THE ONESQUETHAW-COEYMANS WATERSHED STUDY



Prepared by:

Onesquethaw-Coeymans Watershed Council and Capital District Regional Planning Commission



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1 – Executive Summary

The Onesquethaw-Coeymans (OC) watershed is located in southeastern Albany County, New York. The watershed encompasses an area of approximately fifty-two square miles, which includes portions of five municipalities - the towns of Berne, New Scotland, Bethlehem, and Coeymans, and the village of Ravena. From its headwaters in the Helderbergs west of Clarksville, the stream travels approximately 19 miles in its 1400-foot descent to the Hudson River. It enters the Hudson just east of the village of Ravena about 12 miles south of the city of Albany.

The Onesquethaw Coeymans Watershed Council (OCWC) was incorporated in 2000 as a not-for-profit organization. The founding organizations are Trout Unlimited, Audubon Society of New York, the Albany County Water Quality Coordinating Committee and the Mohawk Hudson Land Conservancy.

The purpose of the OCWC is to protect and improve the quality of the creek and its watershed for the benefit of people, wildlife and the environment. This watershed assessment, funded by a grant from DEC's Hudson River Estuary Program, is a major step in achieving that purpose; it provides the foundation for a comprehensive watershed management plan.

Section 3, entitled A Brief Watershed Tour, gives an overview of important points along the creek, highlighting problems that must be addressed. For example, at the confluence of the Onesquethaw and Coeymans, the clear water of the Onesquethaw joins the murky water of the Coeymans. Just below the confluence, eroding banks and debris jams make the creek's shorelines unstable, contributing sediment that impacts water quality. The obvious questions are "why" and "what can and should be done about it?"

Section 4, Watershed Concept Descriptions, provides the general background readers need to understand the report. Included is a description of a watershed; a discussion of the various parts of a watershed, such as stream banks, riparian zone, and flood planes; an explanation of how streams evolve; and how various man-made features of a watershed, such as impervious surfaces, can influence that evolution.

Section 5 shows the location and explains the relevance of specific features within the Onesquethaw Coeymans Watershed, including wetlands, flood plains, steep slopes and water bodies. One particularly important feature is the limestone bedrock in much of the Onesquethaw

watershed; during periods of low-flow, sections of the creek disappear and flow underground through crevasses, caves and other conduits in the limestone. One result is that the creek is cooled when it flows through the bedrock, helping to provide excellent trout habitat. On the other hand, in areas where the limestone is close to the surface, any polluted surface water can easily enter those same crevasses and flow long distances, unfiltered by soil, to pollute the stream.

Section 6, Human Impacts Within the Watershed, describes the diverse range of land uses within the watershed, and describes the ways those land uses interact with the watershed.

This section also describes point source pollution (such as discharges from pipes), which are regulated by the state; and non-point source pollution, which is of diffuse origin, such as street pavement, atmospheric fallout and agriculture. According to DEC, nonpoint sources are the primary sources of contamination for more than 90% of the impaired waterbodies in the state.

Section 6 goes on to describe water and sewer systems within the watershed, water diversions (such as the diversion to Vly Reservoir), landfills, mining, dams and agriculture. The section also mentions trout stocking; while indiscriminate stocking of hatchery fish can reduce healthy wild trout populations, this is not the case in this stream.

Section 7 describes monitoring and other observations done in the watershed. This includes: fisheries, water quality and biomonitoring done by DEC and graduate students, stream flow monitoring done by US Geological Survey, and temperature monitoring done by Trout Unlimited. The section also describes some stream stability work done by the Albany County Soil and Water Conservation District, and various observations of watershed biodiversity (such as work done as part of a Hudsonia biodiversity training program organized by OCWC).

Section 8, Law and Regulation Related to the Watershed, summarizes federal, state, county and local regulations that control activities in the watershed. Federal controls include the National Environmental Policy Act, the Clean Water Act, and various federal mandates for agriculture. State controls include the State Environmental Quality Review Act (SEQRA), State Pollution Discharge Elimination System (SPDES) permits, the Freshwater Wetlands Act, and other provisions of Conservation Law. The state and county health departments control residential wastewater treatment systems.

