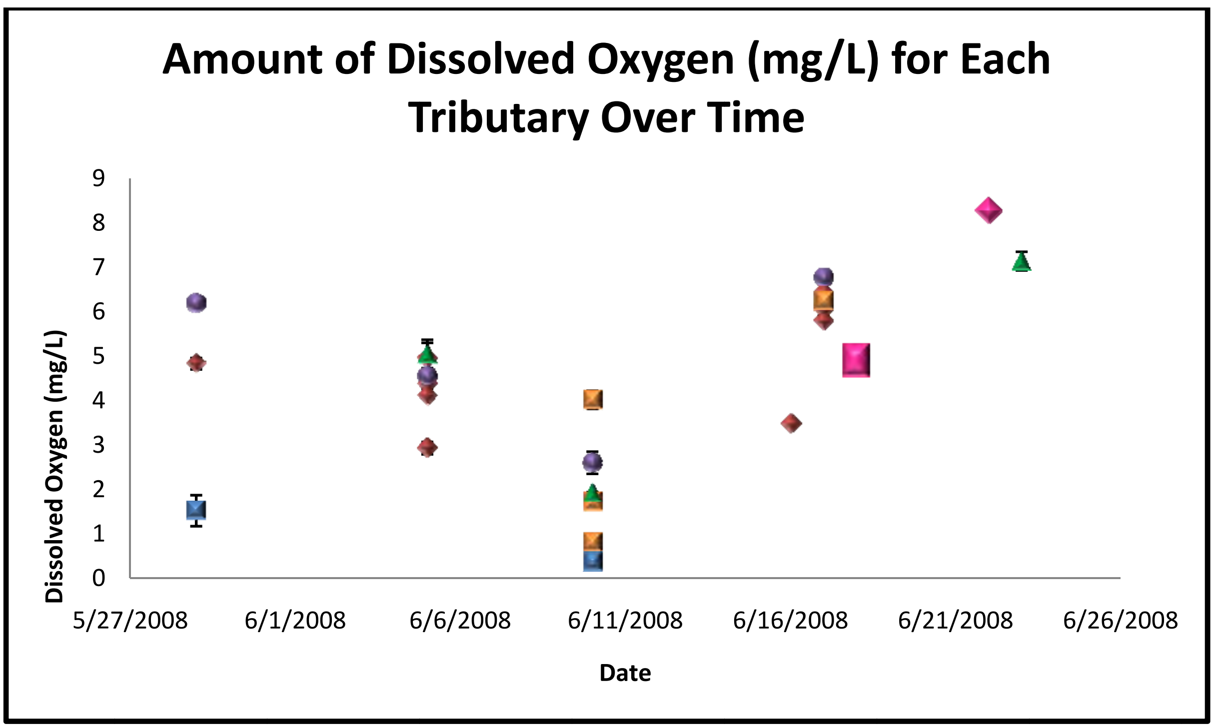
Table 35: Dissolved oxygen in % air saturation for Filley Brook

Date	Site	Position	Average DO	S.D.
5/29/2008	EFB 11	4	15	3.5
6/10/2008	EFB 11	4	3.5	0.1

Graphs and Tables for the Amount of Dissolved Oxygen in mg/L



Graph 15: This graph shows the amount of dissolved oxygen in mg/L for each tributary.



Graph 16: This graph shows the amount of dissolved oxygen in mg/L for each tributary over time.

Table 36: Dissolved oxygen in mg/L for the North Branch of the Park River

Date	Site	Position	Average DO	S.D.
5/29/2008	TNBPR 1	5	4.83	0.13
6/5/2008	TNBPR 1	5	4.97	0.33
6/5/2008	ENBPR 4	8	2.93	0.14
6/5/2008	MNBPR 3	7	4.39	0.13
6/5/2008	MNBPR 2	6	4.12	0.06
6/16/2008	MNBPR 2	6	3.47	0
6/17/2008	TNBPR 1	5	6.05	0.14
6/17/2008	MNBPR 3	7	6.44	0.18
6/17/2008	ENBPR 4	8	5.8	0.04
Storm Water				
6/22/2008	TNBPR 1	4.75	8.28	0.02

Table 37: Dissolved oxygen in mg/L for Tumble Brook

Date	Site	Position	Average DO	S.D.
6/10/2008	MTB 5.5	2	1.72	0.01
6/10/2008	TTB 5	1	4.02	0.2
6/10/2008	ETB 6	3	0.79	0.03
6/17/2008	TTB 5	1	6.24	0
Storm Water				
6/18/2008	TTB Storm 1	0.5	4.96	0.12
6/18/2008	TTB Storm 2	0.75	4.82	0.04

Table 38: Dissolved oxygen in mg/L for Wash Brook

Date	Site	Position	Average DO	S.D.
6/5/2008	EWB 8	3.5	5.05	0.32
6/10/2008	TWB 7	2	1.91	0.03
6/23/2008	EWB 8	3.5	7.14	0.21

Table 39: Dissolved oxygen in mg/L for Beaman's Brook

Date	Site	Position	Average DO	S.D.
5/29/2008	EBB 10	3	6.2	0.01
6/5/2008	EBB 10	3	4.56	0.15
6/10/2008	TBB 9	2	2.6	0.25
6/17/2008	TBB 9	2	6.77	0.09

Table 40: Dissolved oxygen in mg/L for Filley Brook

Date	Site	Position	Average DO	S.D.
5/29/2008	EFB 11	4	1.52	0.35
6/10/2008	EFB 11	4	0.36	0.03

Conclusion

In conclusion, the North Branch Park River watershed is healthy. Most of our data confirms and strengthens this assertion. All of the parameters that were tested for were all up to the standards set forth by the EPA. The only site that may be of concern is the Filley Brook site where sediment analysis might reveal more of the condition of the site and what may be polluting it.

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TRINITY COLLEGE ENVIRONMENTAL SCIENCE PROGRAM

Part II: Biological Assessment Using Macroinvertebrate Populations

For the North Branch Park River and Tributaries

Data Preparer: Caroline Lewis

Assistants: Lucy Schiffman, Jeffrey McNamara, Victoria Doñé, Andrew Kennedy

Project Supervisor: Dr. Jonathan Gourley

7/24/2008

Discussion

There was no visible change in the biotic index (Figures 1 and 2), Simpson's Index (Figures 3 and 4), or taxa richness (Figures 5 and 6) over time or by position in the watershed. There was no visible change in the percent EPT (ephemeroptera, plecoptera, and trichoptera populations) by position (Figure 8); however there are some trends over time: the percent EPT increased in the Wash Brook over time (Figure 7) and decreased in the Beaman's Brook over time (Figure 7). It is good to have high EPT percentages because ephemeroptera, plecoptera, and trichoptera are sensitive to pollution.

Looking at percent EPT alone, The Wash Brook was overall the healthiest, followed by the Park River. The Tumble Brook was the least healthy by this indicator (Tables 1-5). The Wash Brook was also the healthiest section tested by the results of the biotic index, again followed by the Park River (Tables 6-10). By this measure, the Beamans Brook was the least healthy. On average, the quality of the Park River, Tumble Brook, and Wash Brook can be classified as "good" according to the Biotic Index. This means there is only some organic pollution. On average, the Beamans Brook and Tumble Brook tributary have "substantially likely" organic pollution and fair water quality according to the Biotic Index.

The Simpson's Index shows that the Tumble Brook Tributary is the most diverse, followed by the Beamans Brook, and the Tumble Brook is the least (Tables 11-15). On average, the Wash Brook had the most aquatic invertebrates, followed by the Tumble Brook. The Tumble Brook tributary had the least, besides the Filley Brook, where no bugs were found because of the muddy bottom, which does not provide a suitable habitat for aquatic macro invertebrates.

Data Tables for EPT

Table 1. The Percent EPT at various sites along the North Branch Park River.

Site Name	Date	Percent EPT
TNBPR 1	5/29/2008	27
MNBPR 2	5/26/2008	35
MNBPR 3	5/26/2008	63
ENBPR 4	5/29/2008	22
MNBPR 2	6/5/2008	16
MNBPR 3	6/5/2008	21
TNBPR 1	6/5/2008	39
ENBPR 4	6/5/2008	7
MNBPR 2	6/16/2008	2
MNBPR 3	6/17/2008	3
TNBPR 1	6/17/2008	31
Average	NA	24.18181818

Table 2. The Percent EPT at various sites along the Tumble Brook.

Site name	Date	Percent EPT
TTB 5	5/29/2008	12
TTB 5	6/2/2008	6
ETB 6	6/3/2008	3
MTB 5.5	6/10/2008	0
ETB 6	6/10/2008	6
TTB 5	6/10/2008	16
TTB 5	6/16/2008	18
ETB 6	6/25/2008	1
Average	NA	7.75

Table 3. The Percent EPT at various sites along the Wash Brook.

Site Name	Date	Percent EPT
TWB 7	5/23/2008	38
EWB 8	5/26/2008	31
EWB 8	6/5/2008	22
TWB 7	6/10/2008	57
EWB 8	6/23/2008	65
TWB 7	6/24/2008	0
Average	NA	35.5

Table 4. The Percent EPT at various sites along the Beamans Brook.

Site Name	Date	Percent EPT
EBB 10	5/29/2008	45
EBB 10	6/5/2008	23
EBB 10	6/24/2008	0
Average	NA	22.66666667

Table 5. The Percent EPT at various sites along the Tumble Brook tributary.

Site Name	Date	Percent EPT
ETBT	6/2/2008	10

Data tables for biotic index

Table 6. The biotic Index from locations along the Park River.

Site Name	Date	Biotic Index
TNBPR 1	5/29/2008	4.08
MNBPR 2	5/26/2008	4
MNBPR 3	5/26/2008	4.05
ENBPR 4	5/29/2008	5.24
MNBPR 2	6/5/2008	5.41
MNBPR 3	6/5/2008	4.14
TNBPR 1	6/5/2008	3.61
ENBPR 4	6/5/2008	4.93
MNBPR 2	6/16/2008	5.24
MNBPR 3	6/17/2008	4.75
TNBPR 1	6/17/2008	4.38
Average	NA	4.53

Table 7. The biotic Index at locations along the Tumble Brook.

Site name	Date	Biotic Index
TTB 5	5/29/2008	4.6
TTB 5	6/2/2008	4.71
ETB 6	6/3/2008	4.8
MTB 5.5	6/10/2008	4.65
ETB 6	6/10/2008	5.16
TTB 5	6/10/2008	4.59
TTB 5	6/16/2008	4.33
ETB 6	6/25/2008	5.35
Average	NA	4.77375

Table 8. The biotic Index from locations along the Wash Brook.

Site Name	Date	Simpson's Diversity Index
TWB 7	5/23/2008	5.02
EWB 8	5/26/2008	3.08
EWB 8	6/5/2008	4.43
TWB 7	6/10/2008	3.63
EWB 8	6/23/2008	3.57
TWB 7	6/24/2008	6.73
Average	NA	4.41

Table 9. The biotic index from the Beamans Brook.

Site Name	Date	Biotic Index
EBB 10	5/29/2008	6.16
EBB 10	6/5/2008	4.92
EBB 10	6/24/2008	5.39
Average	NA	5.49

Table 10. The biotic Index from one sample at the Tumble Brook tributary.

Site Name	Date	Biotic Index
ETBT	6/2/2008	5.03

Data Tables for Simpson's Diversity Index

Table 11. The Simpson's Diversity Index from locations on the Park River.

Site Name	Date	Simpson's Diversity Index
TNBPR 1	5/29/2008	2.7
MNBPR 2	5/26/2008	4.24
MNBPR 3	5/26/2008	2.23
ENBPR 4	5/29/2008	3.24
MNBPR 2	6/5/2008	2.27
MNBPR 3	6/5/2008	3.25
TNBPR 1	6/5/2008	3.07
ENBPR 4	6/5/2008	2.58
MNBPR 2	6/16/2008	2.8
MNBPR 3	6/17/2008	2.91
TNBPR 1	6/17/2008	2.03
Average	NA	2.847272727

Table 12. The Simpson's Diversity Index from locations along the Tumble Brook.

Site name	Date	Simpsons Diversity Index
TTB 5	5/29/2008	1.53
TTB 5	6/2/2008	1.46
ETB 6	6/3/2008	2.08
MTB 5.5	6/10/2008	5.33
ETB 6	6/10/2008	2.32
TTB 5	6/10/2008	1.51
TTB 5	6/16/2008	2.37
ETB 6	6/25/2008	1.98
Average	NA	2.3225

Table 13. The Simpson's Diversity Index from locations on the Wash Brook.

Site Name	Date	Simpson's Diversity Index
TWB 7	5/23/2008	3.86
EWB 8	5/26/2008	3.3
EWB 8	6/5/2008	2.56
TWB 7	6/10/2008	3.82
EWB 8	6/23/2008	1.63
TWB 7	6/24/2008	3.95
Average	NA	3.186666667

Table 14. The Simpson's Diversity Index from the Beamans Brook.

Site Name	Date	Simpson's Diversity Index
EBB 10	5/29/2008	2.66
EBB 10	6/5/2008	4.41
EBB 10	6/24/2008	3.89
Average	NA	3.653333333

Table 15. The Simpson's Diversity Index from one location of the Tumble Brook tributary.

Site Name	Date	Simpson's Diversity Index
ETBT	6/2/2008	4.74

Graphs

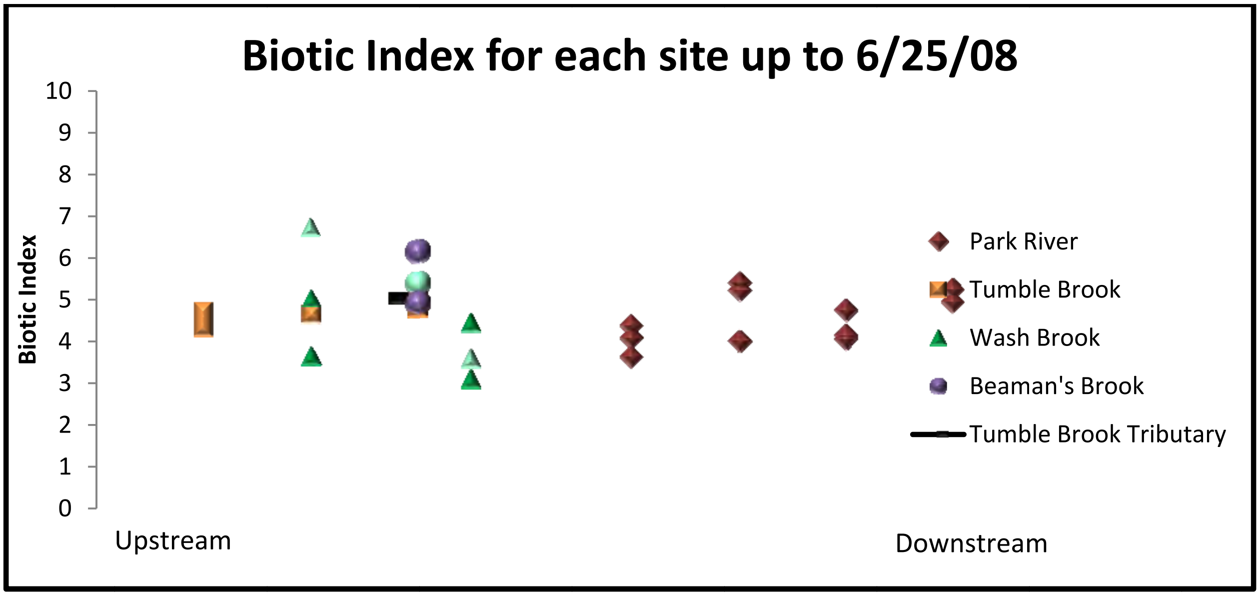


Figure 1. The biotic indices of each sample taken from all sites along the Park River and each Tributary by position.

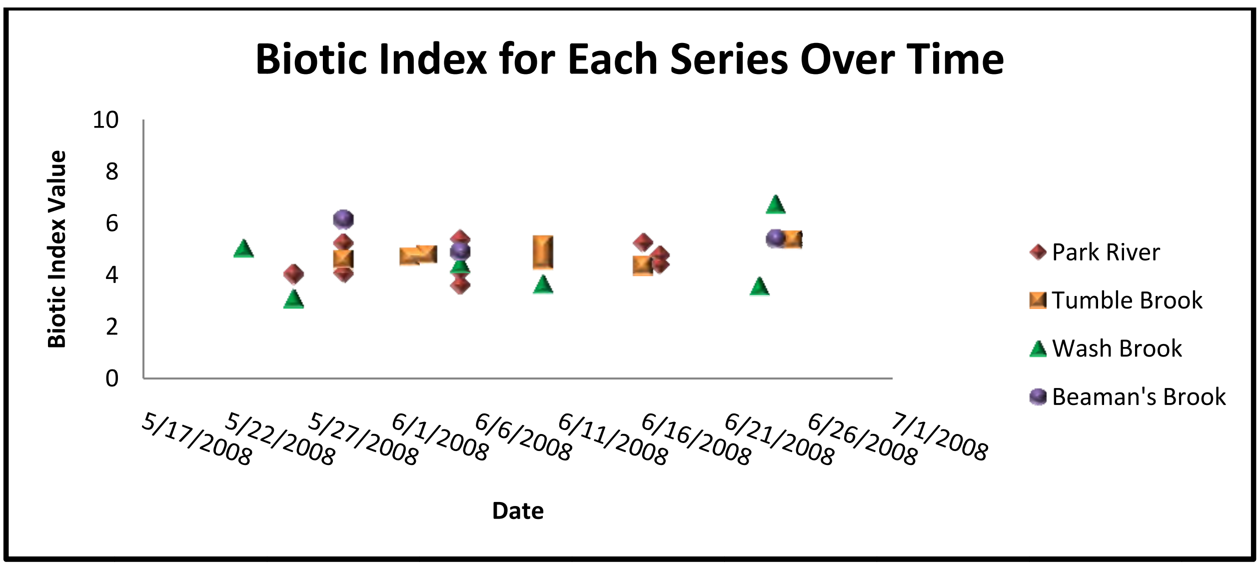


Figure 2. The biotic indices from each sample taken from all sites graphed by time.

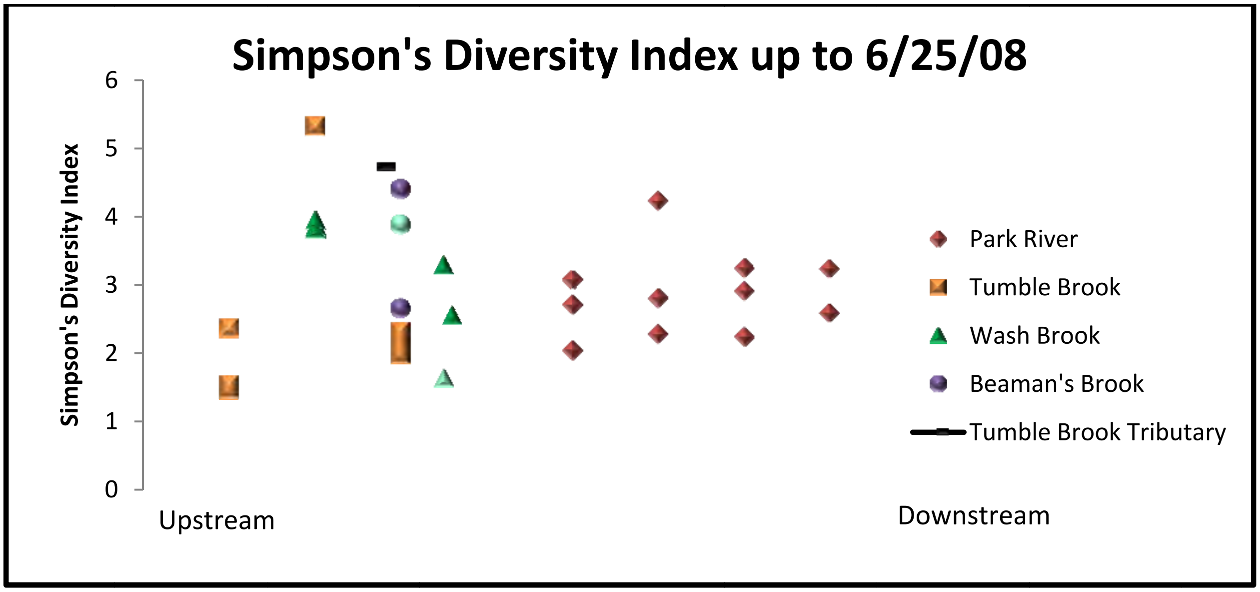


Figure 3. The Simpson's Diversity Index for each sample taken graphed by position.

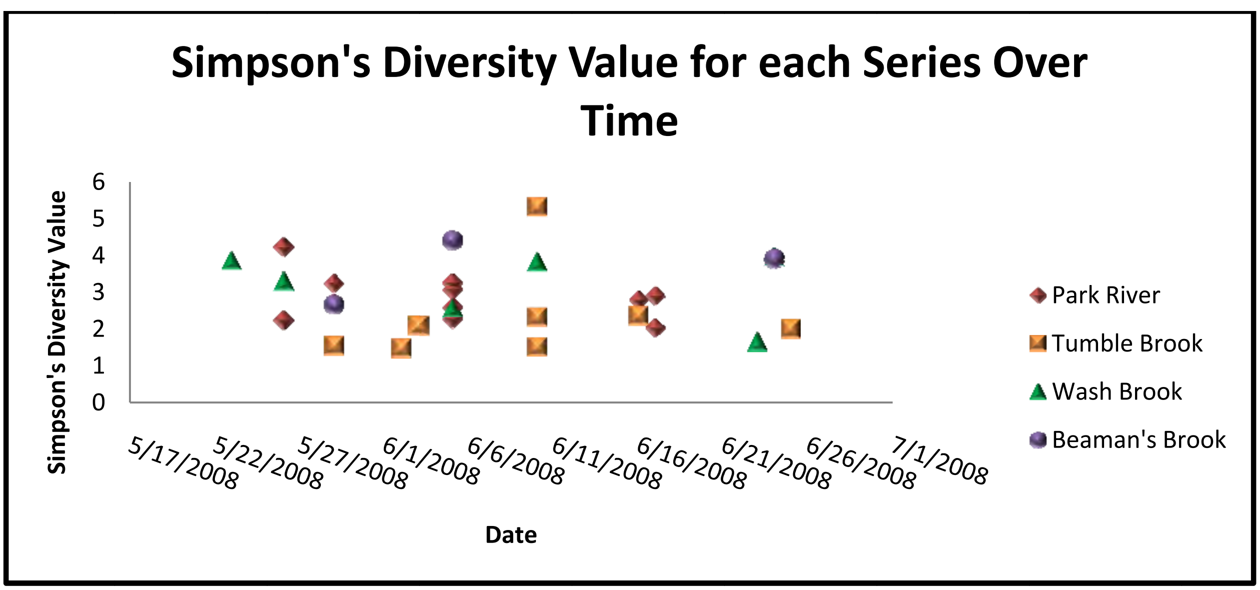


Figure 4. The Simpson's Diversity index for each sample graphed over time.

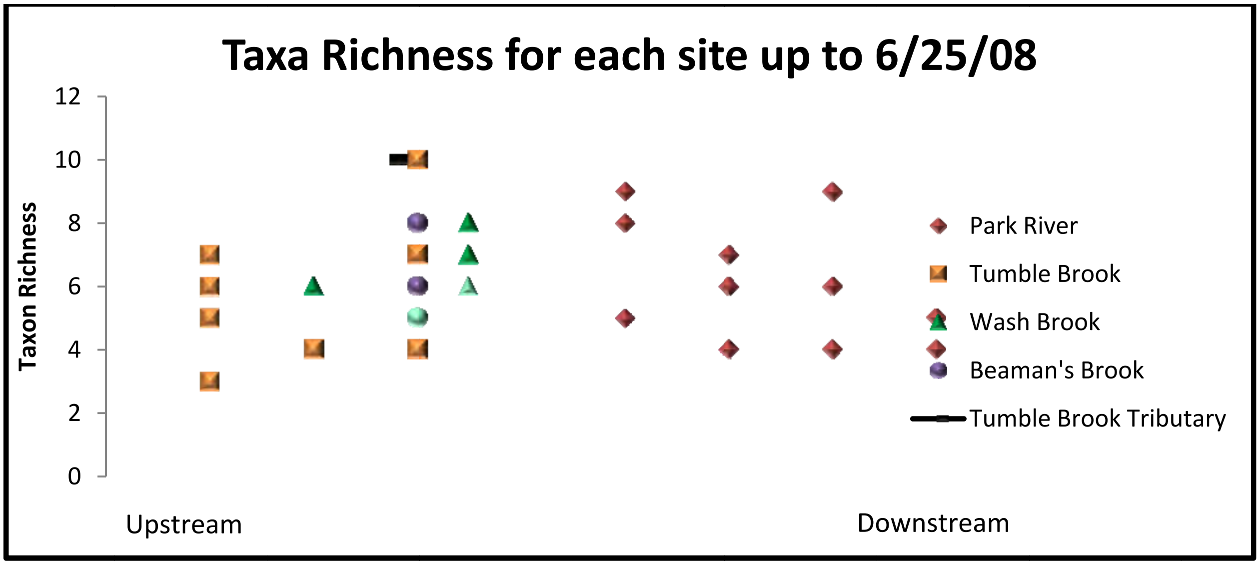


Figure 5. The taxa richness of each sample from all sites graphed by position.

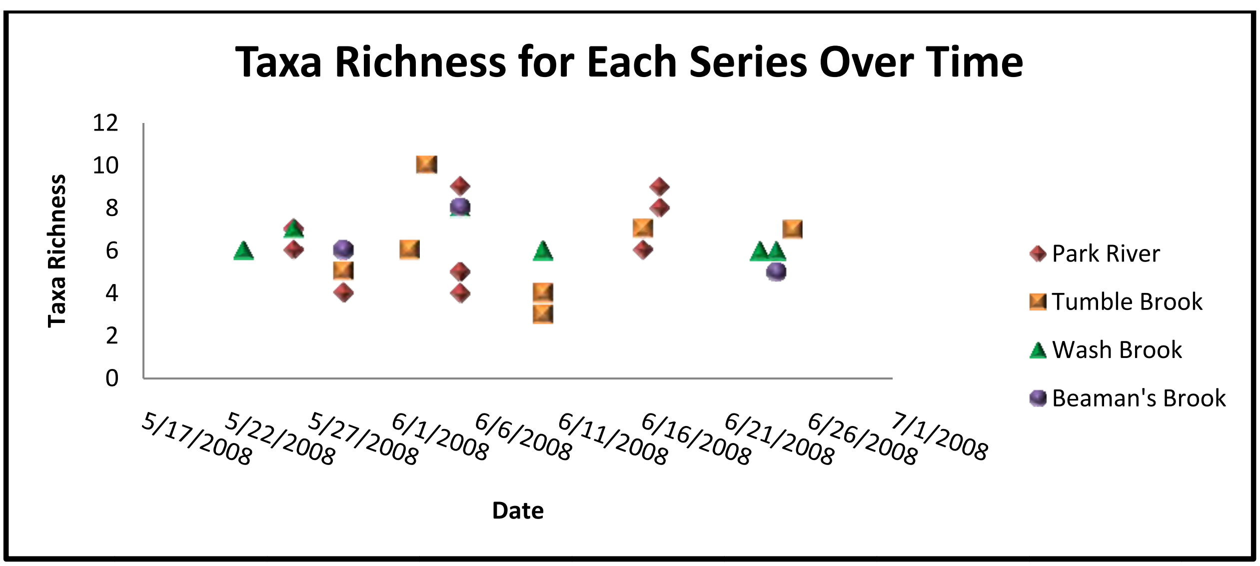


Figure 6. The taxa richness from each sample graphed over time.