Local laws regulating land use and site design, as well as regulations pertaining to soil erosion, sedimentation and storm water runoff are found in zoning ordinances, subdivision laws,

site plan regulations, or in stand-alone laws. Just as there is a wide variation in the development pressures facing each municipality in the watershed, there is a broad range in the way the communities regulate land use, site design, and the impacts of erosion, sedimentation and storm water runoff. A table summarizes the controls, and relevant excerpts are included in an appendix.

Section 9, Issues and Conclusions, includes a series of recommendations for implementation at the municipal level. All of the communities within the watershed fall short of the impervious surface standards recommended by the Center for Watershed Protection. Large lots, large setbacks, overly wide roads, and oversized parking lots are required by local regulations, creating the potential for unnecessary, excessive impervious surfaces. Across the country many communities are starting to recognize that the suburban zoning and subdivision regulations that have become standard over the last half-century are in need of revision because they essentially mandate sprawl-type growth (while making smart growth illegal).

Smart growth means encouraging development at higher densities in key areas and limiting it in others. Smart growth is growth that is compact, connected, diverse (mixed-uses) and designed for both autos and non-auto mobility. A central recommendation is that municipalities modify their comprehensive plans, zoning laws, and subdivision regulations to efficiently facilitate this type of development.

Other recommendations for municipalities include: protect sensitive environmental areas; establish stream and wetland buffers; control construction related runoff; and conduct outreach, encouraging residents to adopt practices that reduce pollution.

Finally, there is a series of recommendations related to land fills, industrial activity (point discharges), barriers and water diversions, impervious surfaces, stream stability, public access to the stream, riparian buffers, land conservation and agriculture. For example, the stream corridor contains beautiful natural features such as waterfalls, caves, and gorges, which should be both protected and made accessible for public use. The stream itself contains a healthy population of wild trout, which could be a significant recreational resource for the residents of the region. Community organizations, local municipalities, and agencies should be alert to opportunities to obtain land and easements for public benefit.

The recommendations and implementation strategies developed by the OCWC and CDRPC, and presented in the Issues and Conclusions section of this watershed assessment

report, should be considered preliminary. As a next step, the OCWC will present this report to municipalities and other stakeholders for their comments, and the recommendations will be modified based on that input. The resulting Onesquethaw-Coeymans Watershed Management Plan is meant to serve as a guide to help the council, residents, and municipalities work together to promote the protection and improvement of water quality and stewardship of the watershed.

2 – Introduction

2.1 - General Outline

The Onesquethaw-Coeymans Watershed Council (OCWC), with assistance from Capital District Planning Commission (CDRPC), has prepared the following assessment of the Onesquethaw-Coeymans Watershed. This effort was funded, in part, by a grant from the New York State Department of Environmental Conservation (DEC) Hudson River Estuary Program's (HREP) Environmental Protection Fund. It is our hope that the following report will provide the foundation for a comprehensive watershed management plan.

The Onesquethaw-Coeymans (OC) watershed is located in southeastern Albany County, New York. The watershed encompasses an area of approximately fifty-two square miles, which includes portions of five municipalities; the towns of Berne, New Scotland, Bethlehem, and Coeymans, and the Village of Ravena. From its headwaters in the Helderbergs, the stream travels approximately 19 miles to its confluence with the Hudson River in Coeymans.

This study is intended to provide a "state of the watershed" including:

- Documentation of natural features
- Analysis of land use, development, and growth trends
- Description of human impacts in the watershed
- Summary of collected water quality data and other natural resource inventories
- An overview of existing federal, state and local regulations related to water quality protection
- Identification of existing and potential water quality issues and possible sources of these impacts

Based on the data and information collected, and input from the public, the OCWC and CDRPC have developed this study containing draft recommendations for watershed protection and restoration, outlined "action items," and an implementation strategy. After presenting this report to municipalities and other stakeholders and receiving their input, the report will be modified to reflect comments. The modified plan will be the Onesquethaw-Coeymans Watershed Management Plan, and is meant to serve as a guide to help the Council, residents, industry, and municipalities work together to promote the protection and improvement of water quality and stewardship of the watershed.