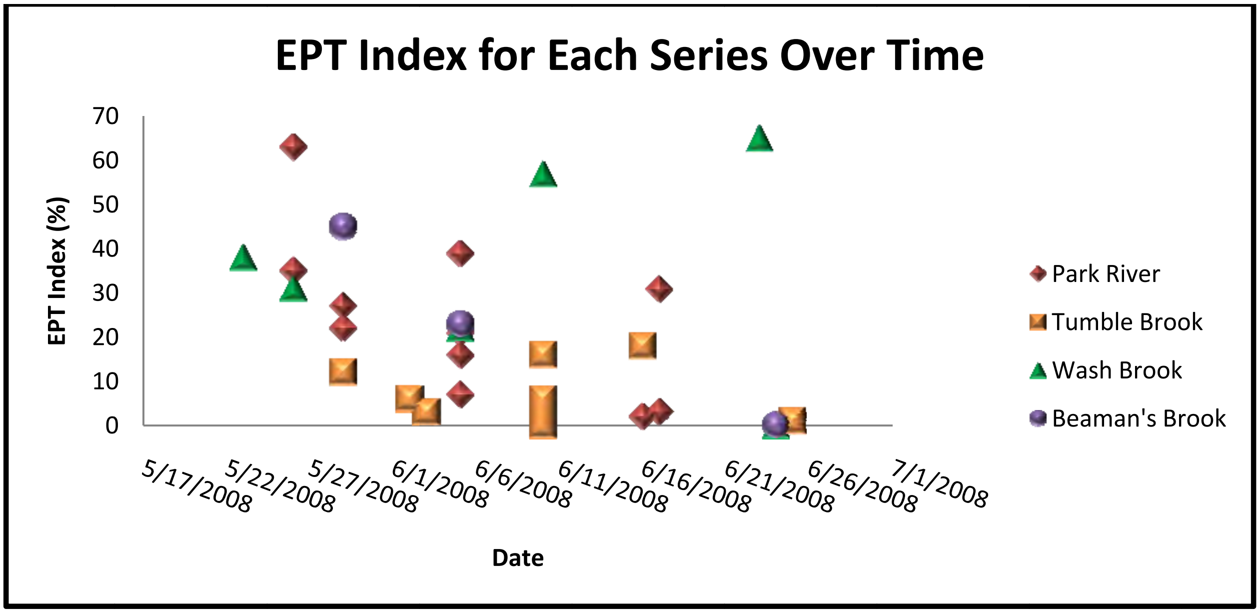


Figure 7. The percent EPT for each site over time.

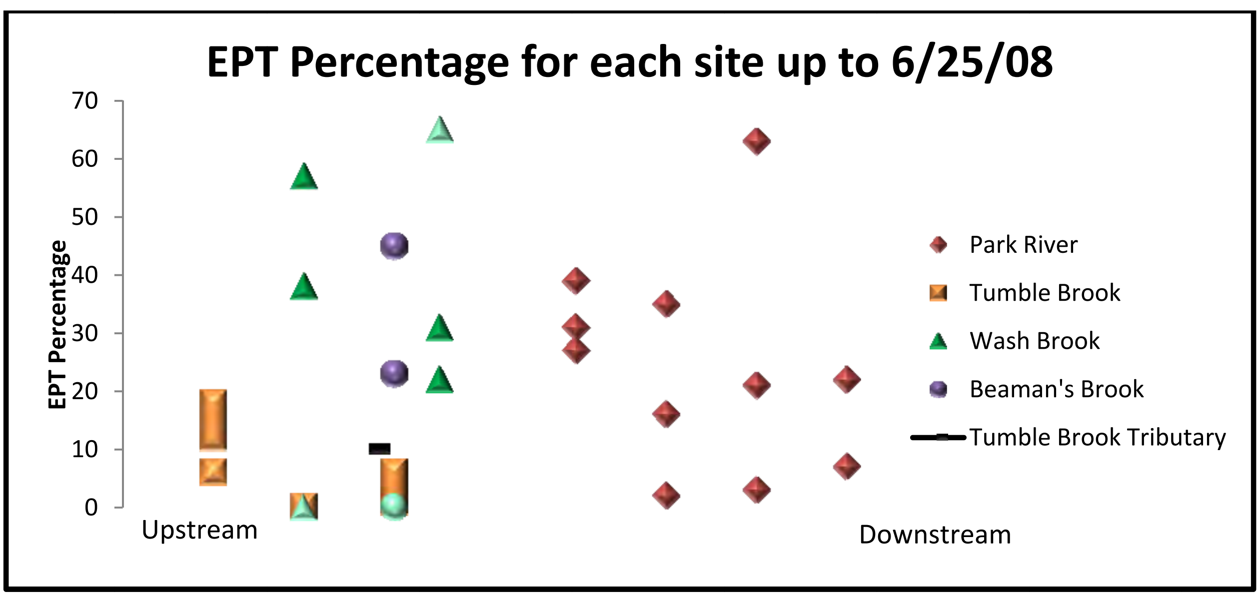


Figure 8. The percent EPT for each site by position.

TRINITY COLLEGE ENVIRONMENTAL SCIENCE PROGRAM

Part III: Anion Chromatography

For the North Branch Park River and Tributaries

Data Preparer: Lucy Schiffman
Assistants: Victoria Doñé, Caroline Lewis, Andrew Kennedy, Jeffrey McNamara
Project Supervisor: Dr. Jonathan Gourley
7/24/2008

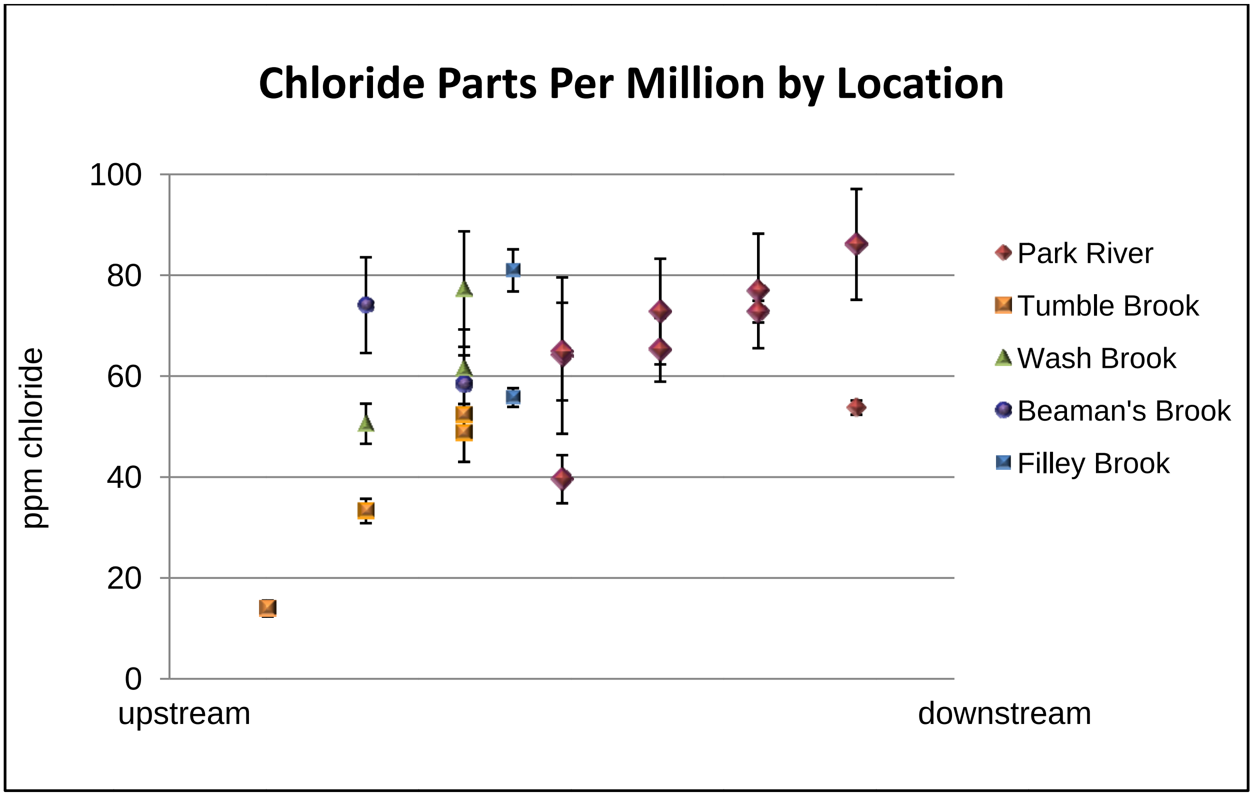
Discussion

All anion concentrations were obtained in triplicate and result averages reflect three independent analysis trials. The data is graphed by location in the watershed as well as over time. Each site has its own position number according to how far upstream or downstream it is in the watershed. For example, the most upstream site has a value of 1 and the most downstream site has a value of 8. The sites also have code names, for instance MTB stands for the middle of Tumble Brook, EFB stands for the end of Filley Brook, etc . See figure A-1 in the executive summary for a full listing of location names and codes.

The graphs made from the ion chromatograph data show that anion content generally increases moving downstream in the north branch of the Park River. When the graphs are organized by date there is not an obvious pattern in anion concentration, but when organized by location in the watershed, there appears to be a rise in both chloride and sulfate anions. This may indicate increased runoff and pollutants further downstream. One tributary that has higher anion concentrations than expected is the Tumble Brook, specifically at the sites directly downstream from several golf courses (MTB, the middle of Tumble Brook, and ETB, the end of Tumble Brook). A site along the Beamans Brook right next to a construction project also has comparatively high nitrate anion concentrations (see tables 6-10). The main trunk of the Park River also shows a rise in all anions, which is expected as you move downstream and the river collects runoff from a larger area of the watershed.

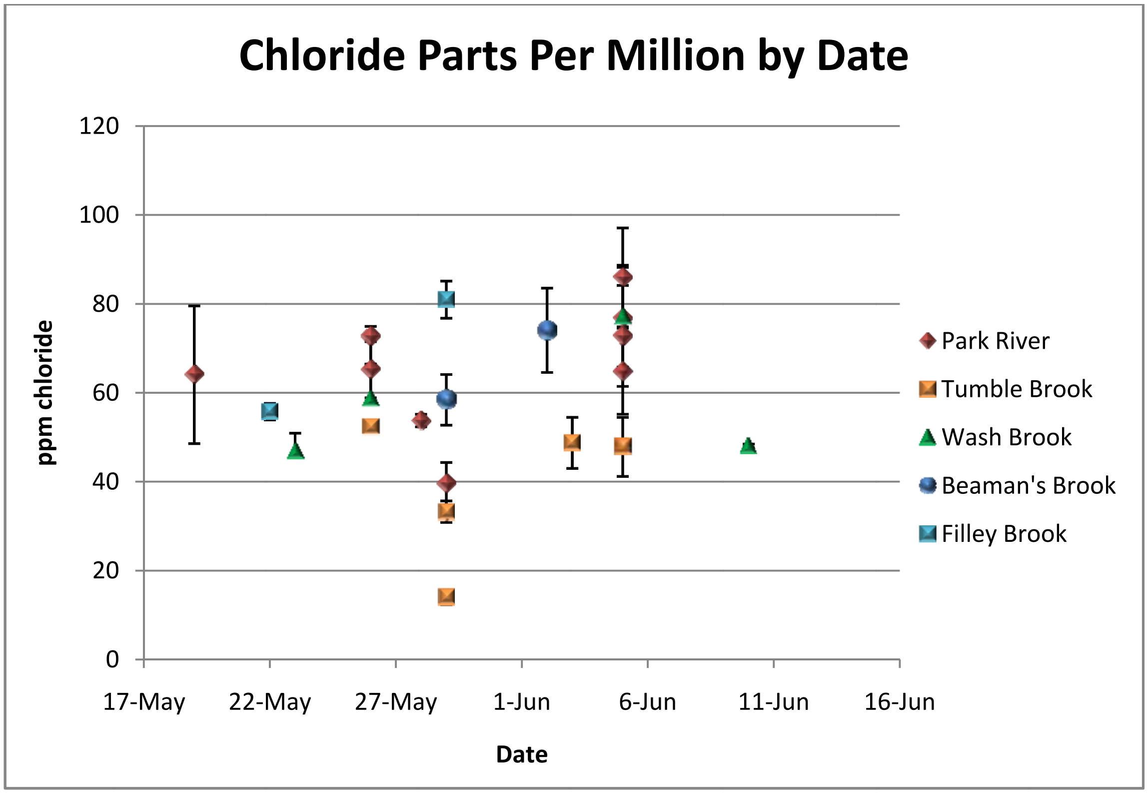
Chloride

Graph 1:



Graph 1 shows the chloride anion concentration in parts per million organized by position in the watershed. There is generally a steady upward trend in chloride anion concentration across the watershed. However, not all tributaries show this trend. There is no trend evident in Filley Brook since there are so few data points. Beamans Brook anion concentration decreases, however, there are only two data points, both with large margins of error. The Tumble Brook tributary shows an upward trend, as does Wash Brook and the Park River, not including the one obvious outlier for the Park River. There are three data points, one for Beamans Brook, Wash Brook, and Filley Brook, that have higher anion concentrations than would be expected so far upstream in the watershed.

Graph 2:



Graph 2 shows the chloride anion concentration in parts per million organized by date collected. There is not a trend in chloride anion concentration across time.

Table 1: Chloride anion concentrations in parts per million for the North Branch of the Park River

Date	Site	Position	Average ppm	SD
5/19/2008	TNBPR 1	5	64.067	15.494
5/26/2008	MNBPR 2	6	65.213	6.310
5/26/2008	MNBPR 3	7	72.784	2.161
5/28/2008	ENBPR 4	8	53.757	1.414
5/29/2008	TNBPR 1	5	39.565	4.770
6/5/2008	TNBPR 1	5	64.871	9.681
6/5/2008	ENBPR 4	8	86.1102	10.980
6/5/2008	MNBPR 3	7	76.890	11.353
6/5/2008	MNBPR 2	6	72.807	10.476

Table 2: Chloride anion concentrations in parts per million for Tumble Brook

Date	Site	Position	Average ppm	SD
5/26/2008	ETB 6	3	52.303	5.736
5/29/2008	TTB 5	1	13.935	1.581
5/29/2008	MTB 5.5	2	32.260	2.418
6/3/2008	ETB 6	3	48.742	5.736
6/5/2008	ETB 6	3	47.844	6.641
6/10/2008	TTB 5	1	42.957	34.503

Table 3: Chloride anion concentrations in parts per million for Wash Brook

Date	Site	Position	Average ppm	SD
5/23/2008	TWB 7	2	50.565	3.980
5/26/2008	EWB 8	3.5	61.501	7.747
6/5/2008	EWB 8	3.5	77.250	11.452
6/10/2008	TWB 7	2	48.077	0.401

Table 4: Chloride anion concentrations in parts per million for Beaman's Brook

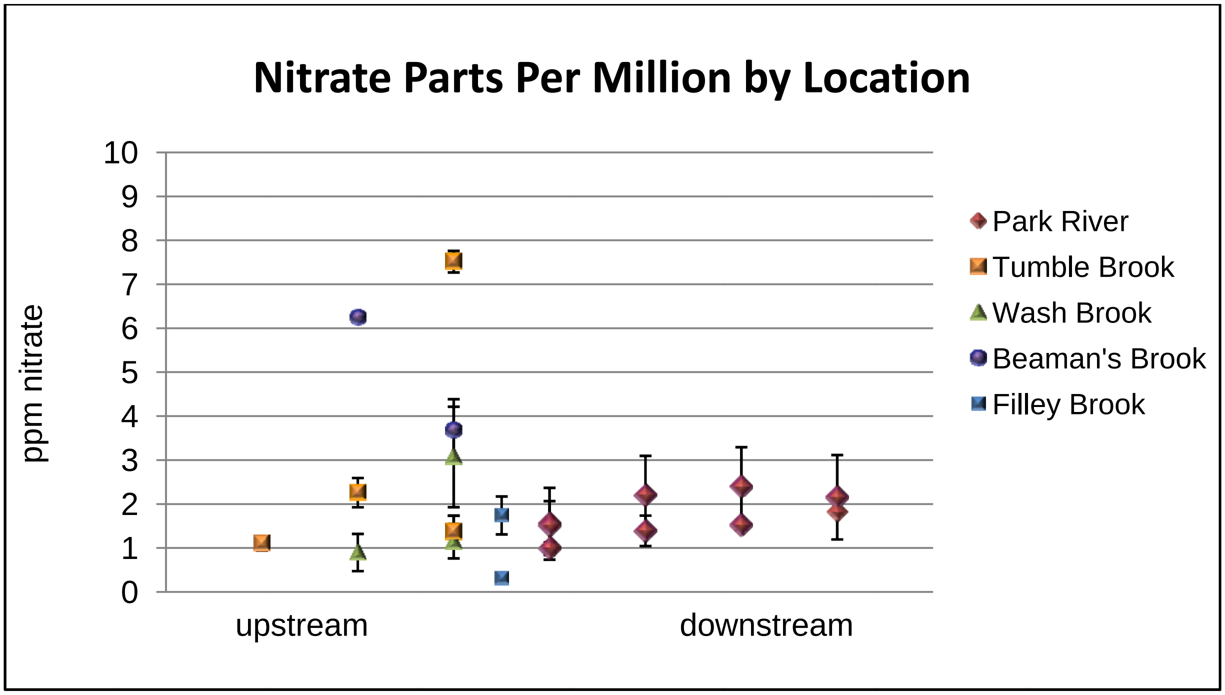
Date	Site	Position	Average ppm	SD
5/29/2008	EBB 10	3	58.428	5.697
6/2/2008	TBB 9	2	74.074	9.490

Table 5: Chloride anion concentrations in parts per million for Filley Brook

Date	Site	Position	Average ppm	SD
5/22/2008	EFB 11	4	55.761	1.861
5/29/2008	EFB 11	4	80.970	4.176

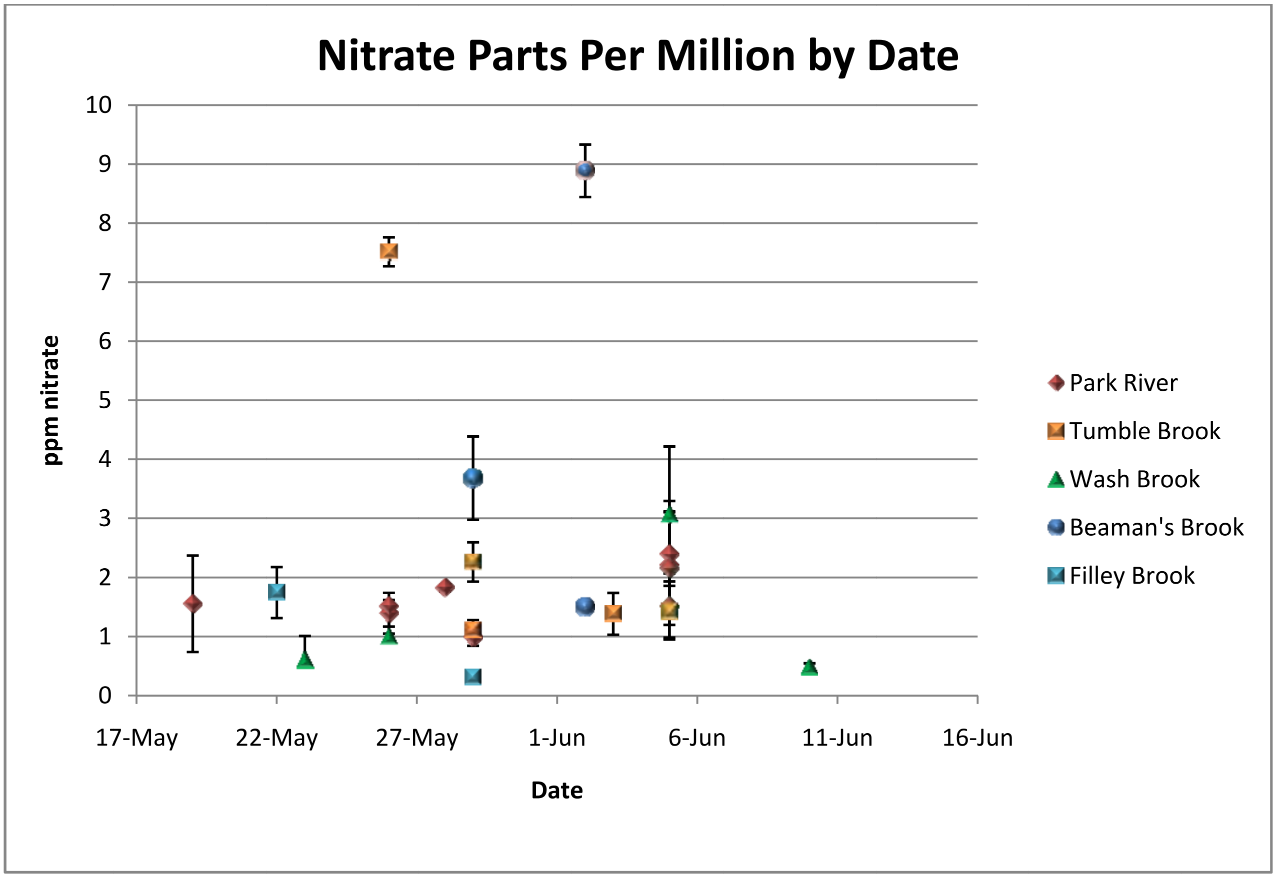
Nitrate

Graph 3:



Graph 3 shows the nitrate anion concentration in parts per million organized by position in the watershed. There may be a slight upward trend in nitrate anion concentration across the watershed, visible in the Park River, but not in any of the tributaries. There is a spike of nitrate anions on two different dates at Tumble Brook and Beamans Brook. The spike in nitrates at Tumble Brook could be due to runoff from fertilizers from the golf course that is located directly upstream from our testing site. The spike at the Beamans Brook site could be due to a current construction project occurring there.

Graph 4:



Graph 4 shows the nitrate anion concentration in parts per million organized by date collected. There is not an obvious trend in nitrate anion concentration across time. There is the same spike of nitrate anions in Tumble Brook and Beamans Brook as seen in graph 3.