2.2 - History of the OC Watershed Council

Prompted by an ongoing interest in the Onesquethaw-Coeymans Creek and watershed and concerns about proposed land uses, several individuals began meeting in late 1997 to discuss the health and quality of the creek and watershed. This group included members of Trout Unlimited (TU) and Audubon Society of New York (ASNY) as well as members of community special interest groups. There was also a strong interest among group members in coordinating a water-quality sampling program that would expand on work done by a student streammonitoring project conducted through the Albany County Water Quality Coordinating Committee.

Through word of mouth, others became interested in the group's focus on the Onesquethaw-Coeymans Creek. The Mohawk Hudson Land Conservancy (MHLC formerly the Albany County Land Conservancy) began to attend meetings and college students from SUNY Albany and SUNY Cortland helped gather data about the watershed as part of their coursework. A Union College professor contributed to water quality monitoring efforts by analyzing the water chemistry of samples collected by Trout Unlimited volunteers.

Considering the growing interest and involvement in watershed efforts, the group developed a mission statement and strategic plan, developed by-laws, and applied for status as a non-profit in order to be better positioned to make long-term plans and raise money for watershed projects. The OCWC was incorporated as a non-profit 501(c)3 organization in November 2000 with federal tax-exempt status granted as of March 2001. The four founding organizations of the Council include TU, Albany County Water Quality Coordinating Committee (ACWQCC), MHLC, and ASNY. The governing board is made up of a President, Vice-President, Secretary, Treasurer, and four to eighteen directors at large. The positions are elected annually and filled by representatives from member organizations as well as interested citizens. The four founding organizations have a permanent seat on the board. The board members meet monthly at the ASNY office at Hollyhock Hollow Sanctuary in Selkirk to discuss watershed issues and the progress of ongoing projects.

The primary goal of the OCWC is to preserve and protect the quality of the creek and watershed by: collecting data about the watershed including water quality and land use;

evaluating past and current information to better understand the current health of the stream and the relationships between water quality and land use; implementing projects that will improve and protect the creek and watershed; conducting community outreach and education; and developing educational, cultural, and recreational opportunities consistent with preservation of stream quality.

Toward this end, the Council has worked toward objectives of its strategic plan, intended to lead to a more complete understanding of the Creek and its watershed. These include:

- Securing needed equipment, funds, and supplies to establish a long-term water quality monitoring program to identify potential point and nonpoint sources of pollution
- Establishing a clearinghouse of information that has been collected about the creek and watershed and organize it so that it can be used in watershed planning efforts
- Expanding Council membership and working toward long-term citizen-driven watershed stewardship
- Identifying water quality improvement projects and securing funding and volunteers for implementation.

Early efforts were supported by council members, volunteers and various organizations. These included development of a GIS database by the Capital District Regional Planning Commission, a stream stabilization project funded by a member item and completed by the Soil and Water Conservation District with assistance from TU volunteers, development of a brochure for the Council, and donation of stream monitoring equipment from Hudson Basin River Watch.

Several of the Council's watershed stewardship and improvement projects have been supported by grants from the HREP. Professional services required for the matching contribution have been donated in-kind by the Council's member organizations.

A grant received from the HREP in 2001 funded an outreach and education program geared toward residents, businesses, and municipal officials. Modeled after the Connecticutbased Nonpoint Education of Municipal Officials (NEMO) program, presentations were developed using remote sensing and geographic information system (GIS) technologies to illustrate the links between land use and water quality. Small group presentations were conducted over a 6 month period followed by a series of community events including a

watershed picnic, a trout fishing demonstration, and a tour of karst features extending from MHLC's Bennett Hill preserve to the Creek.

To further the understanding of the natural resources in the watershed, the Council received funding from HREP in 2005 to participate in Hudsonia's Biodiversity Assessment Training. This program provided town planners and OCWC members training on using mapped and field data to identify important habitats and assess biodiversity. Additional projects and programs conducted by Council members include ongoing stream monitoring led by ASNY with Ravena-Coeymans-Selkirk students funded by Selkirk Cogen Partners, a General Electric-sponsored streambank planting day, annual picnics, and organization of the Onesquethaw-Coeymans Valley Alliance, a network of citizens and community groups that share information about their various interests and activities within the watershed (both water and non-water quality related). The Council has also supported a Trout in the Classroom program through a partnership with Trout Unlimited. Through this environmental education program, students raise trout from eggs and learn about habitat and ecosystems, water quality monitoring, conservation, and the connections between communities and creeks.

Having collected a vast amount of data about the creek and watershed and having established valuable partnerships though previous education and outreach programs, the council applied for another HREP grant in 2005 to fund a Watershed Management Plan. The purpose of this project was to develop a plan for the Onesquethaw-Coeymans Watershed that consists of two components; an assessment of the "State of the Watershed" that describes existing knowledge, trends, partnerships, and significant information gaps, and an action plan developed with the help of watershed stakeholders and municipal officials that identifies strategies to protect and restore water resources and wildlife habitat and maintain community interest in water resource issues identified in other planning efforts.

3 - A Brief Watershed Tour

The Onesquethaw-Coeymans Creek begins as the Onesquethaw Creek high in the Helderbergs. The creek travels 19 miles and drops 1,400 feet in elevation on its way to the Hudson River. About half way through its journey, the Onesquethaw merges with the Coeymans Creek, and the stream is called the Coeymans Creek when it finally reaches the Hudson River. This tour narrates the creek's journey from numerous visible and noteworthy locations.



 Helderberg Lake - Helderberg Lake and its two feeder streams mark the source of the Onesquethaw Creek. The lake sits at an elevation of approximately 1,400-feet above sea level on the Helderberg Escarpment. The creek flows steadily down in elevation over its 19-mile length before joining the Hudson River at the hamlet of Coeymans.



2. Wolf Hill Diversion Dam - The Wolf Hill Dam, constructed in 1965, diverts water from the Onesquethaw, just above Clarksville, to the Vly Reservoir, a primary source of drinking water for the Town of Bethlehem. An outlet pipe and spillway help to ensure that water continues to flow downstream of the Wolf Hill Dam, though the amount of water is significantly reduced from historic flows. Dams on the first (or east) branch of Onesquethaw Creek and Vly Creek created Vly Reservoir around 1957.



3. Salisbury Spring - At Salisbury Spring, water that has traveled in underground conduits emerges in this wetland area along NY Route 443. The wetland has recently been dammed into a small pond.



4. Upper Clarksville Gorge - Below Cole Hill Road, after the confluence with a tributary that runs through the Meadowbrook Farm, the stream plunges through the Upper Clarksville Gorge.
The Gorge is on private property and is not visible from the road. During low flows, the Onesquethaw is underground and the water running through the gorge is from the tributary. Onesquethaw low flows are believed to run through Clarksville Cave and emerge in Mill Pond.



5. Mill Pond in Clarksville - In the 1800's two gristmills were located on the Onesquethaw in the hamlet of Clarksville. Today, one can hardly imagine the creek providing sufficient water flows to power a mill at this site. The millpond section of the stream suggests that historic decreases in flows may be due to the diversion at Wolf Hill Dam. Now, much of the creek is running underground at this point and resurfaces in the pond. There is evidence that at least some of the water feeding the pond from springs has traveled through the Clarksville Cave.



6. Bridge at Tarrytown
Road and Slingerlands
Avenue - A view from
the bridge provides a
good look at the
good look at the
limestone bedrock.
Notice the slabs of
limestone at the bottom
of the creek bed, as well
as layered and folded
rock below the bridge.



Bridge at Tarrytown Road and Slingerlands Avenue

Here the water begins to flow more steadily above ground, though it has been cooled as a result of being underground upstream. This cooler water provides excellent habitat for trout. The creek is ranked as one of the highest quality wild trout fisheries in Albany County.

7. Clarksville Falls - The

Clarksville Falls and spectacular cliffs have drawn visitors to the area for more than 150 years. During high water flows in spring, the falls are a thunderous rush of water, cascading into the pool below. The falls and gorge are on private property and cannot be seen from the road. Landowner permission must be obtained to gain access. Trout and other fish find shelter in several deep, cold pools just downstream. The cliffs present an excellent opportunity to see the layered bedrock. Fossil



trilobites from the Devonian period, 395 million years ago, are common in the rock. Below the falls is a gorge, part of which is called "the impassable" by local residents. The stream is steep-walled, deep, and cannot be waded.