Table 6: Nitrate anion concentrations in parts per million for the North Branch of the Park River

Date	Site	Position	Average ppm	SD
5/19/2008	TNBPR 1	5	1.555	0.817
5/26/2008	MNBPR 2	6	1.394	0.346
5/26/2008	MNBPR 3	7	1.514	0.106
5/28/2008	ENBPR 4	8	1.818	0.058
5/29/2008	TNBPR 1	5	0.9878	0.145
6/5/2008	TNBPR 1	5	1.510	0.560
6/5/2008	ENBPR 4	8	2.158	0.960
6/5/2008	MNBPR 3	7	2.397	0.900
6/5/2008	MNBPR 2	6	2.205	0.896

Table 7: Nitrate anion concentrations in parts per million for Tumble Brook

Date	Site	Position	Average ppm	SD
5/26/2008	ETB 6	3	7.518	0.246
5/29/2008	TTB 5	1	1.118	0.168
5/29/2008	MTB 5.5	2	2.263	0.333
6/3/2008	ETB 6	3	1.384	0.357
6/5/2008	ETB 6	3	1.419	0.439
6/10/2008	TTB 5	1	0.846	0.181

Table 8: Nitrate anion concentrations in parts per million for Wash Brook

Date	Site	Position	Average ppm	SD
5/23/2008	TWB 7	2	0.901	0.423
5/26/2008	EWB 8	3.5	1.161	0.393
6/5/2008	EWB 8	3.5	3.074	1.142
6/10/2008	TWB 7	2	0.477	0.071

Table 9: Nitrate anion concentrations in parts per million for Beaman's Brook

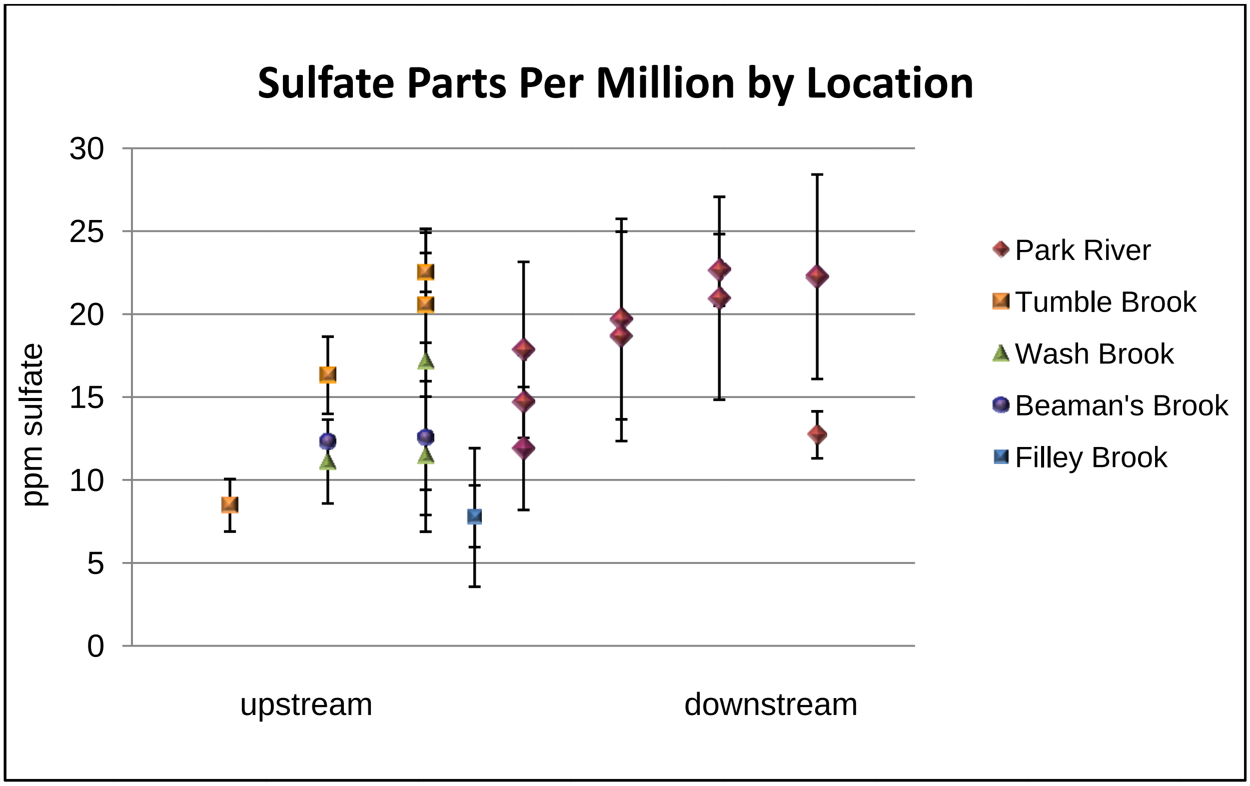
Date	Site	Position	Average ppm	SD
5/29/2008	EBB 10	3	3.683	0.707
6/2/2008	TBB 9	2	6.243	0.987

Table 10: Nitrate anion concentrations in parts per million for Filley Brook

Date	Site	Position	Average T	SD
5/22/2008	EFB 11	4	1.745	0.432
5/29/2008	EFB 11	4	0.311	0.017

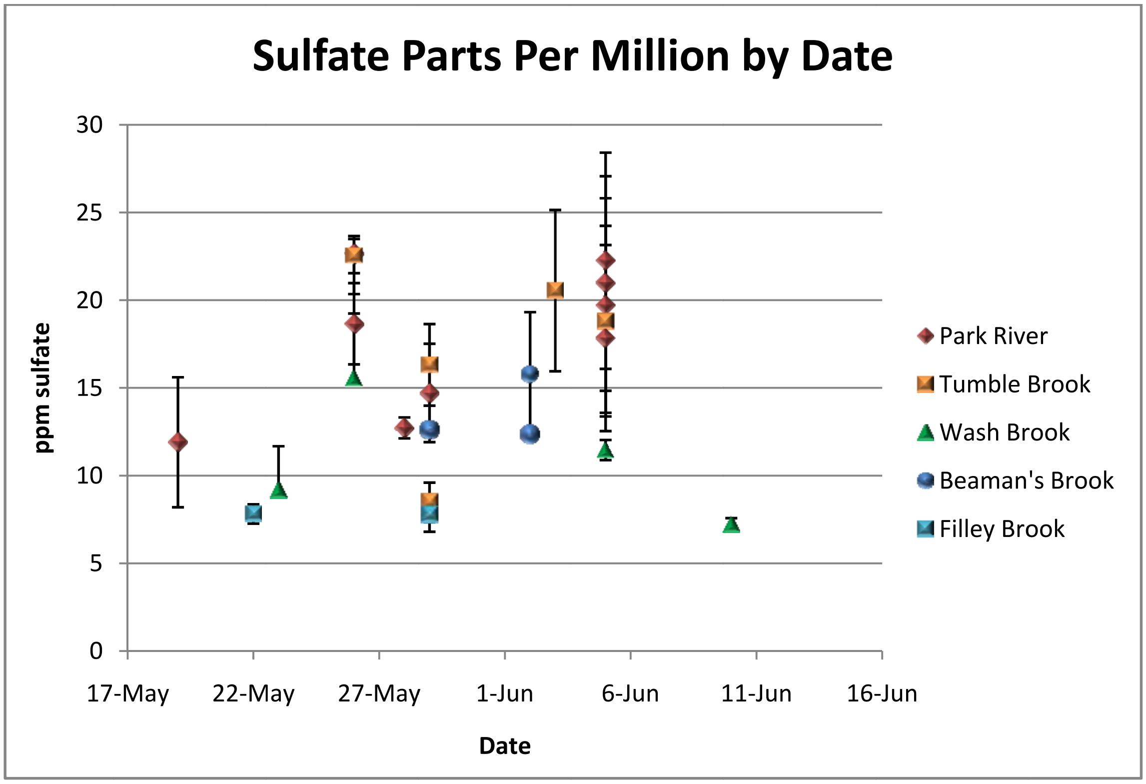
Sulfate

Graph 5:



Graph 5 shows the sulfate anion concentration in parts per million organized by position in the watershed. There appears to be an upward trend in sulfate anion concentration across the watershed. The trends in sulfate content are very similar to those of chloride content. Like chloride, there is generally a steady upward trend in sulfate anion concentration across the watershed, but not all tributaries show this trend. Beamans Brook anion concentration stays about the same. The Tumble Brook tributary shows a strong upward trend, as does the Park River, not including the one obvious outlier for the Park River. The Tumble Brook sulfate concentrations likely spike so sharply due to runoff from the golf courses directly upstream from the middle and end of the Tumble Brook. The margins of error for sulfate are much larger than those for the other anions. This is due to the fact that sulfate anions, as evident in tables 11-15, are found at much lower concentrations than chloride anions.

Graph 6:



Graph 6 shows the sulfate anion concentration in parts per million organized by date collected. There is not an obvious trend in sulfate anion concentration across time.

Table 11: Sulfate anion concentrations in parts per million for the North Branch of the Park River

Date	Site	Position	Average ppm	SD
5/19/2008	TNBPR 1	5	11.910	3.705
5/26/2008	MNBPR 2	6	18.665	2.314
5/26/2008	MNBPR 3	7	22.672	0.995
5/28/2008	ENBPR 4	8	12.728	0.597
5/29/2008	TNBPR 1	5	14.720	2.804
6/5/2008	TNBPR 1	5	17.851	5.303
6/5/2008	ENBPR 4	8	22.259	6.164
6/5/2008	MNBPR 3	7	20.961	6.116
6/5/2008	MNBPR 2	6	19.707	6.044

Table 12: Sulfate anion concentrations in parts per million for Tumble Brook

Date	Site	Position	Average ppm	SD
5/26/2008	ETB 6	3	22.522	0.984
5/29/2008	TTB 5	1	8.483	1.126
5/29/2008	MTB 5.5	2	16.322	2.327
6/3/2008	ETB 6	3	20.555	4.595
6/5/2008	ETB 6	3	18.814	5.433
6/10/2008	TTB 5	1	7.280	0.242

Table 13: Sulfate anion concentrations in parts per million for Wash Brook

Date	Site	Position	Average ppm	SD
5/23/2008	TWB 7	2	11.119	2.526
5/26/2008	EWB 8	3.5	17.163	3.734
6/5/2008	EWB 8	3.5	11.466	3.567
6/10/2008	TWB 7	2	7.220	0.055

Table 14: Sulfate anion concentrations in parts per million for Beaman's Brook

Date	Site	Position	Average ppm	SD
5/29/2008	EBB 10	3	12.586	2.354
6/2/2008	TBB 9	2	15.777	3.551

Table 15: Sulfate anion concentrations in parts per million for Filley Brook

Date	Site	Position	Average ppm	SD
5/22/2008	EFB 11	4	7.821	0.548
5/29/2008	EFB 11	4	7.747	0.938

TRINITY COLLEGE ENVIRONMENTAL SCIENCE PROGRAM

Part IV: Fecal Coliform Testing

For the North Branch Park River and Tributaries

Data Preparer: Caroline Lewis

Assistants: Victoria Doñé, Lucy Schiffman, Andrew Kennedy, Jeffery McNamara

Lab Supervisor: Dr. Jonathan Gourley

7/24/2008

Discussion

No fecal coliform colonies were found in the Park River, Filley Brook, Beaman's Brook, or Tumble Brook from any samples. One fecal coliform colony (type 1B) was found at EWB 8 (end of Wash Brook) on June 24th, 2008. Another fecal coliform colony was found from a storm water sample at the top of the North Branch Park River from 6/23/2008. This was also type 1B. This occurrence of fecal coliform could be due to storm drains carrying urban runoff, especially since no fecal coloiform colonies were found in the North Branch Park River during baseline conditions. Most of our samples from each site contained non-fecal coliform colonies. All samples from Wash Brook and Tumble Brook had non-fecal coliform colonies present. All but one sample from Filley Brook, Beeman's Brook, and The North Branch Park River contained non-fecal coliform colonies.

The most commonly occurring non-fecal coliform colony was type 3, which made up 85% of all non-fecal coliform colonies. This type is of the Enterobacter genera, which normally occurs in soil and water. All samples from each site had colonies that were neither E. coli or coliform colonies (types 5, 6, and 7).

There is no visible change in the type or amount of colonies over time or by position. For graphing purposes, a position number was assigned to each site: one being the most upstream, and eight being the farthest downstream. See the following table for position assignments:

Table 1. The site names and corresponding position numbers.

Site Name	Position Number
TTB 5	1
MTB 5.5	2
ETB 6	3
TWB 7	2
EWB 8	3.5
EBB 10	3
ETBT	2.75
EFB 11	4
TNBPR 1	5
MNBPR 2	6
MNBPR 3	7
ENBPR 4	8
TBB 9	4

One spike in type 7 was found at the end of Tumble Brook on 6/3/2008, where there were 612 colonies. Though this number is higher than at other locations, the type of colony is neither a fecal colony nor a coliform colony, so it is not of concern.

Table 2. The types of colonies.

Colony Number	Colony Number
1A	Fecal coliform
1B	Fecal coliform
2	Non-fecal coliform
3	Non-fecal coliform
4	Non-fecal coliform
5	This colony should not be counted as E. coli or coliform
6	This colony should not be counted as E. coli or coliform
7	This colony should not be counted as E. coli or coliform

Fecal Coliform Graphs

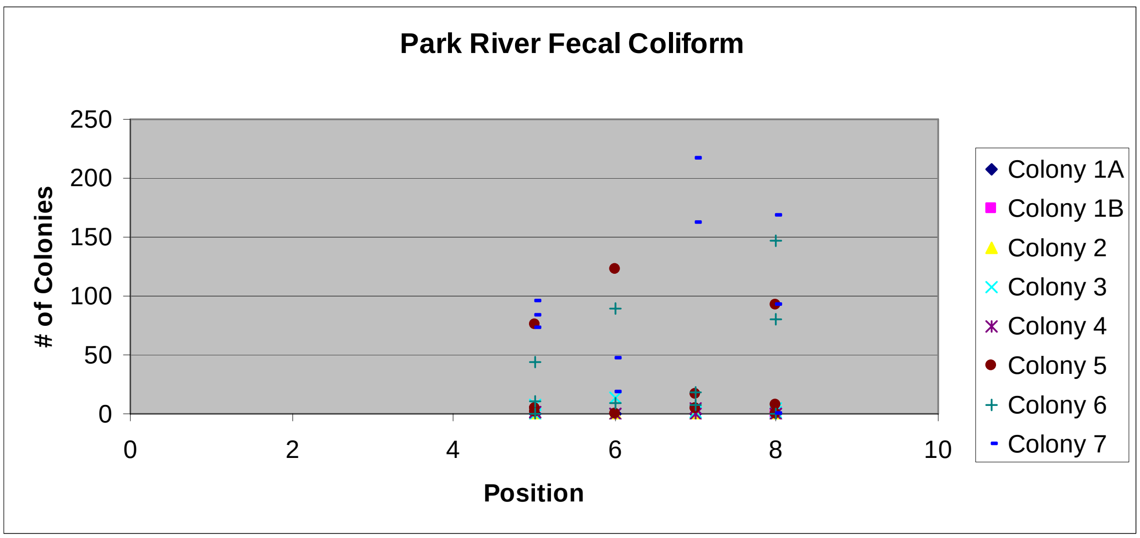


Figure 1. The number of each type of colony from samples of 5 ml of water taken from the Park River, graphed by position.

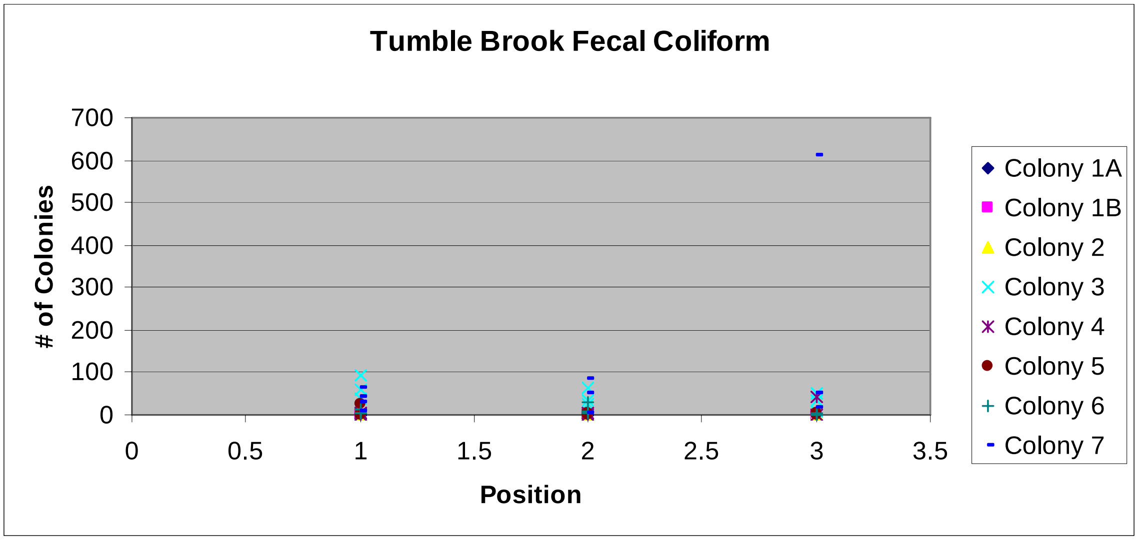


Figure 2. The number of each type of colony from samples of 5 ml of water taken from the Tumble Brook, graphed by position.

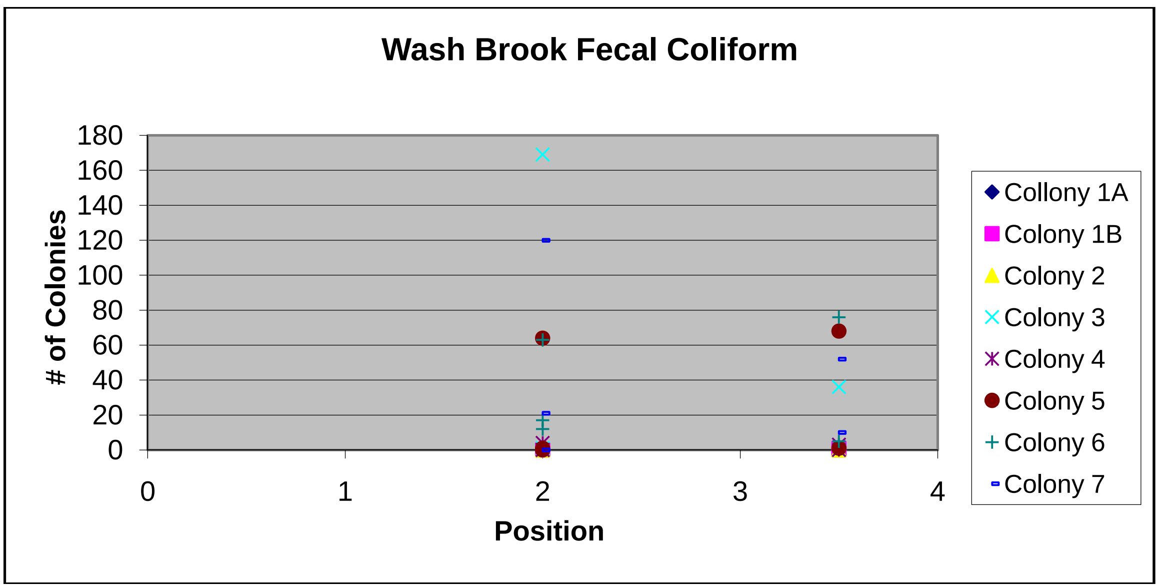


Figure 3. The number of each type of colony from samples of 5 ml of water taken from the Wash Brook, graphed by position.

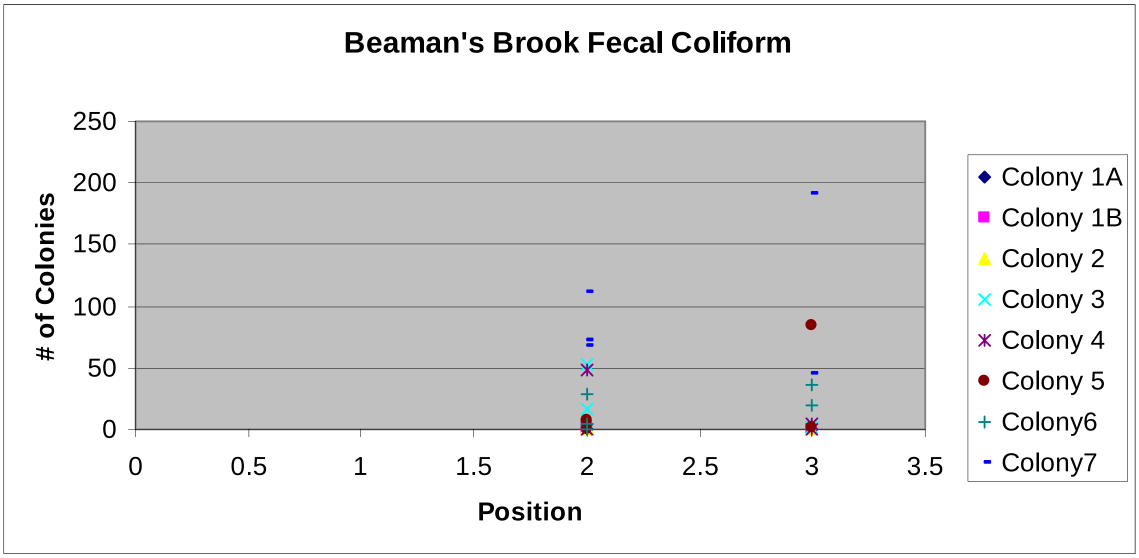


Figure 4. The number of each type of colony from samples of 5 ML of water taken from the Beaman's Brook, graphed by position.

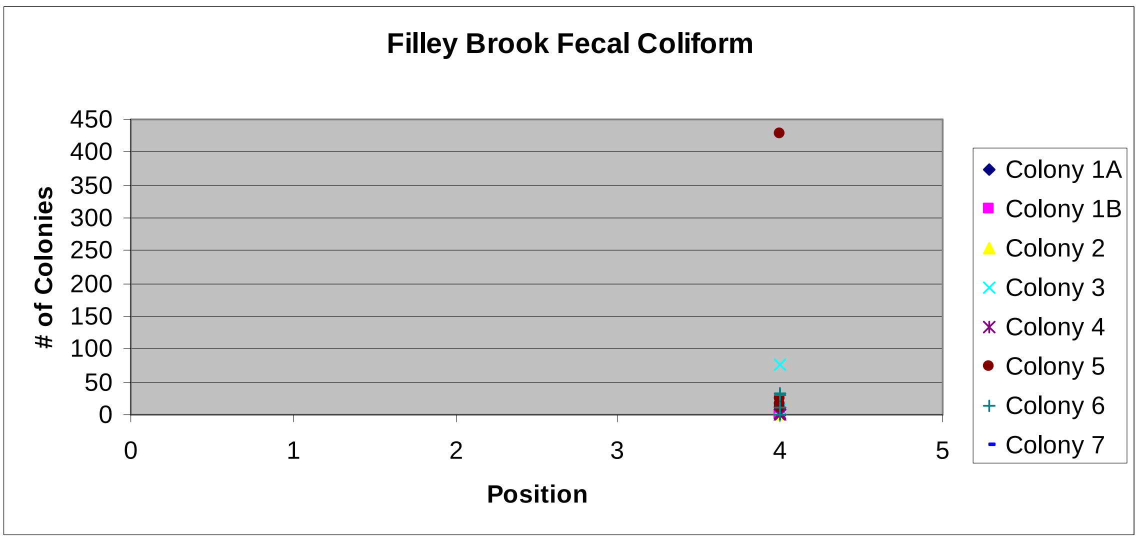


Figure 5. The number of each type of colony from samples of 5 ML of water taken from the Filley Brook, graphed by position.

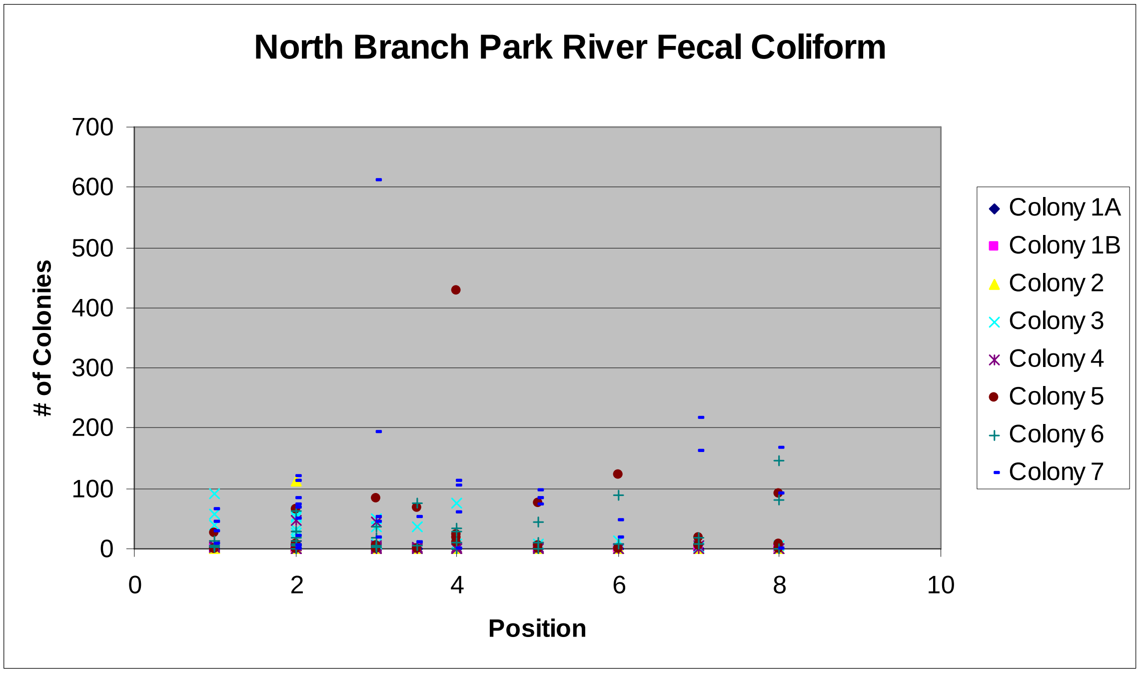


Figure 6. The fecal coliform colonies from all sites graphed by position.

Data Tables

Table 3. Colonies from the Park River from a 5mL sample.

Site Name	Date	1A	1B	2	3	4	5	6	7
TNBPR storm	6/23/2008	0	1	0	6	2	5	14	304
TNBPR 1	5/29/2008	0	0	0	8	2	1	11	72
TNBPR 1	6/17/2008	0	0	0	2	1	5	0	84
TNBPR 1	6/24/2008	0	0	0	0	2	76	44	96
MNBPR 3	6/17/2008	0	0	0	2	5	5	7	216
MNBPR 3	6/24/2008	0	0	0	2	0	17	18	162
MNBPR 2	6/16/2008	0	0	0	13	0	0	9	18
MNBPR 2	6/24/2008	0	0	0	0	0	122	89	47
ENBPR 4	5/28/2008	0	0	0	1	0	0	147	0
ENBPR 4	6/17/2008	0	0	0	4	0	7	0	92
ENBPR 4	6/24/2008	0	0	0	1	0	92	80	168

Table 4. The number of each type of colony in 5mL samples from Tumble Brook samples.

Site Name	Date	1A	1B	2	3	4	5	6	7
TTB 5	5/29/2008	0	0	0	38	6	0	6	8
TTB 5	6/10/2008	0	0	0	58	2	1	4	44
TTB 5	6/16/2008	0	0	0	92	3	0	3	28
TTB 5	6/24/2008	0	0	0	2	4	27	14	64
MTB 5.5	5/29/2008	0	0	0	26	4	0	28	50
MTB 5.5	6/11/2008	0	0	0	62	0	0	7	84
MTB 5.5	6/25/2008	0	0	0	32	4	4	5	4
ETB 6	6/3/2008	0	0	0	49	44	2	2	612
ETB 6	6/11/2008	0	0	0	36	0	0	5	17
ETB 6	6/25/2008	0	0	0	7	2	4	2	53

Table 5. The number of each type of colony from 5mL samples from Filley Brook samples.

Site Name	Date	1A	1B	2	3	4	5	6	7
EFB 11	5/29/2008	0	0	0	1	0	11	33	104
EFB 11	6/25/2008	0	0	0	8	2	24	11	112
EFB 11	5/22/2008	0	0	0	0	0	428	0	0

Table 6. The number of each type of coliform colony from 5mL samples from the Beaman's Brook samples.

Site Name	Date	1A	1B	2	3	4	5	6	7
TBB 9	6/2/2008	0	0	0	0	0	0	0	72
TBB 9	6/10/2008	0	0	0	52	0	6	29	68
TBB 9	6/17/2008	0	0	1	16	48	7	5	112
EBB 10	5/29/2008	0	0	0	5	5	1	19	45
EBB 10	6/24/2008	0	0	0	1	0	84	36	192

Table 7. The number of each colony from Wash Brook samples of 5mL.

Site Name	Date	1A	1B	2	3	4	5	6	7
TWB 7	5/23/2008	0	0	0	113	0	1	12	0
TWB 7	6/10/2008	0	0	0	56	4	0	17	21
TWB 7	6/24/2008	0	0	0	1	0	64	63	120
EWB 8	6/23/2008	0	0	0	0	0	68	76	52
EWB 8	6/24/2008	0	1	0	36	3	1	5	10

TRINITY COLLEGE ENVIRONMENTAL SCIENCE PROGRAM

Part V: Water Temperature Data

For the North Branch Park River and Tributaries

Data Preparer: Andrew Kennedy and Jeffrey McNamara
Assistants: Victoria Doñé, Caroline Lewis and Lucy Schiffman
Project Supervisor: Dr. Jonathan Gourley
7/24/2008

Temperature Data Discussion

A HOBO is a battery powered temperature data logger that is used to monitor underwater temperatures. One HOBO is deployed in the middle of the stream at each site (fig. A-1). The graphed HOBO water temperature data shows a gradual temperature increase from when the HOBOs were placed in the river on May 22nd 2008 and when they were taken out in mid July. Also, all of the data show a large spike in temperature around the date of June 11th 2008. This spike corresponds to the warmest air temperatures in Hartford for the summer from June 7th to June 10th when the high temperature was between 33 and 37 degrees Celsius (see fig. 13). All of the HOBOs also show a small peak in temperature around July 11th 2008. The average temperature increase per day for all twelve sites is 0.129 degrees Celsius with a standard deviation of 0.0250.

Results

Temperature Data Graphs

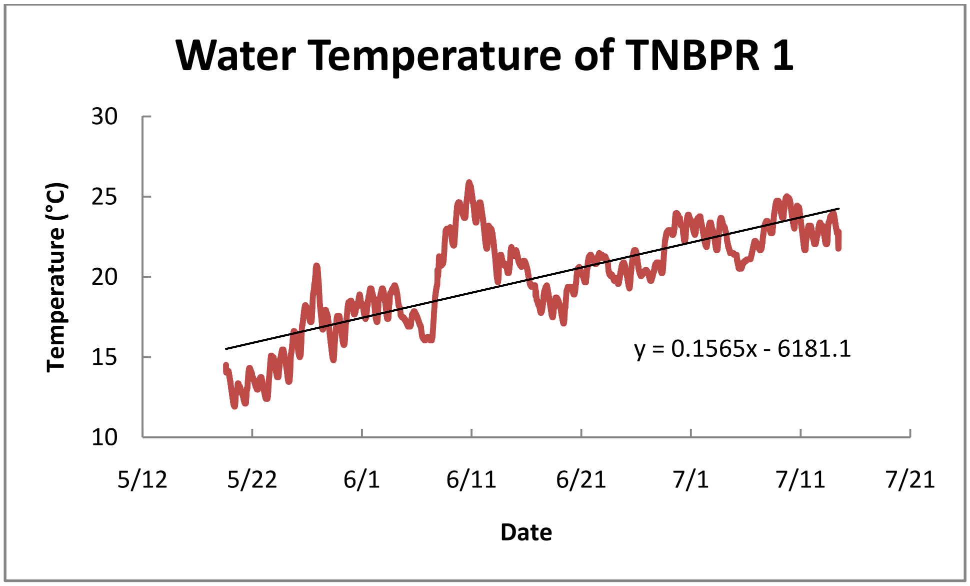


Figure 1: This graph shows the water temperature data from May 19th 2008 to July 14th for site 1

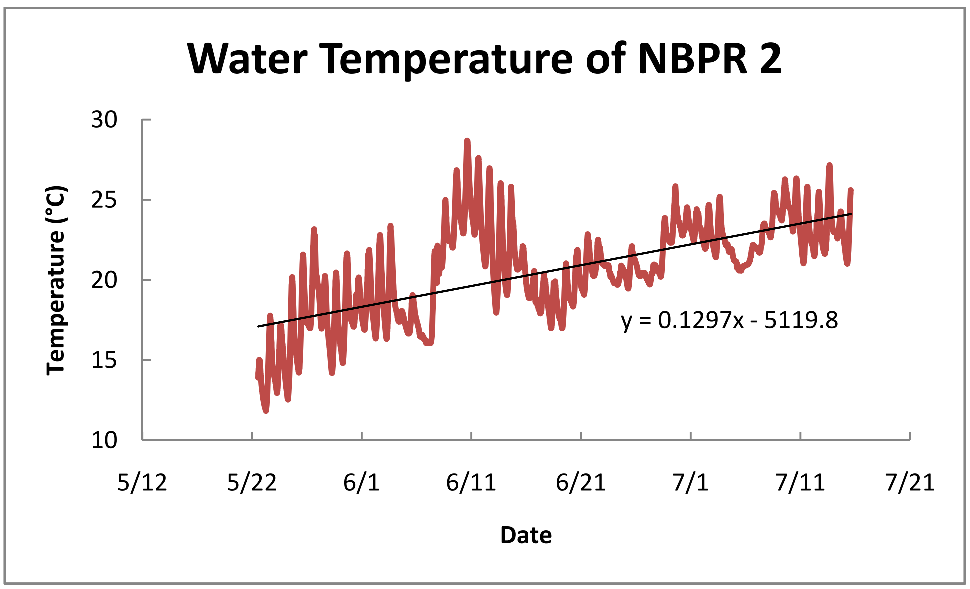


Figure 2: This graph shows the water temperature data from May 22nd to July 15th for site 2

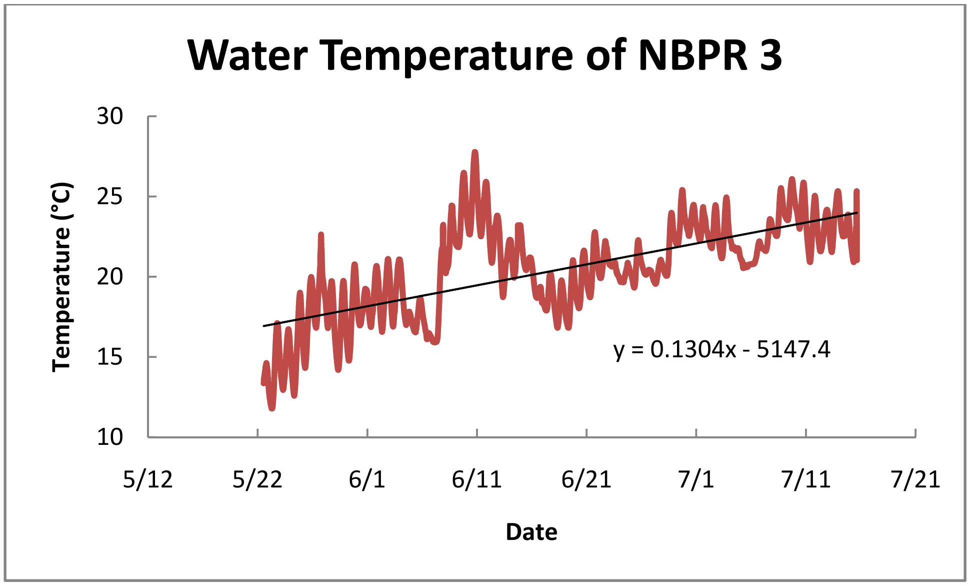


Figure 3: This graph shows the water temperature data from May 22nd to July 15th for site 3.

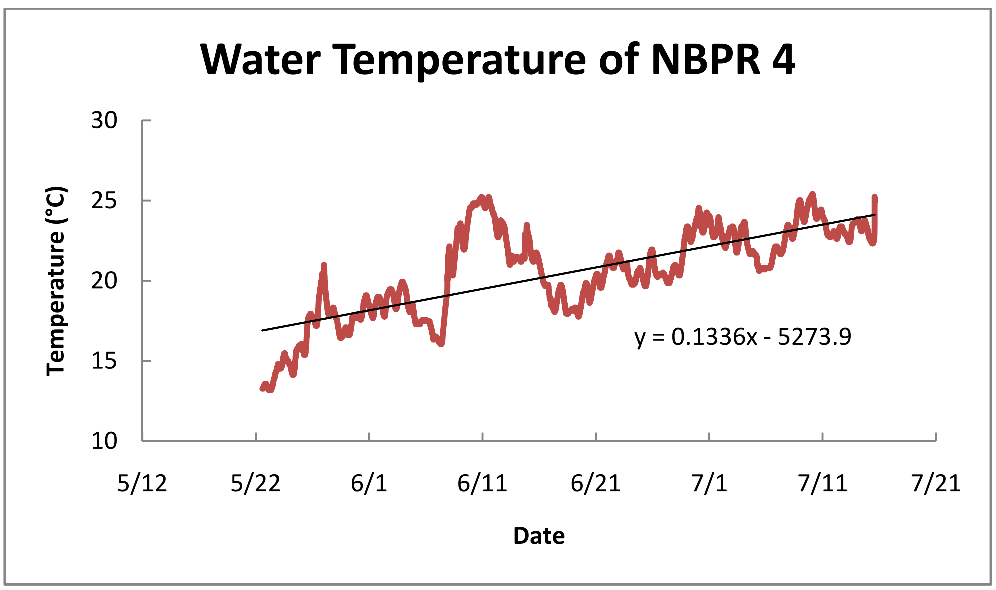


Figure 4: This graph shows the water temperature data from May 22nd to July 15th for site 4.

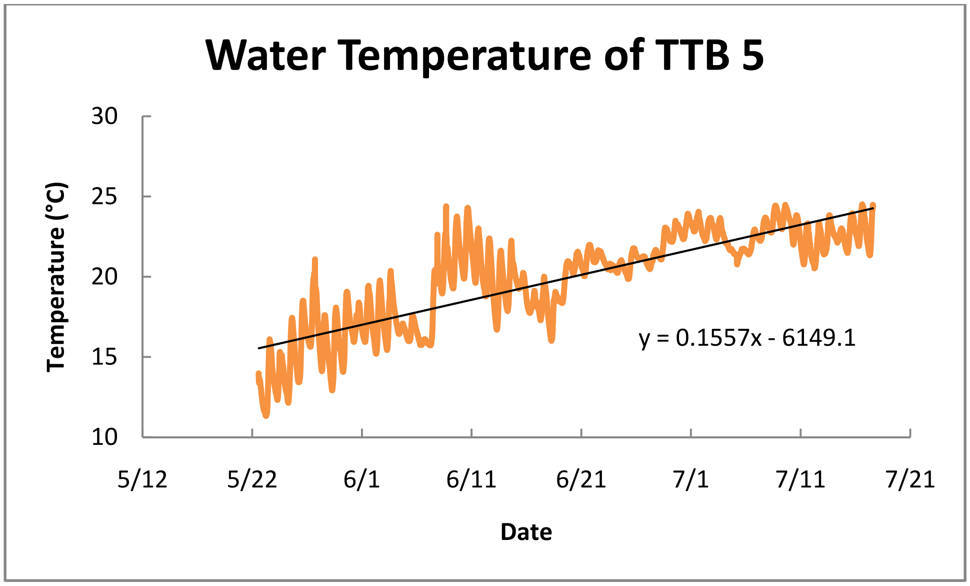


Figure 5: This graph shows the water temperature data from May 22nd to July 17th for site 5.

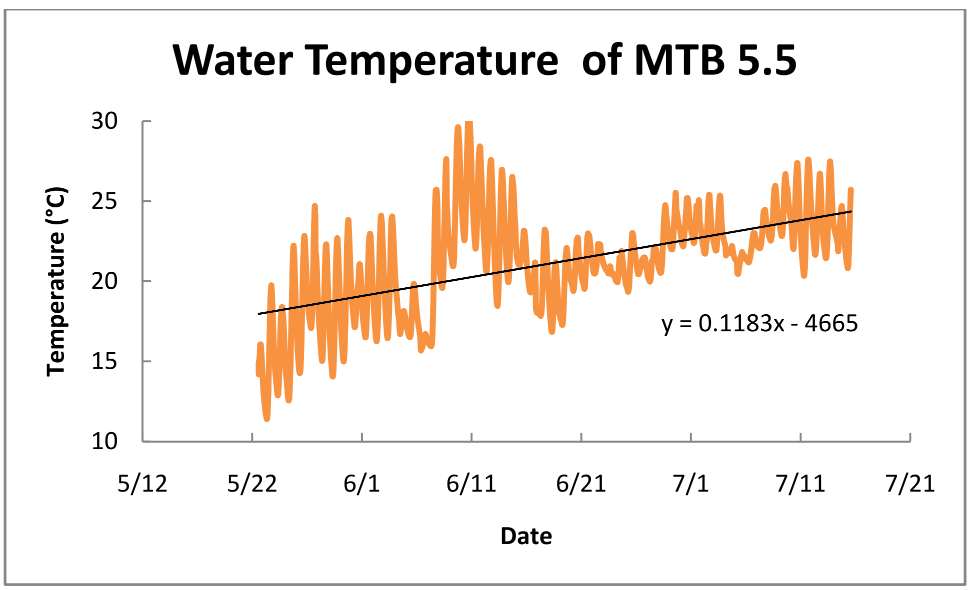


Figure 6: This graph shows the water temperature data from May 22nd to July 15th for site 5.5.

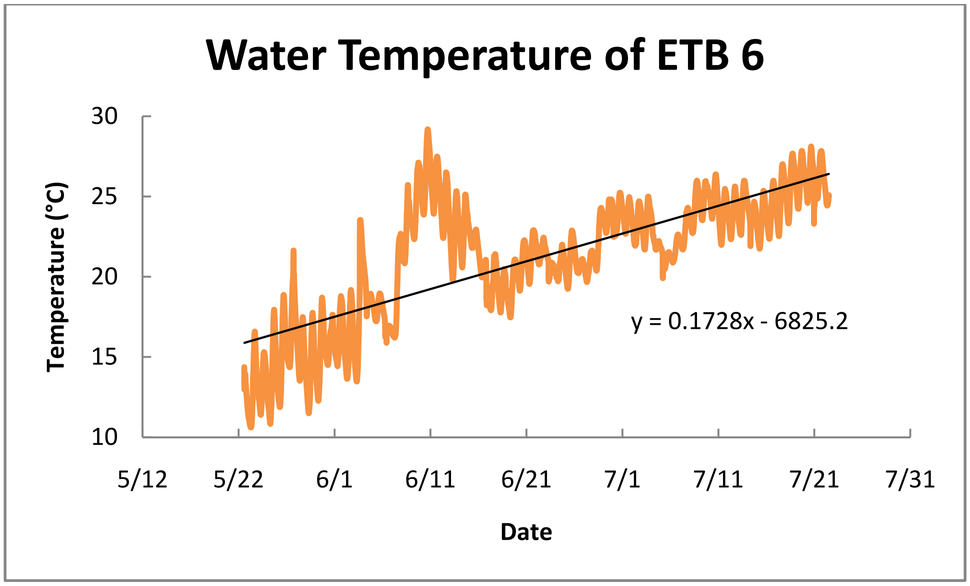


Figure 7: This graph shows the water temperature data from May 22nd to July 22nd for site 6.

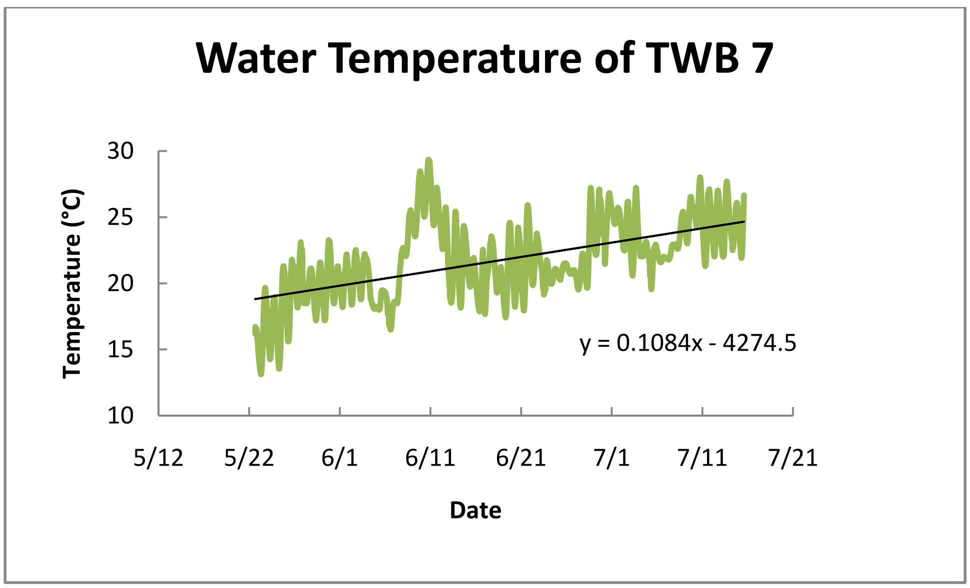


Figure 8: This graph shows the water temperature data from May 22nd to July 15th for site 7.

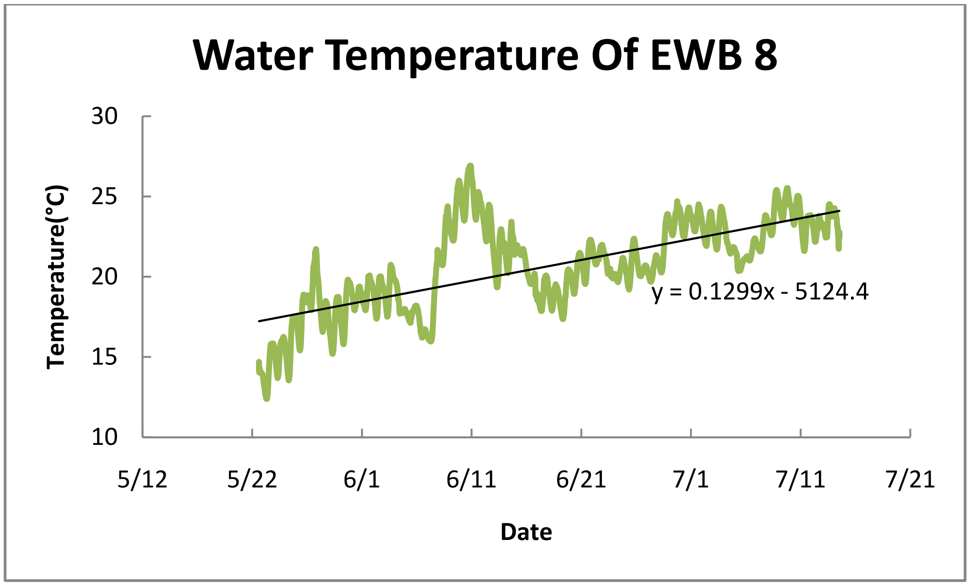


Figure 9: This graph shows the water temperature data from May 22nd to July 14th for site 8.

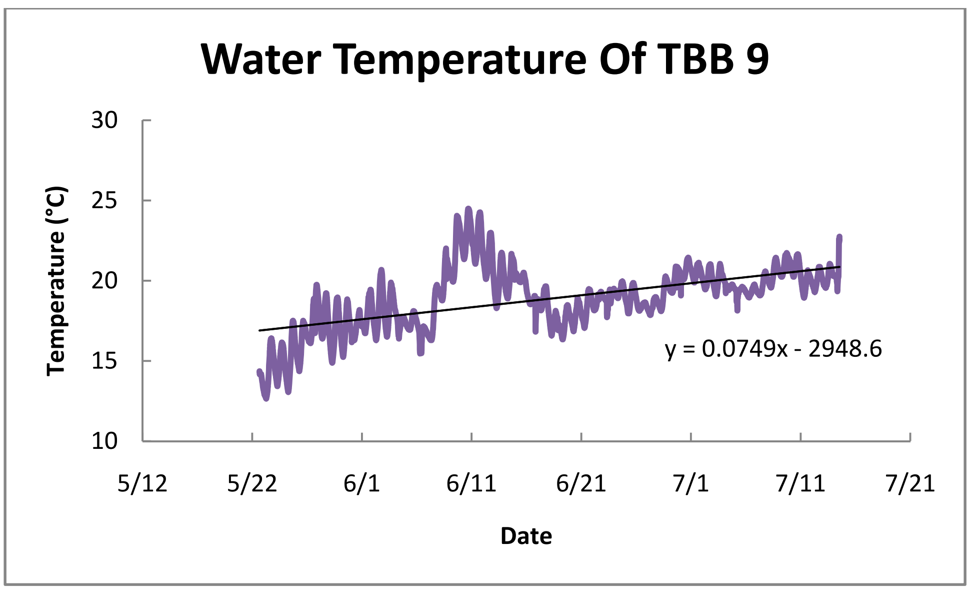


Figure 10: This graph shows the water temperature data from May 22nd to July 14th for site 9

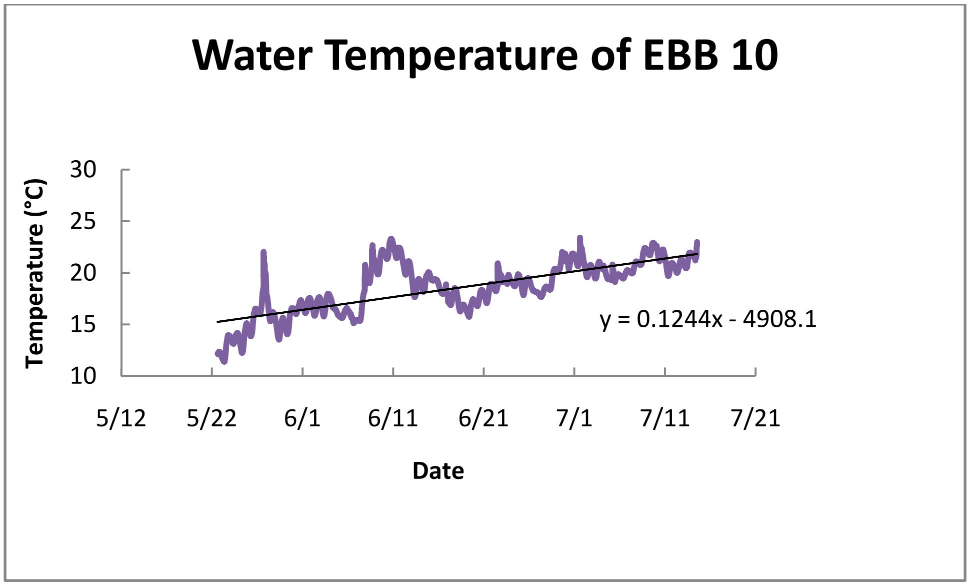


Figure 11: This graph shows the water temperature data from May 22nd to July 14th for site 10.

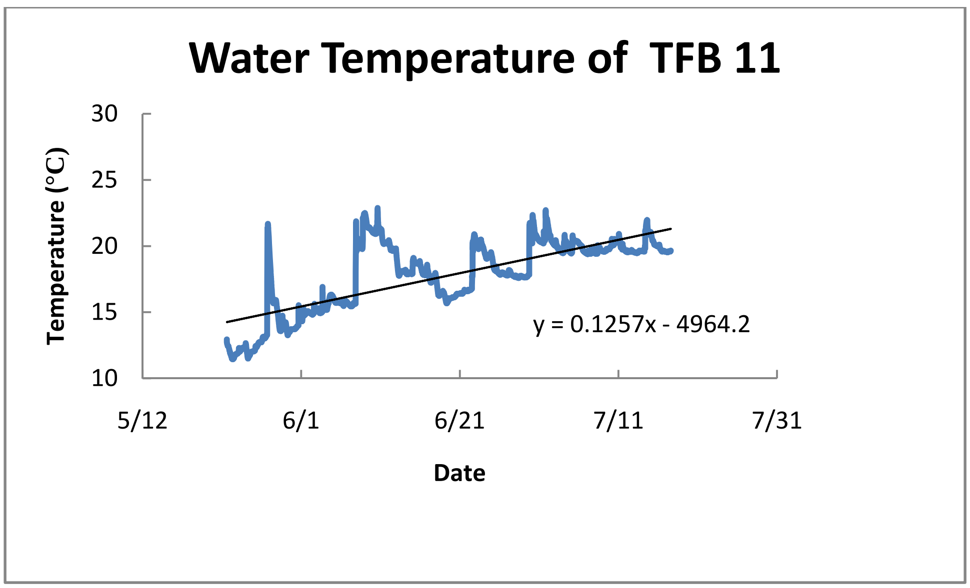


Figure 12: This graph shows the water temperature data from May 22nd to July 17th for site 11.

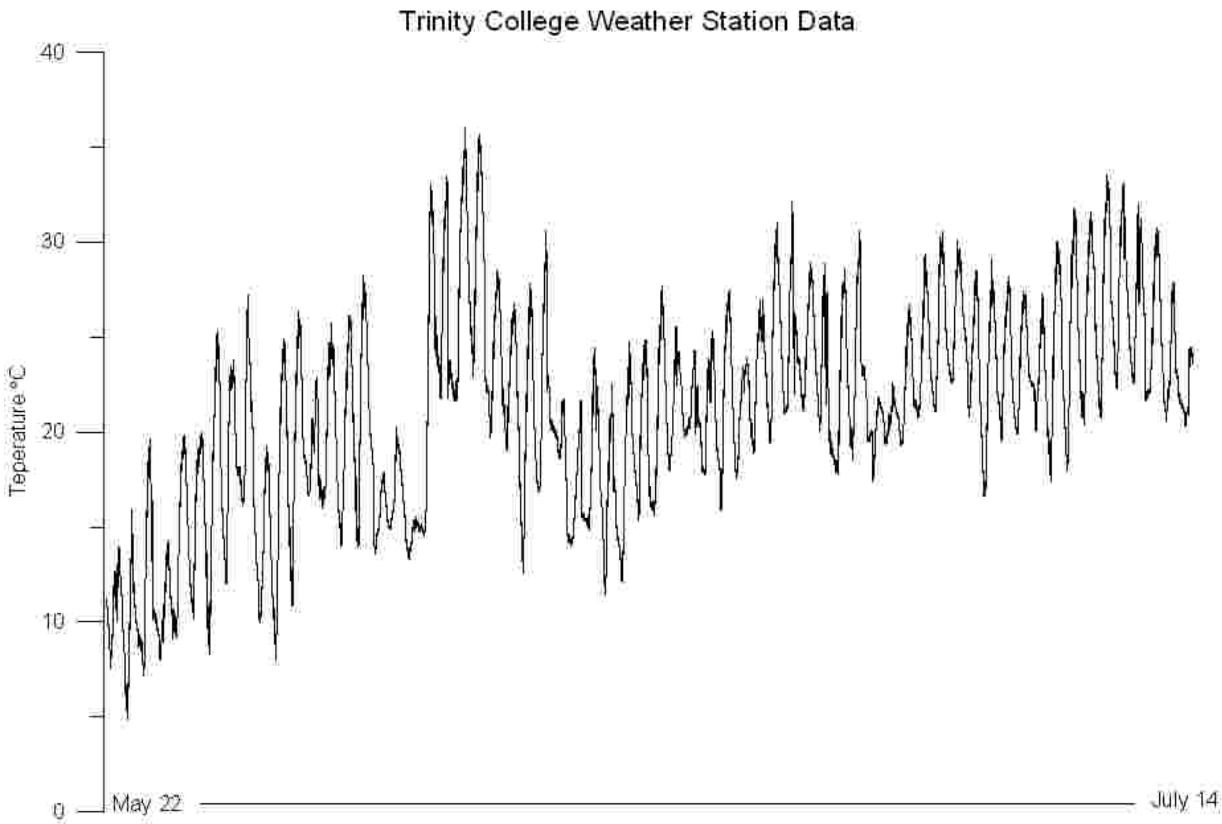


Figure 13: Air Temperature at Trinity College Weather Station

Part VI: Pictures and Site Descriptions

For the North Branch Park River and Tributaries

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7/24/2008

Site Descriptions

(all pictures taken looking downstream)

Site 5 (Top Tumble Brook) – TTB 5

This portion of the stream is in a residential area of West Hartford. It is lined with a concrete wall on both sides. A bridge crosses over the river, and there is a discarded refrigerator beneath it. The bridge, which supports Mountain Road, is located .2 miles south east of the intersection between Still Road and Mountain Road. The sampling site is located just downstream from the bridge. The water is deep near the bridge, about 1 meter, and gets very shallow, about 1 foot, downstream. There is a long riffle zone downstream. The bottom is covered with scattered cobbles and a few small boulders. Looking downstream, there are shrubs, weeds, overgrown grasses, and small bushes on the right bank.