8. Flat Rock Road above the Plank Road Bridge - The limestone rock of the creek bed can be potholed, smooth, or full of sand and gravel. During low flows in summer, the exposed creek bed reveals numerous small, round potholes. Over much of the creek's length, the surrounding limestone is topped with thin soil cover. Consequently, the stream reacts quickly and energetically to weather, flooding rapidly during heavy rains, slowing

to a trickle during drought. The thin soil cover and porous limestone also make the area sensitive to pollution.

- **9.** NY Route 32 and Gregory Falls (see front cover for photo) The tributary from Lawson Lake flows into the mouth of Onesquethaw Cave and resurfaces downstream of Tarrytown Road, joining the Onesquethaw just above the NY Route 32 bridge. The creek then flows under NY Route 32 and cascades over a series of limestone ledges, called Gregory Falls. The falls are located on private property and not visible from the road.
- 10. Onesquethaw Creek Road The road crosses the creek over a one-lane bridge near Dryden Lane. In this section, the creek meanders through rich farmland soils formed over thousands of years from sediments settling out of the water after flood events. Numerous arrowheads found along the shore provide evidence of Native American activity along the creek. Many of the earliest Dutch settlers to the greater Albany area also chose to locate along the Onesquethaw-Coeymans. Historic stone houses on both sides of the bridge, part of the 3,400 acre Onesquethaw Valley Historic District, were constructed in the mid-1700's. A restored Dutch barn on the Touhey property is open to the public. In addition to the barn's extraordinary architecture, visitors can view a copy of the land transfer from members of the Mohawk Tribe to the Dutch settlers, as well as a fascinating array of early farm implements.



11. Hollyhock Hollow

Sanctuary - Owned by the Audubon Society of New York State, Hollyhock Hollow Sanctuary on Rarick Road is open to the public and offers an excellent opportunity to see firsthand several characteristics of karst



topography, including limestone pavement, underground caves, springs, and points where the water enters the bedrock and resurfaces again. A self-guided walk along the sanctuary's Water Trail is available with a trail guide that points out many of the creek's karst features. In addition, the woodland along the stream contains many plant and wildlife species common in riparian woodlands. The sanctuary is home to more than 80 species of birds and is known for its many spring wild flowers, including hepatica, bloodroot, may apple, trout lily, columbine, Solomon's seal, and others.

- **12. City of Albany Filtration Lagoons** A water treatment facility on Old Quarry Road processes water from the Alcove Reservoir for the city's drinking water supply. The facility's filtration lagoons receive backwash from the process. Cold-water springs that feed the Onesquethaw in this area, may originate from the lagoons.
- 13. Rupert Road to South Bethlehem Town Park The Onesquethaw Creek is bordered by the Town of Bethlehem's closed landfill and currently active transfer station (to the north), and Spawn Hollow Road (access on the south). Spawn Hollow Road was the site of a construction-demolition waste dump, which made the news in the early1990's when its fumes sickened area residents and it spontaneously caught fire. Today the site continues to be monitored by the NYS Department of Environmental Conservation (NYS DEC). Behind the Bethlehem Town Transfer Station, the creek crosses under an

abandoned railroad bridge, passes under South Albany Road, and travels on the north side of the Bethlehem Town Pocket Park. Trees and



shrubs along the creek banks provide an important buffer from developed areas and help to shade the water along this stretch. Trout populations are healthy in this entire section.

14. Selkirk Rail Yards Area and the Headwaters of Coeymans Creek – Unlike upstream sections of the Onesquethaw, there are many industrial discharges, under NYS DEC permit, introduced into the creek in this area. The Coeymans Creek, upstream of the confluence with the Onesquethaw, is a small meandering stream that appears polluted.

The Coeymans begins west of the hamlet of Feura Bush, passes through Feura Bush, and then traverses down along the east side of the Selkirk Rail Yards. It appears no more than a drainage



ditch in places. It crosses under the rail yards flowing for about ¹/₄-mile underground. When it emerges again, the creek receives water from two more tributaries and is very murky. **15. Confluence of Onesquethaw and Coeymans Creek** - The clear water of the Onesquethaw joins the murky water of Coeymans Creek east of South Albany Road above NY Route 396. Although the Onesquethaw is the larger of the two streams, it is called Coeymans Creek downstream of the confluence as it heads toward the Town of Coeymans. Shortly after the confluence, Coeymans Creek crosses under NY Route 396 and enters a fairly wide flood plain. Eroding banks and debris jams make the creek's shorelines unstable and contribute sediment that impacts water quality. Another tributary draining an area of the Rail Yards enters, introducing more pollution.