Site 5.5 (Middle Tumble Brook) – MTB 5.5

This portion of the river runs through a residential area. The water is about 1 meter deep. The water is still and the bottom is muddy. There is little vegetation on the banks. There is a bridge, which supports Still Road, crossing over the river. Still Road intersects the Brook a half mile west of the intersection of Still Road and Route 173.

Site 7 (Top Wash Brook) – TWB 7

The site is located on Route 189, ¾ of a mile North of were Terry Plains Road intersects Route 189. There is a small beaver dam downstream from the bridge/road. There are several outflow pipes draining into the river. The depth of the water varies; it is deeper under the bridge, and gets shallower downstream, near the beaver dam. It is mostly muddy bottom with a few small rocky parts (around 4 feet long). There are slow-flowing riffle zones directly after the beaver dams. There is rip rap surrounding the abutment of the bridge

Site 9 (Top Beamans Brook) – TBB 9

Site 9 is located at the end of an unmarked dirt road which runs west from Dudley Town Road, .65 miles south of Blue Hills avenue. This section of the brook is near a construction site that is home to a future animal rescue shelter. Other then the future animal shelter the area is relatively isolated. The brook is at the edge of a forest and a small wooden bridge crosses it. No riffle zones are present in this section. The bottom is sandy and without rocks.

Site 6 (End Tumble Brook) – ETB 6

A bridge crosses the river upstream from our sampling location. There are tall grasses surrounding the right bank (looking downstream) and a forested area on the left. There is a tree whose branches shade the river over the riffle zone. There are small-medium rocks covering the bottom. The sampling site is accessible from Medinah Drive .1 mile east of Maple Avenue.

Site 10 (End Beamans Brook) – EBB 10

Site 10 is located a few hundred feet West of were Goodman St. intersects Route 218. The sampling site is located just downstream of bridge, South of Route 218. The river is very shallow at the sampling site, about a foot deep, but it gets deeper downstream. The bottom is mostly muddy but with a small riffle zone up stream under the bridge.

Site 8 (End Wash Brook) – EWB 8

Site 8 is located at the intersection of Route 218 and Bloomfield Avenue. A bridge crosses downstream of our sampling site. The section under the bridge is channelized. The river is much shallower in the channelized section under the bride, about a foot and a half deep. On the other side of the bridge, the water is calm, and still shallow. The section of the river used for sampling is downstream of the bridge, and is a fast-flowing riffle zone. The bottom is very rocky, containing rocks of various sizes. Trees, shrubs, and grass are present on both banks.

Site 11 (End Filley Brook) – EFB 11

Site 11 is located on the South side of Route 218 just east of the 600 Apartments. Water is about a meter and a half deep in the center. The mud is very thick and one sinks into it when walking in the stream. The banks are wooded on both sides of the stream. On one side there is an office park and on the other side there is an apartment complex. The water is also stagnant and brown in color.

Site 1 (Top North Branch Park River) – TNBPR 1

Site 1 is located just downstream of where Portage Road crosses over the river, approximately .1 miles east of where Portage Road intersects Bloomfield Avenue. This section of the river runs through a residential area with houses on both banks. It has a rocky bottom that includes a mixture of rock sizes.


Site 2 (Mid 2 North Branch Park River) – MNBPR 2

Site 2 is located on University Drive .44 miles north-east of the intersection of University Drive and Bloomfield Avenue. The river is surrounded by dense shrubs and weeds, including poison ivy. There is a series of tunnels that go into the river and under the bridge. There is rip rap surrounding the abutment of the bridge. The depth of the river varies upstream to downstream and across the width. The bottom is covered with large rocks in most areas. There is a very small island (about 3ft in diameter) directly downstream from the third tunnel. This is where our uppermost riffle zone is located. Another riffle zone lies slightly downstream and to the right. This is the largest riffle zone at the site. The last riffle zone is much farther downstream and far to the left. This riffle zone is calmer than the others.

Site 3 (Mid 3 North Branch Park River) – MRBPR 3

Site 3 is located just downstream from the intersection of Albany Ave and Scarborough Street. The river is deep even on the bank and only gets slightly deeper in the middle. The river reaches a depth of approximately 1 meter in the middle. The riffle zone is downstream from blocks of concrete that create a miniature waterfall. There is a fast current around the riffle zone.

Site 4 (End North Branch Park River) – ENBPR 4

Site 4 is accessible from the back of the Medical Arts Building parking lot off of Woodland Street, .1 mile North of Farmington Avenue. The river is separated from the parking lot of the medical arts building by a brief wooded area. The water is about ¾ of a meter deep and there is a slight current. The bottom of the river is mostly sandy with a few scattered rocks.

Appendix E

Pollutant Loading Analysis

Appendix E

Pollutant Loading Analysis
North Branch Park River Watershed

Appendix E

Pollutant Loading Analysis
North Branch Park River Watershed

Tables

End of Report

1 Introduction

A pollutant loading analysis was performed for the North Branch Park River watershed in support of the Baseline Watershed Assessment Report to assess the potential for increases in nonpoint source (NPS) pollutant loads. The model was used to compare existing nonpoint source (NPS) pollutant loads from the watershed to projected future pollutant loads under a watershed buildout scenario. The predicted change in pollutant loads in each of the subwatersheds was used as an indicator of their relative vulnerability to future development. The pollutant loading model is used to identify and rank pollution sources, as well as assist in identifying, prioritizing, and evaluating subwatershed pollution control strategies.

2 Model Description

A pollutant loading model was applied to the North Branch Park River watershed using the land use/land cover data described in *Section 7.0* of the Baseline Watershed Assessment Report. The model was used to compare pollutant loadings from the watershed under existing land use conditions to future pollutant loadings under a watershed buildout scenario. It is important to note that the results of this screening-level analysis are intended for the purposes of comparing existing to future conditions and not to predict future water quality.

The Watershed Treatment Model (WTM), Version 3.1, developed by the Center for Watershed Protection, was used for this analysis. This model calculates watershed pollutant loads primarily based on nonpoint source (NPS) runoff from various land uses. The model was also used to estimate pollutant loads from other sources, including:

- Combined Sewer Overflows
- Illicit Discharges
- Septic Systems
- Sanitary Sewer Overflows
- Managed Turf
- Road Sanding

Reductions in future pollutant loads in the watershed can be estimated using a range of treatment measures, such as structural and nonstructural best management practices, that are included in the WTM.

Other similar screening-level pollutant loading models were considered for use in development of a watershed management plan for the North Branch Park River, including the Spreadsheet Tool for the Estimation of Pollutant Load (STEPL), the Generalized Watershed Loading Function (GWLF) model, and other similar models. While STEPL was identified as a suitable choice for the North Branch Park River, it was determined that the WTM is better suited for modeling bacterial loads and provides a larger suite of best management practices for urban areas. The ArcView GIS version of the GWLF model was also considered for use in the evaluation, although the AVGWLF model has limited capability for modeling CSOs when using the urban runoff module RUNQUAL within the GWLF model. Again, the WTM model was determined to be better suited for modeling CSOs than the AVGWLF model.

The pollutants modeled in this analysis are the default pollutants contained in the WTM model: total phosphorus, total nitrogen, total suspended solids, and total fecal coliform bacteria. These pollutants are the major NPS pollutants of concern in environmental systems. Additional loading from the CSOs and SSOs during wet-weather was simulated in the subwatershed where such discharges are known to exist.

Nitrogen and phosphorus are nutrients that promote the growth of algae and plants in water. When this biomass dies and settles to the bottom of water bodies, its decomposition consumes oxygen which is needed by other organisms for survival. Nitrogen is generally present in relatively small quantities compared to other nutrients in salt water systems, such as Long Island Sound, so limiting its concentration limits the growth of algae. In fresh water systems, such as the streams and impoundments in the North Branch Park River watershed, phosphorus is the nutrient that is relatively scarce and thus limits algal growth.

Total suspended solids (TSS) is a measure of both biodegradable and mineral sediment. Its discharge to a water body results in turbidity and sedimentation. TSS may also have secondary effects; biodegradable TSS exerts a biological oxygen demand (BOD), and mineral TSS can be associated with particulate phosphorus.

Fecal coliform is commonly used as a surrogate parameter to indicate the possible presence of disease-causing bacteria, viruses, and protozoans that also live in human and animal digestive systems. Therefore, their presence in streams suggests that pathogenic microorganisms might also be present and that swimming or contact recreation might be a health risk. Fecal coliform is present in stormwater runoff due to contamination with the fecal material of humans or animals and can enter rivers through direct discharge of waste from mammals and birds, from agricultural and storm runoff, and from human sewage (EPA, 2006).

3 Model Inputs

3.1 Nonpoint Source Runoff

Land use/land cover data that is described in the Baseline Watershed Assessment Report was adapted for use in the WTM. Data were prepared in this manner for both the existing conditions and future conditions (watershed buildout) pollutant loading scenarios. The available land use data for the North Branch Park River have categories defined by the Capitol Region Council of Governments (CRCOG). The WTM allows the user to enter custom land use categories. The land use categories that are chosen for the model were selected based on the parameter-specific land use categories listed in *Table E-2*. *Table E-3* summarizes the assignment of WTM land use categories for each of the CRCOG land use categories. The Multi-family and Single-family residential land uses were further refined into three sub-categories of residential land use for the WTM since a large percentage of the watershed consists of residential use. Generally, Low-density/Single family residential is considered greater than 1 acre, Medium density between ¼ and 1 acre and High-density/Multi-family is less than ¼ acre. Exceptions were made for variable-sized lots within subdivisions of generally uniform lot sizes to maintain consistency within residential subdivisions.

The WTM uses the Simple Method to calculate nutrient, sediment, and bacteria loads from various land uses. The user specifies several model parameters for each land use in the watershed that are used to estimate runoff quantity and pollutant levels. These parameters include Event Mean Concentrations (EMCs), which are literature values for the mean concentration of a pollutant in stormwater runoff for each land use, and an average impervious cover percentage for each land use.

A literature review was conducted to determine EMC values and impervious percentage values for use in the evaluation. Since comparison between existing and proposed watershed conditions is the focus of this analysis, EMC values were selected to reflect the relative difference in NPS pollutant characteristics between existing and future land uses. *Table E-2* at the end of this report shows EMC values from several sources for the pollutants of interest, with the selected values displayed at the bottom of the table.

The default impervious cover coefficients in the WTM were adjusted to better reflect local conditions in the North Branch Park River watershed. Impervious cover estimates for each land use category were modified based on measured total impervious area (TIA) for representative parcels or areas within each land use. The default impervious cover coefficients, literature values, and the selected impervious cover coefficients are presented in *Table E-1*.

3.2 Other Pollutant Sources

In addition to nonpoint source runoff pollutant loads, the WTM also provides the capability to model other pollutant sources including point sources and subsurface contributions. The following sections describe the model inputs and parameter values for other pollutant sources within the North Branch Park River watershed.

3.2.1 Combined Sewer Overflows

The WTM uses a modification of the Simple Method to calculate annual loads from CSOs. The primary assumption is that CSO discharges occur when the combined volume of stormwater and wastewater exceeds the total system capacity. The MDC system experiences approximately 50 CSO discharge events annually in the North Branch Park River (MDC, 2009). Statistical analysis of 15 years of precipitation data at a nearby weather station reveals that the approximate critical depth of rainfall to cause 50 CSO discharge events per year is 0.3 inches.

The volume of a typical CSO is based on the median storm event. In the WTM, any rainfall beyond the system capacity contributes to the CSO volume. Thus, this volume is calculated as the runoff caused by the difference between the median storm event depth and the rainfall depth that causes CSOs (assumed to be 0.3 inch). The runoff volume from this storm event is determined using the Simple Method. The resulting CSO pollutant load is the product of the CSO volume, the number of CSO events, and typical CSO pollutant concentrations, summarized in *Table E-5*.

3.2.2 Illicit Discharges

The WTM default assumptions for illicit discharges were used (i.e., a fraction of the total sewage flow contributes to illicit connections). The WTM makes separate assumptions for residential and business illicit connections. For residential connections, the WTM's default assumption is that one in every 1,000 sewered individuals is connected to the sewer system via an illicit connection. This value is then multiplied by the number of individuals connected to the system, and then by typical per capita flow and pollutant concentrations for raw sewage. For businesses, it is assumed that 10% of businesses have illicit connections, and approximately 10% of those have direct sewage discharges.

3.2.3 Septic Systems

Although the majority of the North Branch Park River watershed is served by sanitary sewers, portions of the western and northwestern sections of Bloomfield are on private septic systems (Thiesse, pers. comm., December 18, 2009). The number of unsewered dwelling units in each subwatershed was estimated using GIS data including the mapped sewer service area, impervious cover, and aerial photographs. The approximate number of unsewered dwelling units in each subwatershed is provided as *Table E-6*. The WTM default values were used for septic system failure rate (30%) and effluent concentrations from both working and failing septic systems.

3.2.4 Sanitary Sewer Overflows

There is currently one sanitary sewer overflow (SSO) discharge location in the North Branch Park River subwatershed. WTM default assumptions were used since detailed information on the volume and frequency of overflow was not available.

The WTM estimates the SSO load as a product of total flow from SSOs and pollutant concentrations of raw sewage. Unlike most urban pollutant sources, which can be classified as either storm loads or non-storm loads, SSOs can occur both during and between storms. Some are initiated by storm events, such as when the cause of the overflow is lack of capacity, or infiltration of rainfall into the sanitary system. SSOs can also be caused by pipe breakage or blockage, resulting in flow between storm events. The WTM default assumption is that 50% of the load from SSOs occurs as a storm load, with the remainder as a non-storm load.

Based on the MDC GIS data, there are 82 miles of sanitary sewer that convey wastewater to the SSO location in the North Branch Park River subwatershed. An estimated 12 overflows occur per year by assuming the default rate of 140 SSOs per 1,000 miles of sewer.

3.2.5 Managed Turf

In urban watersheds, subsurface flow constitutes a relatively small fraction of total annual flow, and most constituents have a relatively low concentration in groundwater. One possible exception is nitrogen, which can leach from urban lawns and other managed turf grass. The annual nitrogen load from managed turf areas is calculated as the product of its concentration and the annual infiltration volume. The area of managed turf in each subwatershed is based on 2006 Center for Land use Education and Research (CLEAR) Land Cover Data and includes residential lawns, golf courses, parks, and other areas with grass or turf. Managed turf areas used in the WTM are summarized in *Table E-6*.

3.2.6 Road Sanding

Sediment loads from road sanding are calculated based on the quantity of sand applied to roads in a typical year. Data from the West Hartford Public Works Department was extrapolated to the rest of the watershed since more detailed data was unavailable. A sanding application rate for typical roads was calculated based on the average rate in West Hartford in pounds per mile per year. The local roads GIS layer was used to calculate the total length of roads in each subwatershed and the total amount of sand applied to the roads in an average year. Note that winter road application is typically a 50/50 mixture of road sand and salt. The volume of salt is not included in this calculation, so the result is for total suspended solids only. Since road sand consists of relatively large sediment particle sizes, not all of the sediment will reach the receiving water body due to gravity settling. The default WTM assumption is that 90% of road sand is delivered to the receiving water in closed section roads, while only 35% is delivered in open section roads.

4 Existing Pollutant Loads

Table E-7 presents the existing modeled pollutant loads for the North Branch Park River watershed. Nonpoint source runoff accounts for approximately 71% of the total nitrogen load, 89% of the total phosphorus load, 33% of the total suspended solids load, and 7% of the fecal coliform bacteria load for the entire watershed. Road sanding accounts for nearly the entire balance of the total suspended solids load, while CSOs and SSOs contribute more than 90% of the fecal coliform load for the watershed. *Table E-8* presents a breakdown of estimated annual loadings of total nitrogen, total phosphorus, TSS, and fecal coliform by subwatershed.

Because the study subwatersheds vary in size, pollutant loads were also evaluated in terms of loading rates (i.e., pollutant loads per acre of land area, as shown in *Table E-8*). A higher loading rate indicates relatively greater pollutant sources per unit area, which suggests that implementation of best management practices (BMPs) in these areas may be more effective in reducing pollutant loads. The highest loading rates for nitrogen and phosphorus are associated with the North Branch Park River, Filley Brook, Wash Brook South, Tumbledown Brook, and Wash Brook North subwatersheds. Filley Brook has the loading rates of total suspended solids, while the North Branch Park River subwatershed has the largest fecal coliform loading rate due to contributions from CSOs and SSOs.

- *North Branch Park River*. The North Branch Park River subwatershed is the largest subwatershed by area. It also has the largest amount of commercial/industrial, institutional, and transportation land uses. The nutrient loads in this subwatershed are approximately 3 times greater than the next highest subwatershed, primarily due to the comparatively large size and highly urban nature of the subwatershed. The estimated nitrogen loading rate (excluding CSO and SSO contributions) is the second highest of the subwatersheds at 9.4 lb/ac-year, while the phosphorus loading rate is the highest of the subwatersheds at 1.3 lb/ac-year. The estimated fecal coliform loading due to nonpoint source runoff is 279,377 billion per year, while the contribution of fecal coliform from sewer overflows is significantly larger (approximately 6 orders of magnitude) than the nonpoint source runoff contribution.

- *Wash Brook South*. Wash Brook South ranks among the top four subwatersheds in annual pollutant loading and loading rates. The high loading is due to the proportionally high commercial/industrial, residential, and roadway land uses in this subwatershed.

- *Filley Brook*. The Filley Brook subwatershed has the highest TSS loading rate in the watershed and is among the 4 highest subwatersheds in terms of pollutant loading rates for nitrogen, phosphorus, and fecal coliform bacteria. However, the total loading of each pollutant is among the lowest in the watershed due to its small size. The high pollutant loading rates reflect the large percentage of medium density residential (50%) and commercial/industrial (20%) development in the subwatershed.

Table E-9 summarizes the contribution of nonpoint source pollutant loads by land use for the entire watershed. The majority of the nitrogen and phosphorus loads are from roadway, commercial/industrial, and residential land uses. The majority of the TSS loads is due to roadway (41.8%) and commercial/industrial (31.1%) land use. Residential land use accounts for approximately 83% of the nonpoint source bacterial load. Other modeled pollutant sources contribute significantly to the watershed pollutant loads, particularly CSOs and SSOs, which are the predominant source of the fecal coliform loads in the watershed.

5 Future Pollutant Loads

Anticipated future land use due to new development and redevelopment within the watershed (*Table E-10)* was used in the WTM model to simulate potential future pollutant loads under a watershed buildout scenario. The predicted changes in land use under a watershed buildout scenario are presented in *Table E-11.* Future land use categories were derived from the watershed buildout scenario presented in the Baseline Watershed Assessment Report. Future controls or best management practices were not considered in the calculation of future pollutant loads. Therefore, the predicted future pollutant loads reflect a potential worst-case scenario against which potential watershed management pollution control strategies may be evaluated. Additionally, future pollutant loads were modeled with and without CSO and SSO mitigation to evaluate the potential reductions in pollutant loads that could be achieved by the MDC's ongoing and planned sewer overflow mitigation projects.

Table E-12 presents projected future pollutant loads and load increases under a watershed buildout scenario. Not considering ongoing and planned CSO and SSO mitigation efforts, a significant increase in nutrient and bacteria pollutant loads is predicted in many of the subwatersheds. *Table E-13* presents the projected future pollutant loads in terms of the projected load increase based on existing loads (percent increase) and loading rate increase for each subwatershed.

The watershed as a whole is predicted to experience a 13% increase in nitrogen loads, a 16% increase in phosphorus loads, and a 20% increase in TSS loads under a future buildout scenario and assuming completion of the ongoing and planned CSO and SSO mitigation projects. Overall fecal coliform loads for the entire watershed are predicted to decrease by 64%, primarily as a result of the MDC sewer overflow mitigation projects. However, these projects will only affect pollutant loads in the North Branch Park River subwatershed. Almost all of the other subwatersheds are predicted to experience significant increases in fecal coliform loads (generally 20% to 80% increases) under a watershed buildout scenario due to nonpoint source runoff. Several of the subwatersheds are predicted to experience significantly higher increases in pollutant loads and loading rates under a watershed buildout scenario. These subwatersheds, which include the Beamans Brook East, Wash Brook North, Wash Brook West, and Wintonbury Reservoir subwatersheds, correspond to areas with significant developable land.

6 References

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Tables

Table E-1. Impervious Cover Coefficients

Land Use	Impervious Cover Coefficients			
	STEPL	NEMO[1]	WTM	Selected
Agriculture	-	-	-	0
Open Space	0.01	0.001 - 0.094		0.01
Commercial/Industrial	0.85	0.205 - 0.557	0.72	0.7
Multi-family/High Density Residential	0.75	0.09 - 0.39	0.44	0.44
Medium Density Residential	-	-	0.33	0.33
Single-family/Low Density Residential	0.3	0.065 - 0.12	0.21	0.21
Institutional	0.5	-	-	0.3
Forest	-	-	-	0
Roadway	0.95	0.433	0.8	0.8

[1] *Sleavin et al. (2000) and Prisloe et al. (2003)*

Table E-2. Runoff Event Mean Concentrations (EMCs)

Source	Pollutant	Land Use									
		Agriculture	Open Space (Urban)	Commercial	Multi-family/High Density Residential	Medium Density Residential	Single-family/Low Density Residential	Institutional	Forest	Roadway	Units
STEPL	N	1.9	1.5	2	2.2	-	2.2	1.8	0.2	3	mg/L
	P	0.3	0.15	0.2	0.4	-	0.4	0.3	0.1	0.5	mg/L
	FC	-	-	-	-	-	-	-	-	-	#/100mL
	TSS	-	70	75	100	-	100	67	-	150	mg/L
NSQD	N*	-	1.2	2.2	2	-	-	-	-	2.3	mg/L
	P	-	0.25	0.22	0.3	-	-	-	-	0.25	mg/L
	FC	-	-	-	-	-	-	-	-	-	#/100mL
	TSS	-	51	43	48	-	-	-	-	99	mg/L
NURP	N*	-	1.5	1.75	2.6	-	-	-	-	-	mg/L
	P	-	0.1	0.201	0.38	-	-	-	-	-	mg/L
	FC	-	-	-	-	-	-	-	-	-	#/100mL
	TSS	-	70	57	101	-	-	-	-	-	mg/L
WTM	N*	-	-	2	2	-	2	-	-	2	mg/L
	P	-	-	0.26	0.26	-	0.26	-	-	0.26	mg/L
	FC	-	-	20,000	20,000	-	20,000	-	-	20,000	#/100mL
	TSS	-	-	55	55	-	55	-	-	55	mg/L
RUNQUAL	N	-	-	-	-	-	-	-	-	-	mg/L
	P	-	-	-	-	-	-	-	-	-	mg/L
	FC	-	-	9,600	9,600	9,600	9,600	9,600	-	-	#/100mL
	TSS	-	-	-	-	-	-	-	-	-	mg/L
CH2M HILL	N*	1.1	1.1	-	2.7	1.7	1.2	-	-	-	mg/L
	P	0.2	0.2	-	0.3	0.2	0.2	-	-	-	mg/L
	FC	-	500	1,400	8,700	8,700	8,700	1,400	500	1,400	#/100mL
	TSS	19.2	20	-	47.7	30.5	22.1	-	70	-	mg/L
Selected	**N**	**1.5**	**1.5**	**2.2**	**2.7**	**1.7**	**1.2**	**1.8**	**0.2**	**3**	**mg/L**
	P	**0.2**	**0.15**	**0.4**	**0.3**	**0.2**	**0.2**	**0.3**	**0.1**	**0.5**	**mg/L**
	FC	**500**[†]	**500**	**1,400**	**8,700**	**8,700**	**8,700**	**1,400**	**500**	**1,400**	**#/100mL**
	TSS	**19.2**	**20**	**100**	**47.7**	**30.5**	**22.1**	**67**	**70**	**150**	**mg/L**

N=Total Nitrogen; P=Total Phosphorus; FC=Fecal Coliform; TSS=Total Suspended Solids *Nitrate and nitrite only
[†] No data - selected same value as forest and open space to model non-animal agricultural land use
See References for Source Information

Table E-3. Modeled Land Use Categories

North Branch Park River Land Use Category (CRCOG)	WTM Land Use Category
Agriculture	Agriculture
Cemetery	Open Space (Urban)
Commercial	Commercial (includes Industrial uses)
Government/Non-Profit	Institutional
Group Quarters	Institutional
Health/Medical	Institutional
Mixed Use	High Density Residential
Multi-Family	Residential Low, Medium, High Density based on parcel size and impervious cover
One Family	Residential Low, Medium, High Density based on parcel size and impervious cover
Resource/Recreation	Open Space (Urban)
ROW	Roadway
Undeveloped	Forest
Unknown	Forest

Table E-4. Existing Land Use Composition by Subwatershed

Subwatershed	Existing Modeled Land Use Composition (acres)								
	Agriculture	Commercial/ Industrial	Forest	Institutional	Medium Density Residential	Multi-family/High Density Residential	Open Space (Urban)	Roadway	Single-family/Low Density Residential
Beaman Brook East	0.0	0.0	18.7	0.0	26.2	0.0	14.6	5.1	98.3
Beaman Brook West	0.0	92.4	128.8	215.2	359.4	0.0	234.7	110.2	44.3
Blue Hills Reservoir	32.5	325.3	97.9	72.7	21.6	0.0	385.1	47.8	52.1
Cold Spring Reservoir	23.6	13.5	352.6	0.0	22.4	0.0	90.8	72.8	579.3
Filley Brook	19.5	75.7	27.8	21.3	201.1	0.0	1.0	57.5	0.2
North Branch Park River	0.0	394.0	426.5	733.0	813.9	748.9	300.0	580.2	36.8
Tumbledown Brook	32.9	293.8	122.4	64.8	527.6	0.0	336.6	115.5	66.9
Tumbledown Brook South	4.8	2.6	498.0	81.6	515.1	0.0	323.8	105.9	90.1
Tunxis Reservoir	38.0	83.0	68.1	24.1	30.1	0.0	371.1	56.6	202.7
Wash Brook North	128.7	202.8	190.0	39.8	73.9	0.0	25.8	62.3	38.7
Wash Brook South	25.9	271.3	240.9	101.2	587.3	0.0	57.0	148.4	127.3
Wash Brook West	38.9	1.4	217.0	0.0	190.5	0.0	248.8	56.7	275.6
West Hartford Reservoir	0.0	4.3	1774.2	25.9	2.5	0.0	17.9	24.5	198.1
Wintonbury Reservoir	63.3	125.0	187.7	0.0	185.3	0.0	256.2	50.4	25.7
Total (Watershed)	408	1885	4351	1380	3557	749	2663	1494	1836

Table E-5. Model Parameters - CSOs, SSOs, and Illicit Connections

Pollutant Source	Parameter	Description (Source)
Combined Sewer Overflows (NBP subwatershed only)	Median Storm Event (inches) = 0.685 Sewershed Area (acres) = 1594 Sewershed Impervious Cover (%) = 29.7% # of CSOs/year = 50 Critical CSO value (rainfall depth in inches) = 0.3	WTM, 2001- Model default values; MDC, 2009
Sanitary Sewer Overflows (NBP subwatershed only)	82 miles of sanitary sewer up-gradient of SSO location 140 SSOs per 1,000 miles of sewer	MDC, 2009; WTM, 2001- Model default values
Household and Business Illicit Connections	Household Fraction of Population Illicitly Connected = 0.001 Business Fraction of Businesses with Illicit Connections = 0.1 Fraction of Business Connections that are Wash Water Only = 0.9	WTM, 2001; Model default values

Table E-6. Model Parameters - Septic Systems, Managed Turf, and Road Sanding

Subwatershed	Approximate Number of Unsewered Dwelling Units	Turf and Grass Area (acres)	Length of Roads (mi)	Road Sand Applied (lbs/yr)
Beaman Brook East	0	45	1.8	68,264
Beaman Brook West	150	328	22.4	835,105
Blue Hills Reservoir	0	86	8.0	298,198
Cold Spring Reservoir	300	205	13.0	484,205
Filley Brook	0	201	11.4	426,367
North Branch Park River	0	838	81.7	3,041,953
Tumbledown Brook	130	786	26.0	970,130
Tumbledown Brook South	100	592	24.5	912,539
Tunxis Reservoir	175	255	8.7	324,045
Wash Brook North	0	72	11.1	413,436
Wash Brook South	20	529	30.1	1,121,120
Wash Brook West	150	277	8.0	297,972
West Hartford Reservoir	30	12	5.3	198,151
Wintonbury Reservoir	0	143	8.2	305,421

Table E-7. Modeled Existing Pollutant Loads by Source Type

Source	N lb/yr	P lb/yr	TSS lb/yr	Fecal Coliform billion/yr
Nonpoint Source Runoff	97,441	15,234	3,686,296	883,935
Other Sources	38,949	1,874	7,487,076	11,170,230
Septic Systems	14,487	182	7,274	0
SSOs	516	86	3,441	390,550
CSOs	3,653	731	73,054	10,654,285
Illicit Discharges	1,004	586	9,416	125,395
Managed Turf	19,288	289	0	0
Road Sanding	0	0	7,393,891	0
Total	**136,389**	**17,108**	**11,173,372**	**12,054,165**

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Table E-8. Modeled Existing Pollutant Loads

Subwatershed	N (lb/yr)	P (lb/yr)	TSS (lb/yr)	Fecal Coliform (billion/yr)	N (lb/ac-yr)	P (lb/ac-yr)	TSS (lb/ac-yr)	Fecal Coliform (billion/ ac-yr)
Beaman Brook East (163 ac)	778	112	65,702	18,530	4.8	0.7	403	113.8
Beaman Brook West (1,185 ac)	8,917	1,096	892,088	63,816	7.5	0.9	753	53.9
Blue Hills Reservoir (1,035 ac)	6,740	1,115	500,837	27,292	6.5	1.1	484	26.4
Cold Spring Reservoir (1,155 ac)	8,825	822	499,416	95,667	7.6	0.7	432	82.8
Filley Brook (404 ac)	4,349	543	454,764	30,696	10.8	1.3	1,126	76.0
North Branch Park River (4,033 ac) (excluding CSOs and SSOs)	37,808	5,121	3,537,838	279,377	9.4	1.3	877	69.3
CSOs and SSO	4,169	817	76,495	11,044,834	1.0	0.2	19.0	2,738.4
Tumbledown Brook (1,561 ac)	15,486	1,660	1,112,424	93,446	9.9	1.1	713	59.9
Tumbledown Brook South (1,622 ac)	10,149	937	895,817	84,370	6.3	0.6	552	52.0
Tunxis Reservoir (874 ac)	7,142	672	381,828	41,445	8.2	0.8	437	47.4
Wash Brook North (762 ac)	5,187	845	527,067	26,722	6.8	1.1	692	35.1
Wash Brook South (1,559 ac)	13,603	1,778	1,263,600	111,061	8.7	1.1	810	71.2
Wash Brook West (1,029 ac)	6,680	602	329,983	68,767	6.5	0.6	321	66.8
West Hartford Reservoir (2,048 ac)	1,839	332	246,421	33,749	0.9	0.2	120	16.5
Wintonbury Reservoir (894 ac)	4,719	657	389,091	34,393	5.3	0.7	435	38.5
Watershed Total (18,323 ac)	136,389	17,108	11,173,372	12,054,165	7.4	0.9	610	657.9

Table E-9. Modeled Existing Pollutant Loads by Land Use

Land Use	N	P	TSS	Fecal Coliform	N	P	TSS	Fecal Coliform
	(lb/yr)	(lb/yr)	(lb/yr)	(billion/yr)	(%)	(%)	(%)	(%)
Agriculture	274	37	3,506	416	0.3%	0.2%	0.1%	0.0%
Commercial/Industrial	25,239	4,589	1,147,223	73,199	25.9%	30.1%	31.1%	8.3%
Forest	389	195	136,280	4,436	0.4%	1.3%	3.7%	0.5%
Institutional	7,112	1,185	264,709	25,209	7.3%	7.8%	7.2%	2.9%
Medium Density Residential	18,778	2,209	336,905	437,981	19.2%	14.5%	9.1%	49.5%
Multi-family/High Density Residential	8,071	897	142,590	118,528	8.3%	5.9%	3.9%	13.4%
Open Space (Urban)	2,109	211	28,126	3,205	2.2%	1.4%	0.8%	0.4%
Roadway	30,887	5,148	1,544,327	65,691	31.7%	33.7%	41.8%	7.4%
Single-family/Low Density Residential	4,713	785	86,793	155,719	4.8%	5.1%	2.4%	17.6%
Total	**97,572**	**15,256**	**3,690,458**	**884,382**	**100%**	**100%**	**100%**	**100%**

Table E-10. Modeled Future Land Use Composition

Subwatershed	Future Land Use Composition (acres)								
	Agriculture	Commercial/ Industrial	Forest	Institutional	Medium Density Residential	Multi-family/ High Density Residential	Open Space (Urban)	Roadway	Single-family/ Low Density Residential
Beamans Brook East	0.0	0.0	1.3	0.0	49.4	91.5	14.6	5.1	1.0
Beamans Brook West	0.0	119.8	12.9	215.2	456.0	16.2	234.6	110.2	20.1
Blue Hills Reservoir	0.0	404.9	16.8	72.7	73.9	23.1	385.1	47.8	10.8
Cold Spring Reservoir	0.0	13.5	92.5	0.0	34.5	18.9	90.8	72.8	832.0
Filley Brook	0.0	115.9	0.0	21.3	209.2	0.0	0.0	57.5	0.2
North Branch Park River	0.0	561.0	66.3	733.0	1,153.7	803.4	129.6	580.2	6.1
Tumbledown Brook	0.0	329.0	20.1	64.8	546.3	131.7	335.1	115.5	18.1
Tumbledown Brook South	4.8	2.6	236.8	81.6	692.5	4.4	163.9	105.9	329.3
Tunxis Reservoir	7.7	86.6	21.8	24.1	167.8	0.0	328.4	56.6	180.6
Wash Brook North	47.3	424.8	48.7	39.8	74.7	0.0	25.8	62.3	38.7
Wash Brook South	23.9	285.0	28.6	101.2	828.3	57.0	39.7	148.4	47.1
Wash Brook West	0.0	1.4	4.5	0.0	466.9	0.0	54.5	56.7	444.9
West Hartford Reservoir	0.0	4.3	1,490.1	0.0	2.5	0.0	17.9	24.5	508.2
Wintonbury Reservoir	0.0	299.1	15.2	0.0	233.3	39.4	256.2	50.4	0.0
Total (Watershed)	**83.7**	**2,647.8**	**2,055.6**	**1,353.6**	**4,989.0**	**1,185.6**	**2,076.2**	**1,494.0**	**2,437.2**

Table E-11. Modeled Change in Land Use Composition by Subwatershed

Subwatershed	Change in Land Use Composition (acres)								
	Agriculture	Commercial/ Industrial	Forest	Institutional	Medium Density Residential	Multi-family/ High Density Residential	Open Space (Urban)	Roadway	Single-family/ Low Density Residential
Beamans Brook East	0.0	0.0	-17.4	0.0	23.2	91.5	0.0	0.0	-97.3
Beamans Brook West	0.0	27.4	-115.9	0.0	96.6	16.2	0.0	0.0	-24.3
Blue Hills Reservoir	-32.5	79.6	-81.1	0.0	52.2	23.1	0.0	0.0	-41.2
Cold Spring Reservoir	-23.6	0.0	-260.1	0.0	12.1	18.9	0.0	0.0	252.7
Filley Brook	-19.5	40.2	-27.8	0.0	8.1	0.0	-1.0	0.0	0.0
North Branch Park River	0.0	167.0	-360.2	0.0	339.8	54.5	-170.5	0.0	-30.6
Tumbledown Brook	-32.9	35.2	-102.3	0.0	18.8	131.7	-1.6	0.0	-48.8
Tumbledown Brook South	0.0	0.0	-261.2	0.0	177.4	4.4	-159.9	0.0	239.2
Tunxis Reservoir	-30.3	3.6	-46.3	0.0	137.7	0.0	-42.7	0.0	-22.0
Wash Brook North	-81.4	221.9	-141.3	0.0	0.8	0.0	0.0	0.0	0.0
Wash Brook South	-2.0	13.7	-212.3	0.0	241.0	57.0	-17.3	0.0	-80.2
Wash Brook West	-38.9	0.0	-212.6	0.0	276.3	0.0	-194.2	0.0	169.3
West Hartford Reservoir	0.0	0.0	-310.0	0.0	0.0	0.0	0.0	0.0	310.0
Wintonbury Reservoir	-63.3	174.1	-172.4	0.0	48.0	39.4	0.0	0.0	-25.7
Total (Watershed)	**-324.4**	**762.7**	**-2321.1**	**0.0**	**1432.0**	**436.7**	**-587.1**	**0.0**	**601.1**

Table E-12. Modeled Future Pollutant Loads and Load Increases*

Subwatershed	N (lb/yr)	P (lb/yr)	TSS (lb/yr)	Fecal Coliform (billion/yr)	Projected Load Increase* N (lb/yr)	Projected Load Increase* P (lb/yr)	Projected Load Increase* TSS (lb/yr)	Projected Load Increase* Fecal Coliform (billion/yr)
Beamans Brook East (163 ac)	1,824	197	103,961	27,600	1,046	84	38,259	9,070
Beamans Brook West (1,185 ac)	9,895	1,227	1,001,484	77,163	979	131	109,396	13,347
Blue Hills Reservoir (1,035 ac)	8,113	1,342	601,382	36,848	1,374	227	100,545	9,556
Cold Spring Reservoir (1,155 ac)	9,621	934	575,831	121,300	796	112	76,415	25,633
Filley Brook (404 ac)	4,832	641	531,371	33,202	483	98	76,607	2,506
North Branch Park River (4,033 ac) (excluding CSOs and SSOs)	42,098	5,749	3,991,783	333,157	4,290	628	453,945	53,780
CSOs and SSOs	1,429	269	21,705	3,054,121	-2,740	-548	-54,791	-7,990,714
Tumbledown Brook (1,561 ac)	17,236	1,885	1,254,746	113,685	1,750	224	142,323	20,239
Tumbledown Brook South (1,622 ac)	11,516	1,118	1,127,110	126,752	1,367	181	231,293	42,382
Tunxis Reservoir (874 ac)	7,722	748	439,446	56,544	579	75	57,617	15,099
Wash Brook North (762 ac)	8,013	1,363	837,496	35,206	2,827	518	310,429	8,484
Wash Brook South (1,559 ac)	15,352	1,982	1,422,426	143,257	1,749	204	158,826	32,196
Wash Brook West (1,029 ac)	6,234	779	466,272	116,664	-447	178	136,289	47,897
West Hartford Reservoir (2,048 ac)	2,525	439	334,238	59,727	687	107	87,817	25,978
Wintonbury Reservoir (894 ac)	7,523	1,126	654,922	50,871	2,804	469	265,831	16,478
Watershed Total* (18,323 ac)	**153,934**	**19,797**	**13,364,172**	**4,386,097**	**17,545**	**2,689**	**2,190,801**	**-7,668,068**

*Reflects completion of ongoing and planned CSO and SSO mitigation projects.

Table E-13. Modeled Future Pollutant Loading Rate Increases and Load Increases

Subwatershed	Projected Future Loading Rate*				Projected Load Increase* (%)			
	N	P	TSS	Fecal Coliform	N	P	TSS	Fecal Coliform
	lb/ac-yr	lb/ac-yr	lb/ac-yr	billion/yr				
Beamans Brook East (163 ac)	11.2	1.2	638	169	134%	75%	58%	49%
Beamans Brook West (1,185 ac)	8.4	1.0	845	65	11%	12%	12%	21%
Blue Hills Reservoir (1,035 ac)	7.8	1.3	581	36	20%	20%	20%	35%
Cold Spring Reservoir (1,155 ac)	8.3	0.8	499	105	9%	14%	15%	27%
Filley Brook (404 ac)	12.0	1.6	1315	82	11%	18%	17%	8%
North Branch Park River (4,033 ac) (excluding CSOs and SSOs)	10.4	1.4	990	83	11%	12%	13%	19%
CSOs and SSOs	0.4	0.1	5.4	757	-66%	-67%	-72%	-72%
Tumbledown Brook (1,561 ac)	11.0	1.2	804	73	11%	13%	13%	22%
Tumbledown Brook South (1,622 ac)	7.1	0.7	695	78	13%	19%	26%	50%
Tunxis Reservoir (874 ac)	8.8	0.9	503	65	8%	11%	15%	36%
Wash Brook North (762 ac)	10.5	1.8	1099	46	54%	61%	59%	32%
Wash Brook South (1,559 ac)	9.8	1.3	912	92	13%	11%	13%	29%
Wash Brook West (1,029 ac)	6.1	0.8	453	113	-7%	30%	41%	70%
West Hartford Reservoir (2,048 ac)	1.2	0.2	163	29	37%	32%	36%	77%
Wintonbury Reservoir (894 ac)	8.4	1.3	733	57	59%	71%	68%	48%
Watershed Total* (18,323 ac)	**8.4**	**1.1**	**729**	**239**	**13%**	**16%**	**20%**	**-64%**

*Reflects completion of ongoing and planned CSO and SSO mitigation projects.