16. US Geological Survey (USGS) Gaging Station - The USGS measured stream flow on the Coeymans Creek below the Pictuay Road Bridge from 1967-1977.

17. Confluence with the Feuri Spruyt to Old Ravena Road - In this section, the Feuri Spruyt joins the Coeymans Creek as it meanders through a flood plain along Miller Road, which is sometimes covered during high water. Just before crossing under NY Route 9W, the creek



receives treated sewage effluent from a trailer park and the waters of Mosher Brook. Below NY Route 9W, the creek travels through thick woods, crosses under a railroad bridge, and emerges at the Old Ravena Road crossing.

18. Old Ravena Road to Coeymans Falls - From Old Ravena Road to the Coeymans Falls, the creek meanders several miles without road access, crossing under the NYS Thruway,

until it reaches the falls at NY Route 144, near the Hudson River. It passes the proposed City of Albany Landfill, Lafarge Cement Plant, a construction company, the



defunct Frangella Mushroom Plant, and industrial storage sites.

19. Coeymans Falls in the hamlet of Coeymans – Here, a series of four dramatic falls,

beginning under the NY Route 144 bridge, mark the final mile of the creek. The Coeymans enters a tidal pool and backwater of the Hudson River at the hamlet of Coeymans. There are steep banks on



both sides of the creek. This tidal pool is an ecologically important resource, serving as a spawning area for several fish species, including shad, alewife and blue herring.

20. The Hudson River - The confluence with the Hudson River is flanked on both sides by

marinas, and protected by a manmade breaker. Sediment transported by the Onesquethaw-Coeymans Creek is deposited against this breaker, and is periodically dredged.



4 – Watershed Concept Descriptions

The following is an overview of several important water quality concepts, followed by specific reference to the OC watershed.

4.1 - Watersheds

All land areas on earth are part of a watershed. Precipitation falling on land feeds streams and replenishes groundwater. Precipitation onto water surfaces also enters into watershed flow. As water moves in surface and subsurface flows, it combines into progressively larger streams and rivers, local water tables, and regional aquifers. Watersheds may be as small as several acres or some may encompass thousands of acres of land. Furthermore, smaller sub-watersheds aggregate to form larger watersheds. Watershed boundaries are defined by the highest and lowest elevations from which water drains toward a single channel. The highest elevations are the divides that separate one watershed from another and therefore define water (and water pollution) drainage. The boundary lines will intersect at the lowest elevation of the watershed planning area, typically the mouth of a stream or the outlet of a lake or reservoir.

The watershed is the appropriate geography in which to plan for water quality protection. Water pollution components are transported downhill and downstream within watersheds. Since all the activities within a watershed have the potential to impact the water quality downstream, it is at the watershed level that any analysis of water quality must occur without regard to political boundaries.

The OC watershed includes the areas that drain into both the Onesquethaw and Coeymans Creeks. The Onesquethaw Creek begins at Helderberg Lake in the town of Berne and flows in an easterly direction through the towns of New Scotland and Bethlehem, and then crosses into the town of Coeymans west of US 9W. Before entering the Town of Coeymans, it joins with Coeymans Creek, is joined by the Feuri Spruyt tributary west of US 9W, and then flows south until it empties into the Hudson River east of the village of Ravena (See "Sub-Watershed Map"). This portion of the Hudson River is included in the Hudson River Estuary, a productive sea-tidal (to Troy) and salty (to Poughkeepsie) ecosystem that provides a rich breeding ground for fish, shellfish, and waterfowl.



4.2 – Stream Processes, Erosion and Sedimentation³

Since any given stream environment is inherently complex, there are several components that must be taken into consideration when attempting to study the system. The components shaping the physical properties of a stream include the adjacent watershed, floodplains, stream banks, riparian zone, and channel. On a larger scale, the watershed includes the surrounding upland area that collects runoff draining into the stream (U.S. EPA 1997). The lower land

³ This section, and portions of section 4.3, are taken from: Kisby-Clark, Staci, December 7, 2002, entitled "Use of GIS and GPS to Determine the Extent and Possible Causes of Erosion Along the Onesquethaw Creek, Albany County, NY". A bibliography of the references sited can be found in the original report.

surrounding a stream comprises the floodplain which functions to hold overflow water during a flood period. The stream bank can be broken down into the lower portion beginning at the normal water line and running down to the bottom of the stream, and the upper segment from the water line to the break in slope of the surrounding land. Finally, the channel can be defined by the cross-section of the stream that is normally submerged. It is composed of the substrate material making up the streambed and supports all aquatic life in the stream (U.S. EPA 1997). Each of the stream segments is significant to the system.