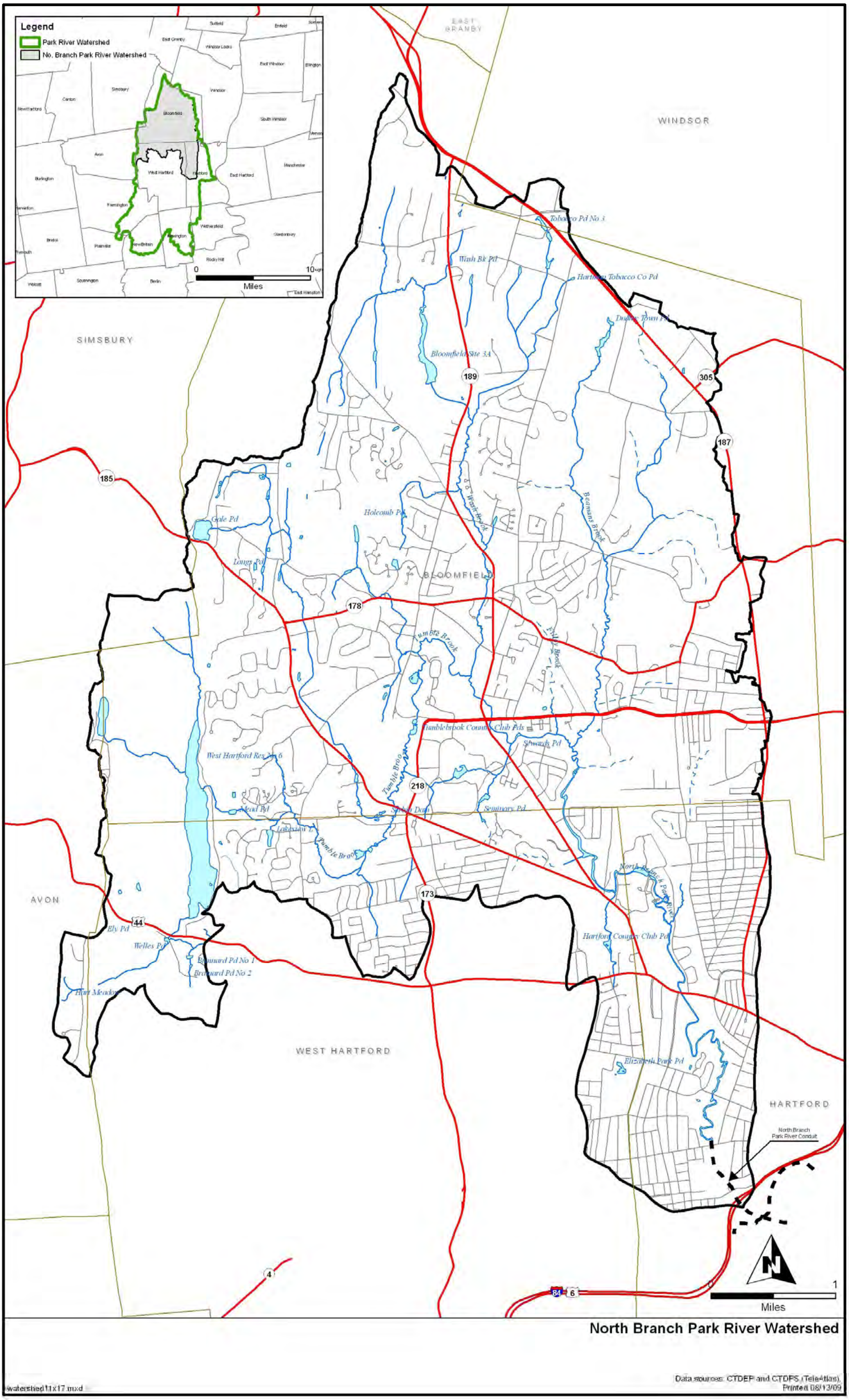

Figure 2-1. North Branch Park River Watershed

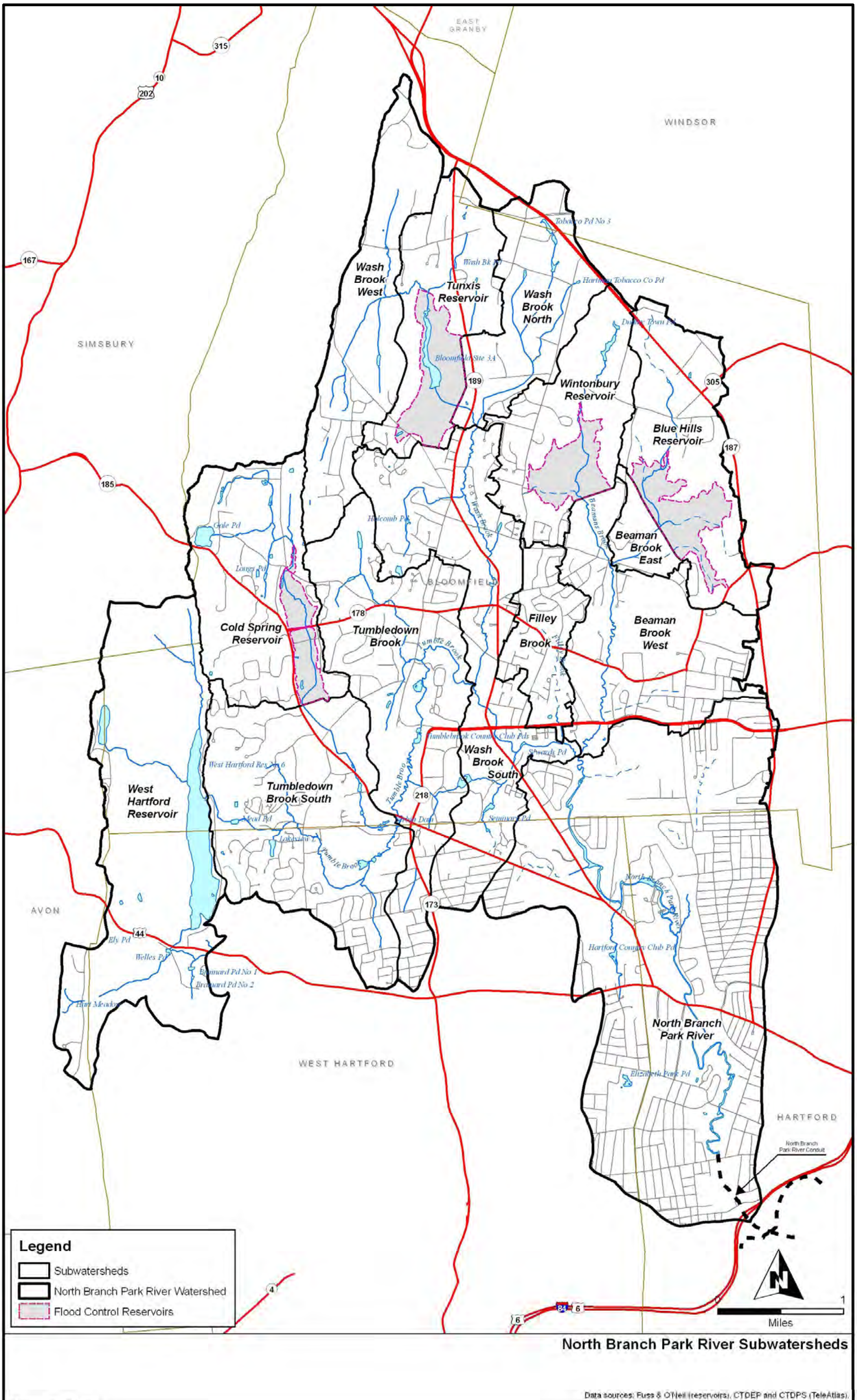

Figure 2-2. North Branch Park River Subwatersheds

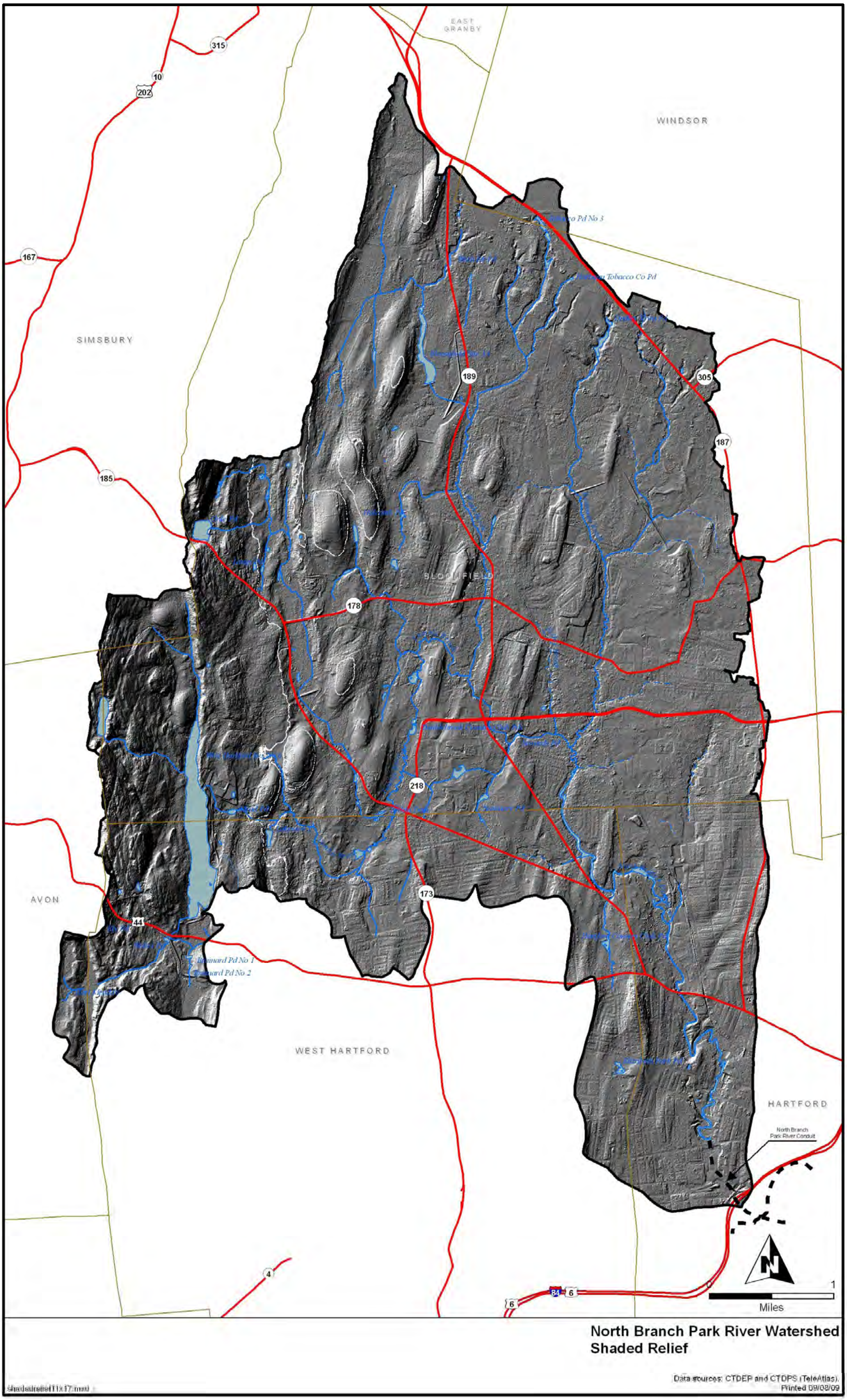

Figure 4-1. Shaded Relief Map

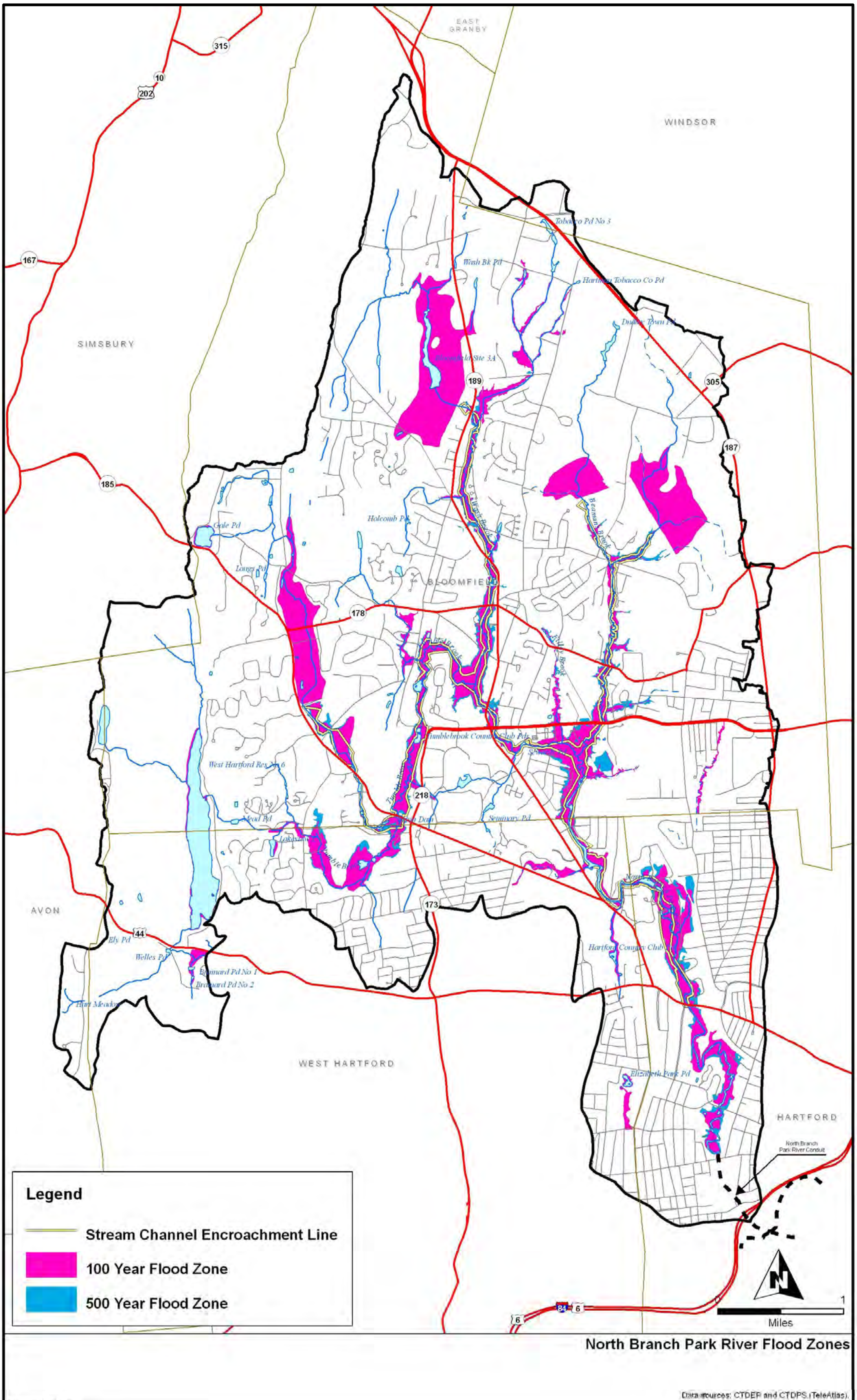

Figure 4-3. Flood Zones

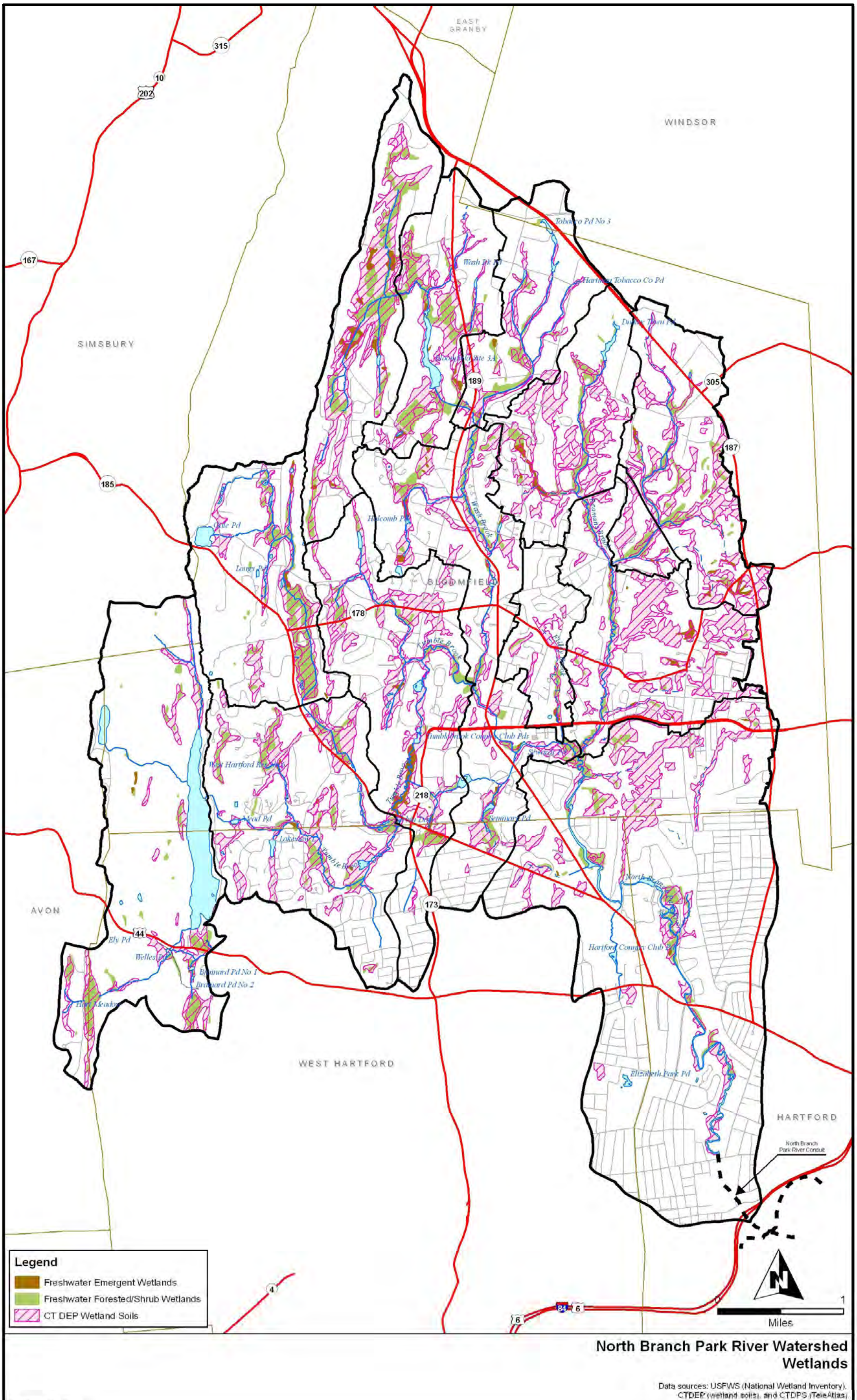

Figure 4-4. Wetlands

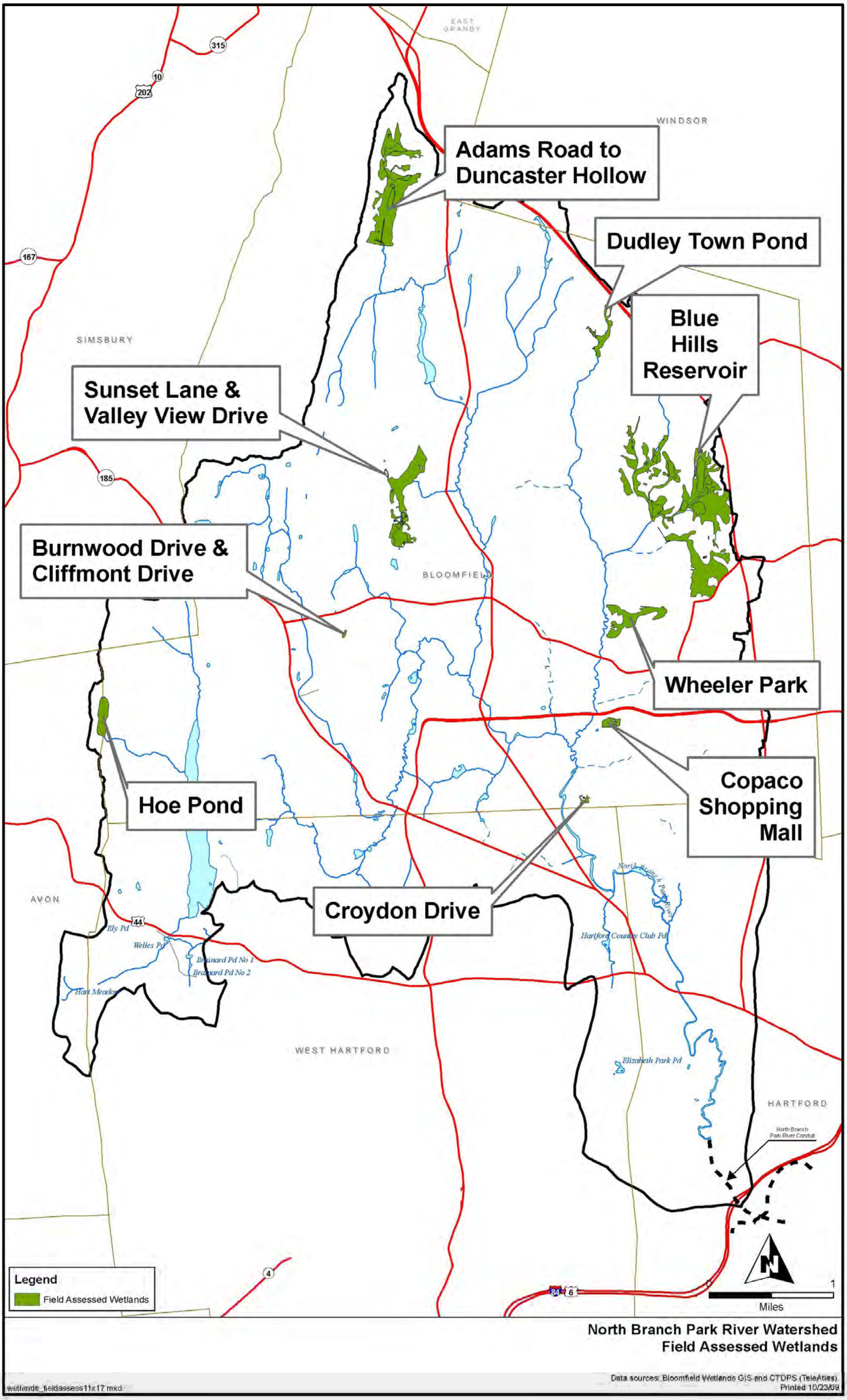

Figure 4-5. Field Assessed Wetlands

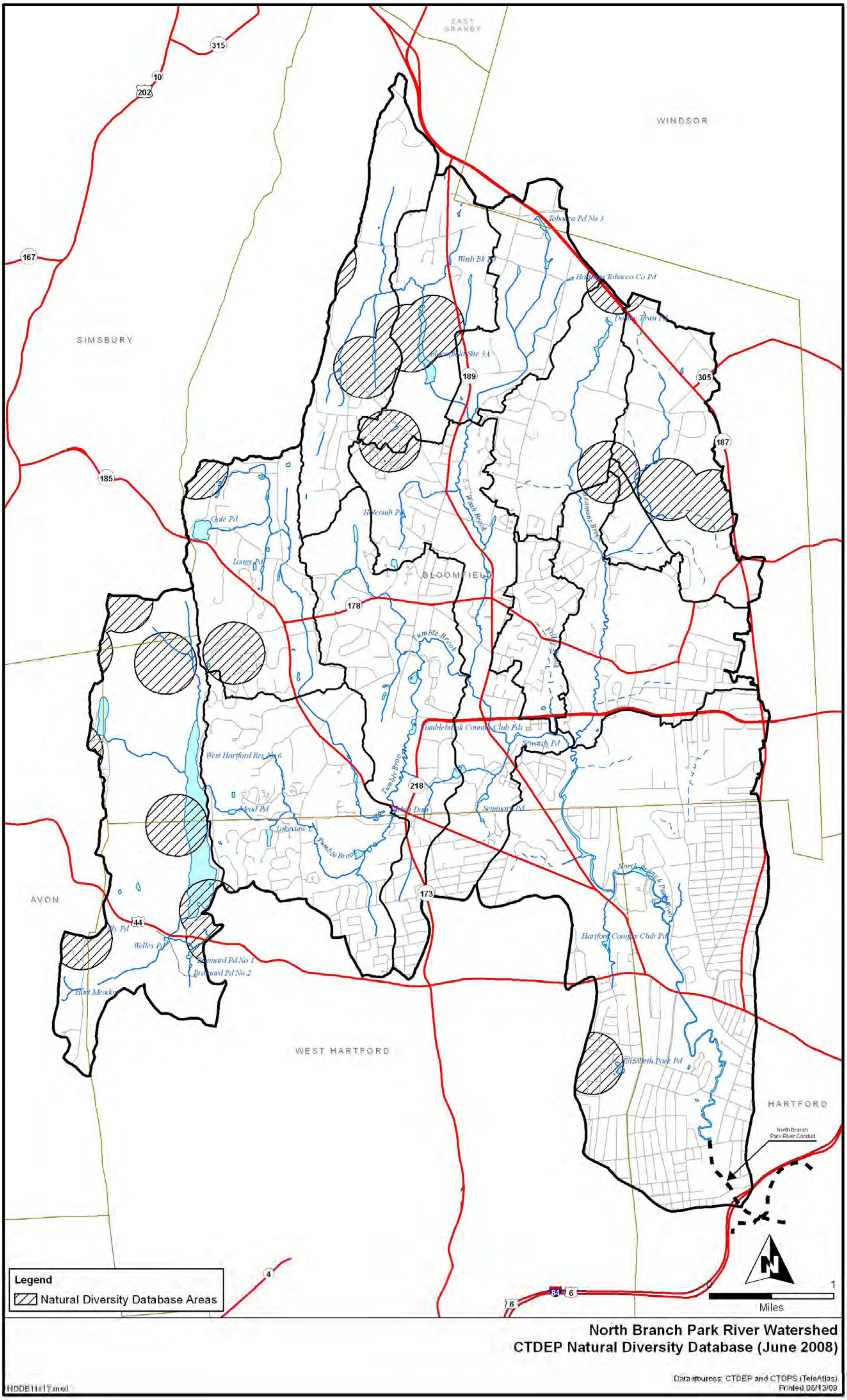

Figure 4-6. Natural Diversity Database Areas

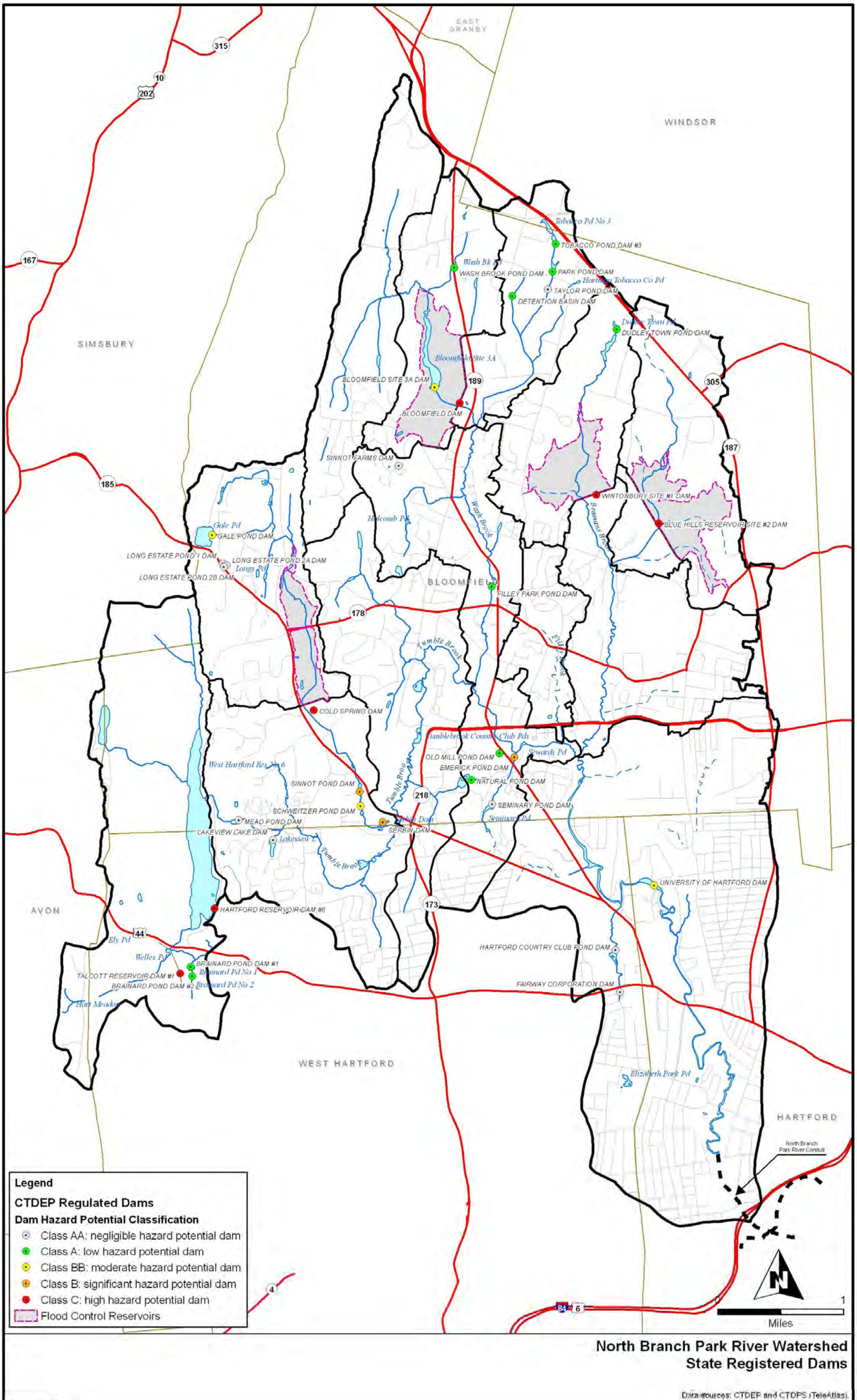

Figure 5-1. State-Registered Dams

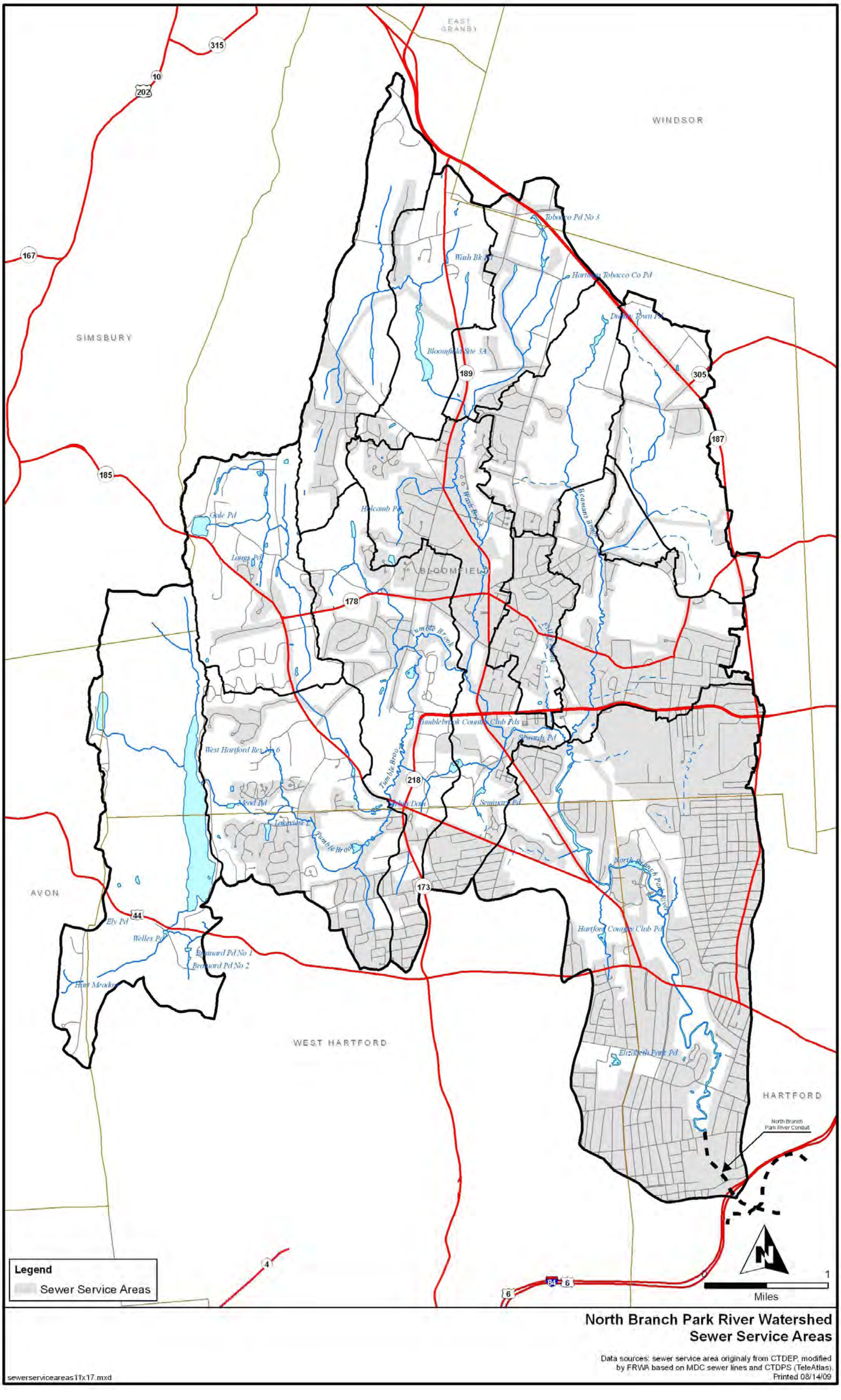

Figure 5-2. Sewer Service Areas

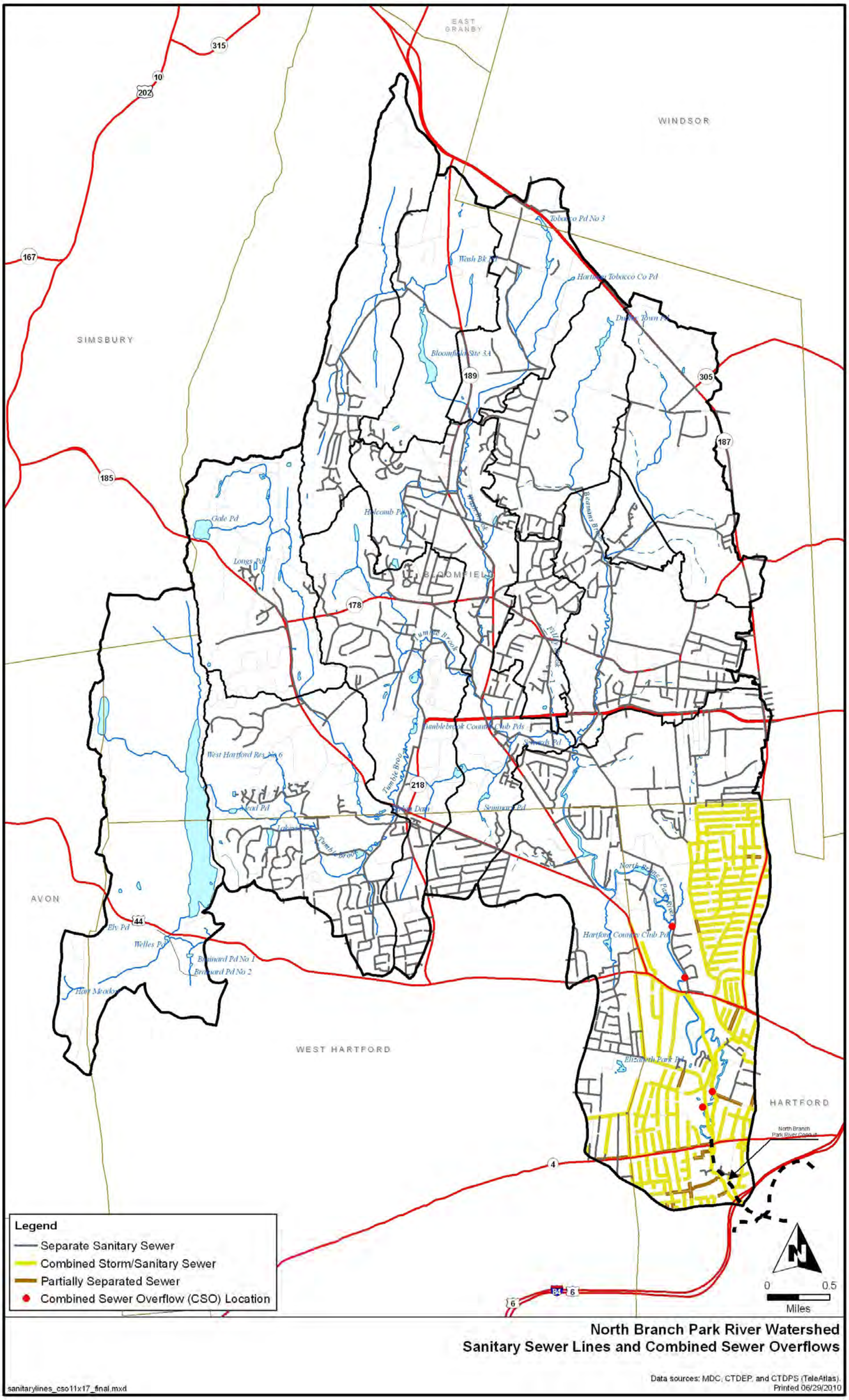

Figure 5-3. Sanitary Sewer Lines and Combined Sewer Overflows

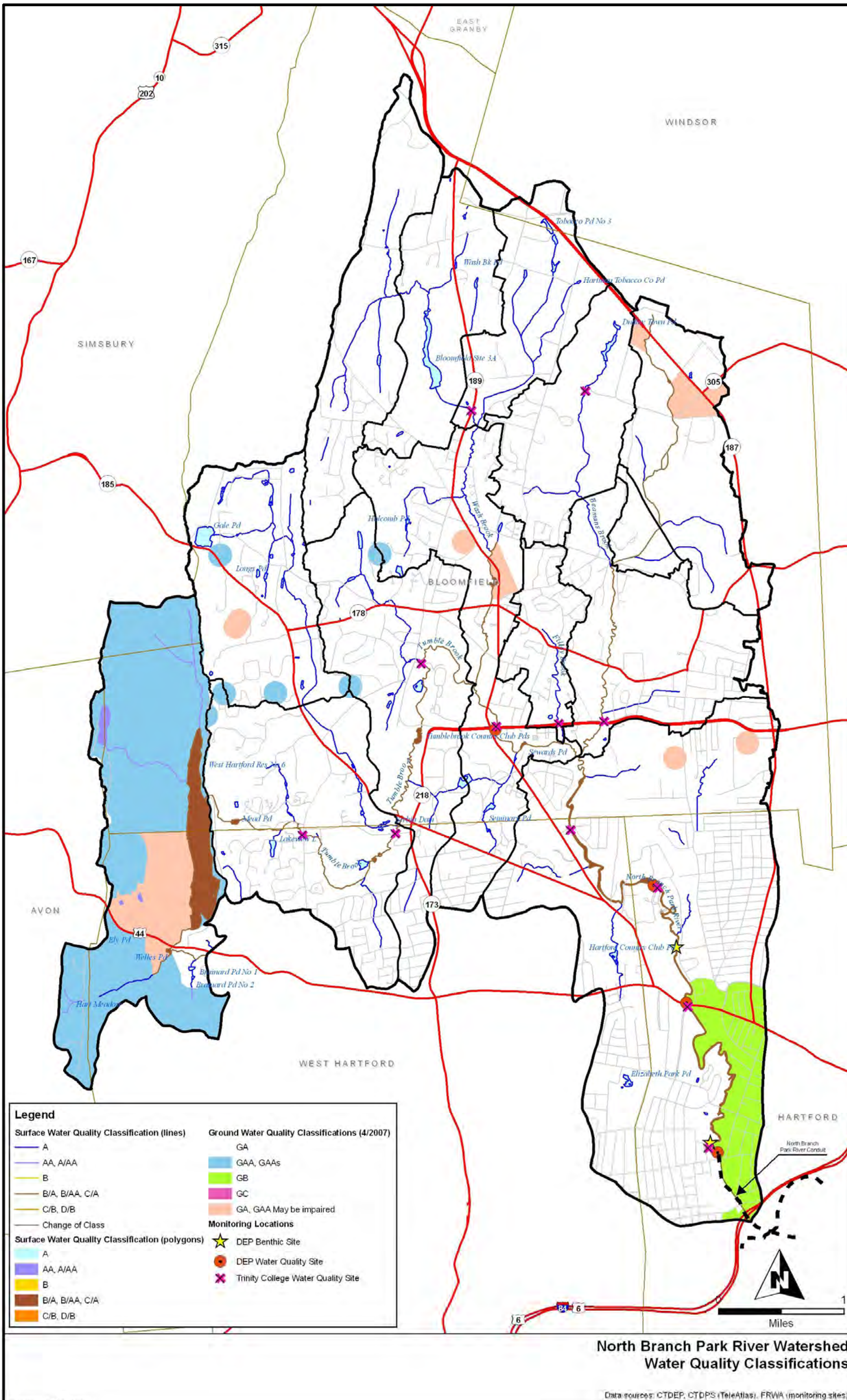

Figure 6-1. Water Quality Classifications and Monitoring Locations

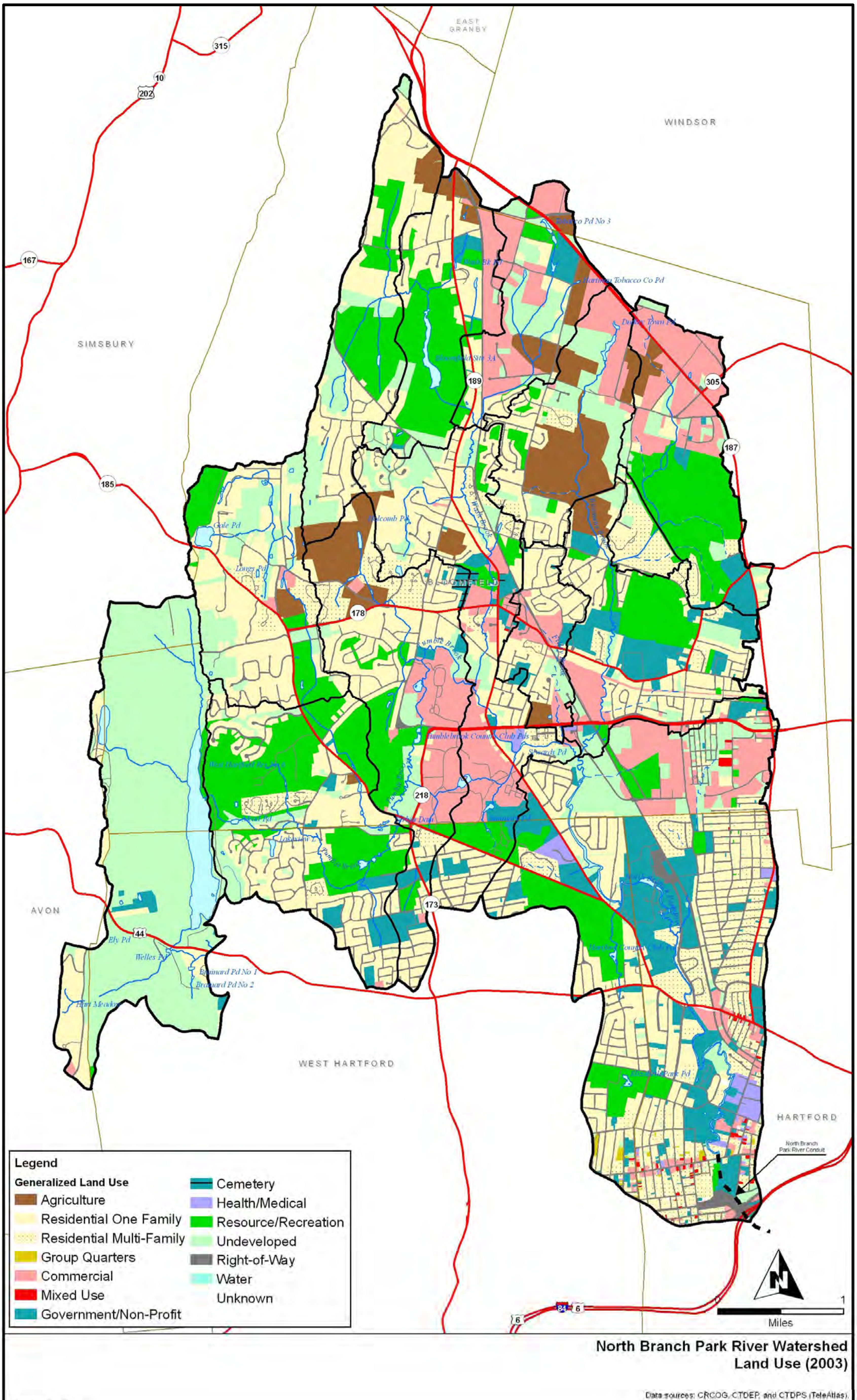

Figure 7-1. Land Use

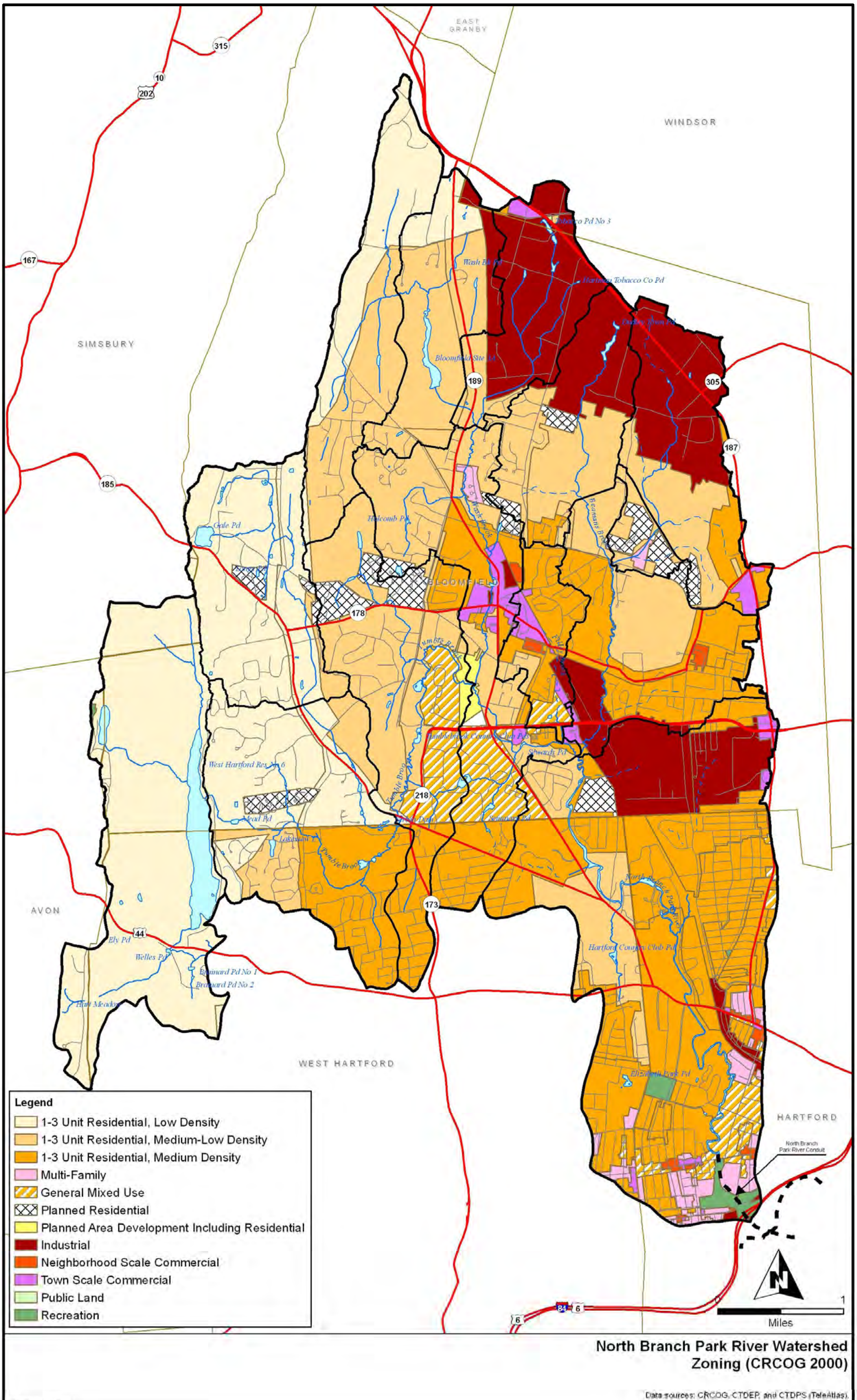

Figure 7-2. Zoning

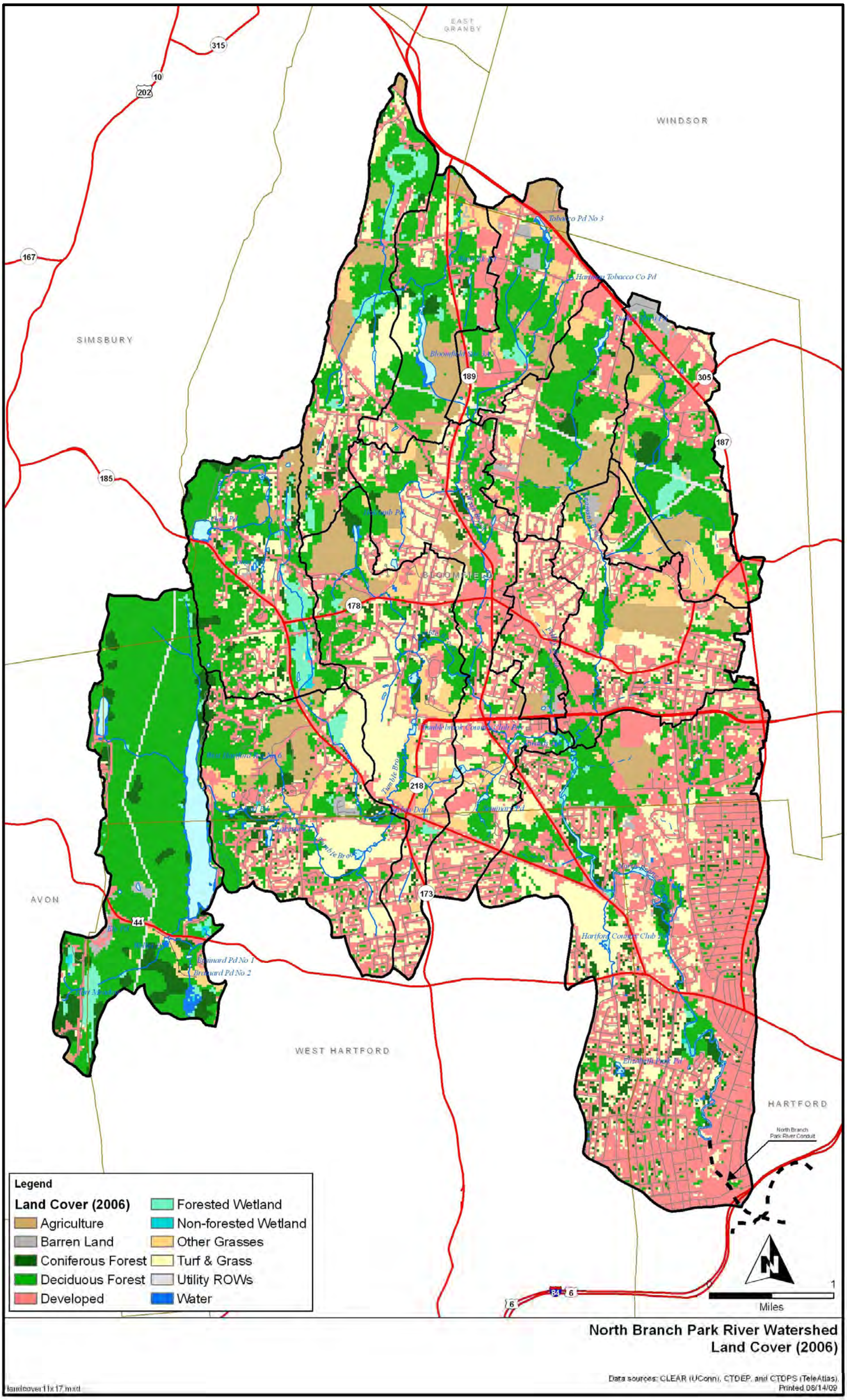

Figure 7-3. Land Cover

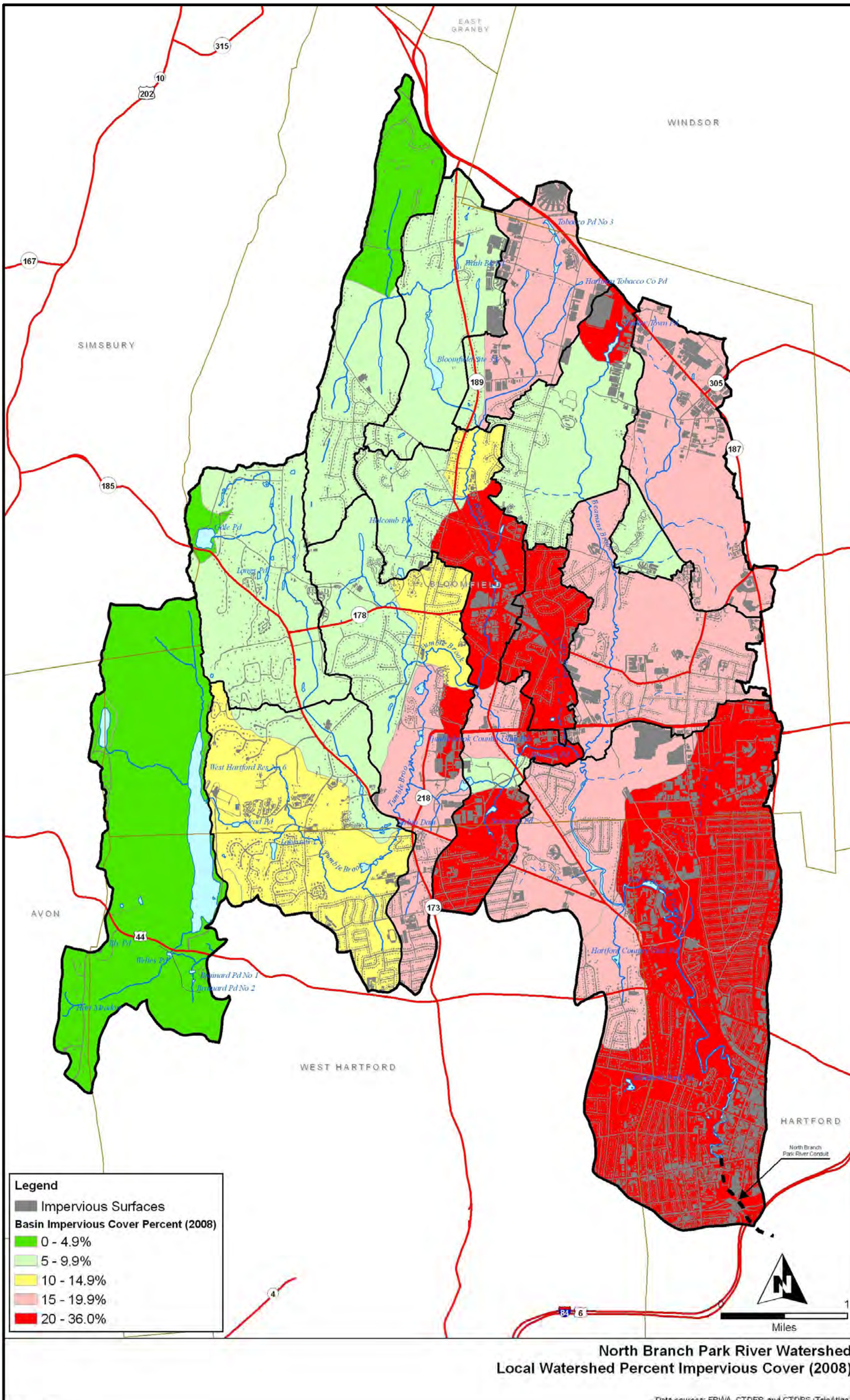

Figure 7-5. Local Watershed Percent Impervious Cover

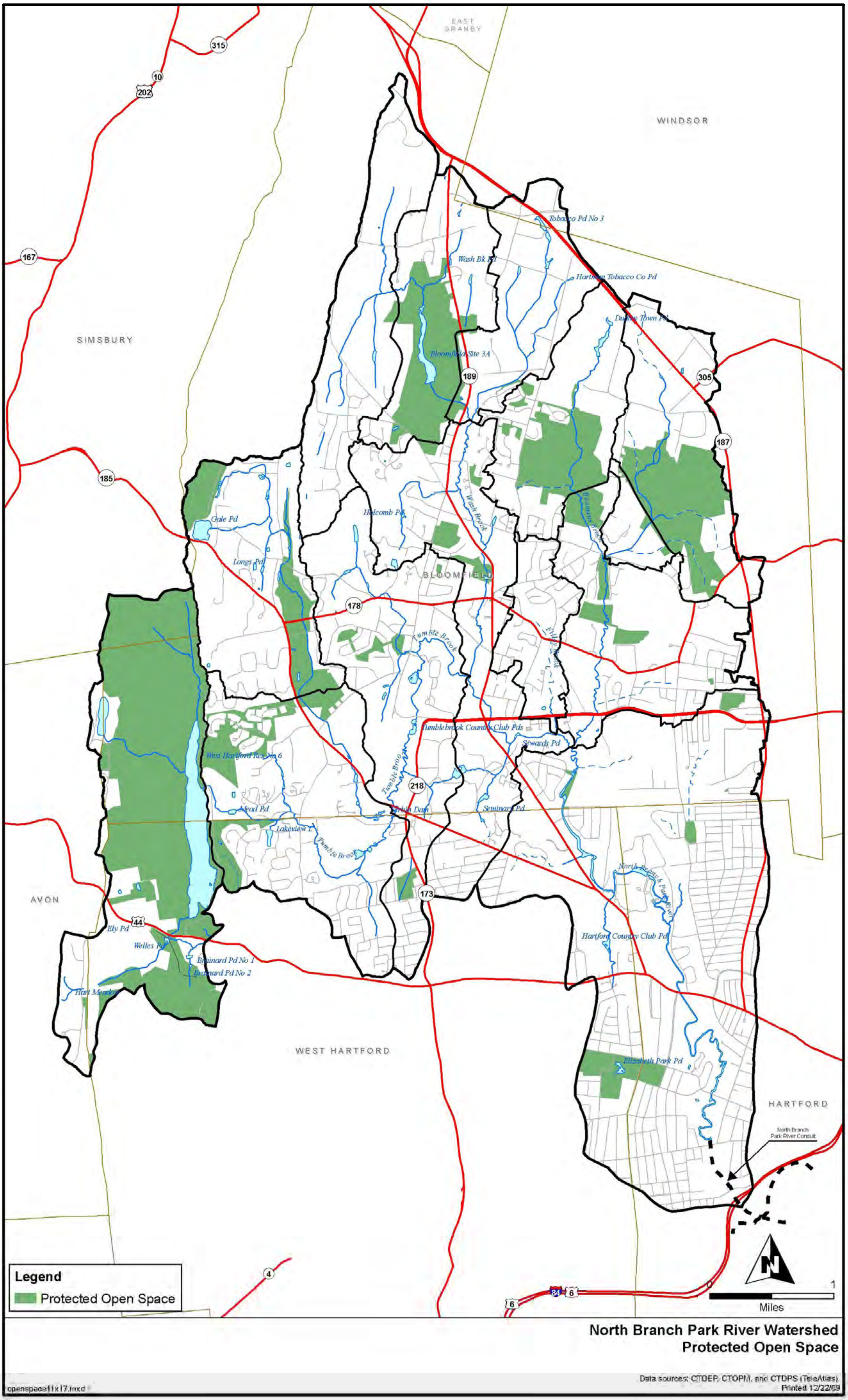

Figure 7-6. Protected Open Space

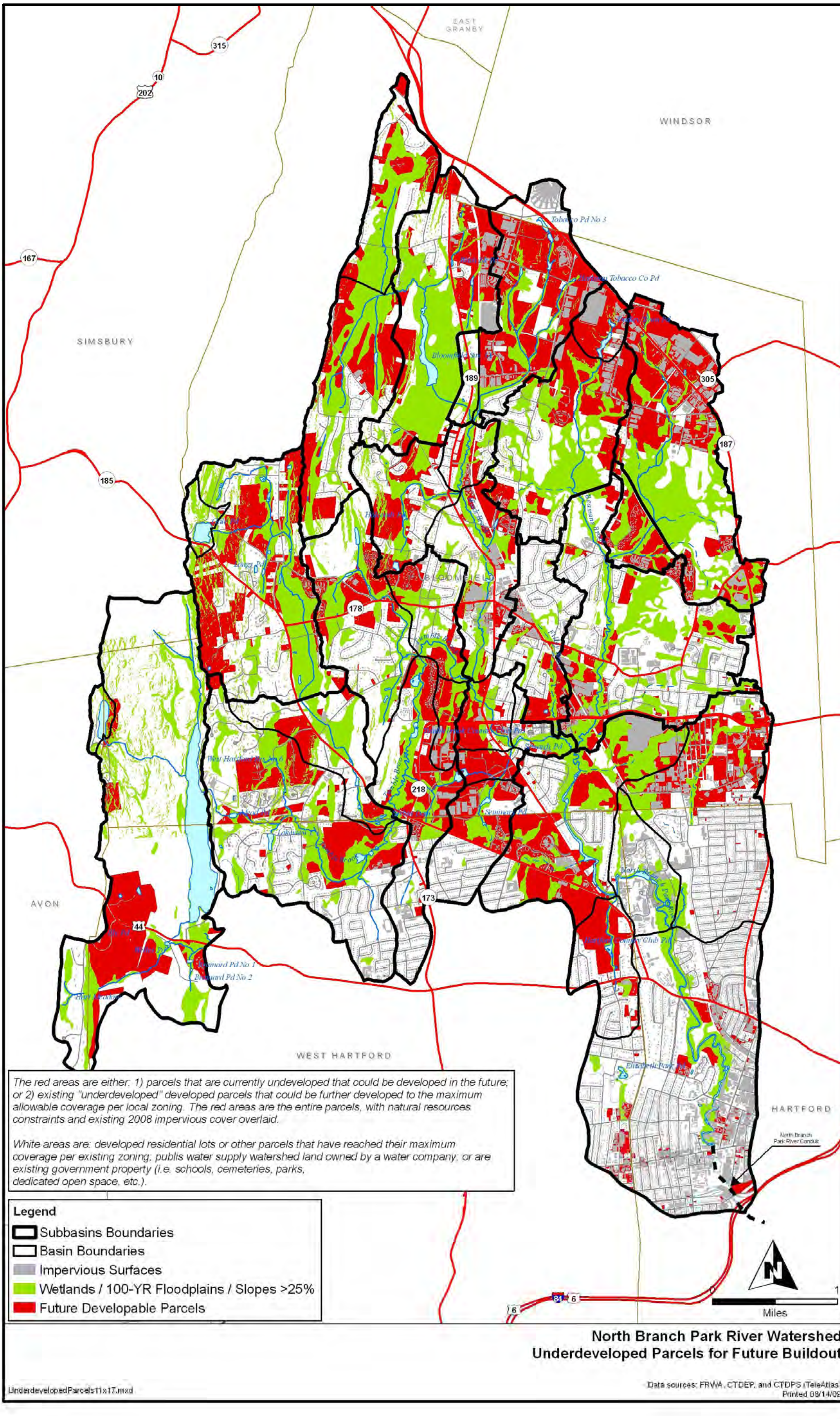

Figure 7-7. Future Developable Land