Stream banks are important because they provide a transitional zone between the aquatic channel environment and upland terrestrial systems. Typically, healthy stream banks are characterized as being well vegetated, resistant to erosion, and providing cover and habitat for several fish and microbiotic species (Bain and Stevenson 1999). Rooted vegetation along the banks helps to bind the soil particles thereby increasing their resistance to erosion (Fischer and Fischenich 2000; Geyer et al 2000). Compared to vegetated stream banks, erosion is 30 times more prevalent on non-vegetated banks (Naiman and Decamps 1997). A stable channel including its banks and riverbed has the ability to maintain a steady water flow, shape, slope, and normal sediment input load within the stream (Fischer and Fischenich 2000).

Stream bank erosion within the channel naturally occurs from the removal of soil and surficial sediments along the banks and bed of the stream, by lateral flow of water. At an acceptable level, this process adds rock and woody material into the stream to provide food and habitat for the aquatic and wildlife species. In general, it is often initiated by periods of heavy rainfall and increased stream flow (Streambank Erosion URL 2002). However, when the stress applied by a stream exceeds its resistance to erode, the rate of channel erosion will increase. Major alterations to channel width, flow velocity, discharge, channel slope, roughness of channel materials, sediment load, and sediment particle size distribution often result (U.S. EPA 1999).

Water within a watershed typically follows the dominant hydrological pathway depending upon soil type and permeability, adjacent land use, slope, potential run-off generation areas, and land drainage installations. In a natural environment, surface water runoff and sediment loads do not overwhelm the system's ability to remove these particles before entering a stream system (Naiman and Decamps 1997). However, human activities such as construction, land clearing, logging, and agriculture cause soil to be eroded from the earth's surface. Disturbance to aquatic and wildlife habitat, the loss of property and productive land, and a

greater risk for flood related damages are also likely effects (Fischer and Fischenich 2000; Streambank Erosion URL 2001).

Vegetation adjacent to and upgradient from a stream, known as riparian vegetation, creates filter strips that are vital to reducing sediment input and channel erosion due to upland erosion. A surrounding upland area of unmowed, undisturbed vegetation creates a coarse path through which water can flow (Fischer and Fischenich 2000). At a sufficient density and width, this type of environment has the effect of slowing water flow velocity, reducing the energy available for erosion and flooding, and trapping sediments in stems and



foliage on the ground (USDA URL 2001). Results of a flood study done by Geyer et al (2000) in central Kansas, in which pre flood conditions along the banks of a stream where compared to post flood banks, suggests that woody vegetation in the riparian zone is the single most important factor in limiting erosion. Riparian vegetation buffers intercept surface water runoff, wastewater, subsurface flow and deeper groundwater flows from upland sources carrying nutrients, sediment, organic matter, pesticides, and other pollutants that may otherwise empty into a surface water or groundwater recharge area (USDA URL 2001). Lastly, tree canopies surrounding a stream act to intercept rainfall thereby reducing the impact of raindrop related erosion. (Fischer and Fischenich 2000). Tree canopy also shades the water, keeping it cooler and promoting healthy aquatic habitat.

Soil erosion from land disturbed by construction is a highly visible source of solids in runoff. Important sites include large-scale projects such as highway construction, large-scale residential subdivisions, commercial and industrial development and urban renewal.

4.3 - Stormwater Runoff and Impervious Surfaces²

Impervious surfaces are constructed areas covered by materials that are impenetrable by water, such as asphalt, concrete and stone. Other impervious surfaces unrelated to man-made materials include compacted soils, high clay content soils, frozen soils, saturated soils, and soils with high groundwater tables, although the last three are usually seasonal (Barnes et al 2000-2001).

The types of man-made impervious areas can be grouped into two categories: rooftops and transportation systems. The greater percentage of impervious area is often transport-related, which tends to have an even greater hydrologic impact than rooftop-related imperviousness. Typically, as in residential areas, rooftops are surrounded by, and drain to, permeable surfaces, unlike roads and parking lots, which usually drain directly into a storm drain system or water body. Transport-related impervious areas are largely ignored, while rooftop imperviousness is often regulated by zoning laws (Schueler 1994).

Rooftops, sidewalks, roads, and parking lots typically made of impervious materials, seal surfaces and repel water. Therefore, water cannot infiltrate into the ground and is forced to flow overland. This increases the risk that the sediments and pollutants are carried into a water body before being filtered. Flood frequency also increases as a result of impervious areas (Barnes et al 2000-2001; Zandbergen 1998). In order to respond to increased runoff and flow velocity due to impervious surfaces, stream channels are forced to react. The typical response is to increase their cross-sectional area by widening the stream banks, down cutting the streambed, or both. As discussed earlier, this response causes channel instability that can lead to increased stream bank erosion and habitat degradation (Schueler 1994). Another impact of impervious areas is their reduction of the amount of water storage from depressions thereby increasing water flow during flooding events (Brun and Band 2000).

Impervious areas can be defined as "the total percentage of area that is not 'green'" (Schueler 1994). However, not all impervious surfaces are 100 percent impenetrable due to cracks and gaps (Barnes et al 2000-2001). On the watershed scale, Booth and Jackson (1997) consider there to be two types of impervious area calculations: Total Impervious Area (TIA) and Effective Impervious Area (EIA). TIA refers to all areas within a watershed that are impenetrable due to constructed surfaces. These calculations also include impervious areas that

² ibid

drain onto pervious surfaces such as lawns, gardens, and grassy fields. EIA includes only those impervious surfaces that are connected to any downstream drainage systems. It does not include the above permeable areas unless they contribute runoff directly into a stream or any other body of water (Booth and Jackson 1997). Zandbergen (1998) considers the EIA to be the most suitable measure of the impact of urbanization on its watershed. However, he suggests that TIA is a better indicator of the overall extent of urbanization.

On undeveloped land, rainfall has greater opportunity to slowly filter into the ground water than on developed land. Trees, shrubs and grasses all help to slow rainfall as it travels



along the ground thus allowing a higher degree of percolation into the soil and groundwater. Vegetative cover also helps decrease the rate of surface water flow and, therefore, reduces the amount of soil, sediment and other particles carried off site and deposited in streams, rivers and lakes. On developed land, however, both the volume and rate of surface runoff is substantially increased due to the clearing of vegetation, soil compaction by heavy equipment, and the construction of impervious surfaces and structures. Roadways are built, fields are paved over for parking lots and buildings are constructed on previously undeveloped land thereby reducing the amount of natural ground cover for the filtering of rainwater. Since rain cannot filter through impermeable surfaces, it accumulates on these surfaces and creates larger volumes of water to run over the land surface. As surface runoff volumes increase, the rate of flow also increases. This higher volume and faster rate of water runoff accelerates the erosion of stream channels, alters runoff patterns, increases downstream flooding and carries more sediment and surface pollutants to be deposited in streams, rivers and lakes. This increase in direct runoff also reduces the amount of water left for groundwater recharge, soil moisture replenishment, and the base flow of water available to streams during dry periods, therefore, potentially impacting human water supplies and plant and animal habitats.

The "Impervious Areas" map shows the areas of relatively impervious, non-vegetated surface within the OC watershed, which, as of 2002, was approximately 10% of total watershed land area. These areas include such features as parking lots, buildings, roads, railroad areas, and mining sites. The majority of the impervious surfaces, or 5.4% of land area, are due to industrial land use by mines, cement production and the Selkirk Rail Yards. These areas, although devoid of vegetation, may have some surfaces that are semi-permeable. Their EIA may be lower than the indicated TIA of 5.4%. (However, much of the upper watershed is in karst terrain with thin soil cover, which may increase EIA). The remaining impervious surfaces, or 4.6% of land area, are comprised of roads and development. Healthy watersheds usually have no more than 10 to 15 percent of their area covered by impervious surfaces. Above this percent of imperviousness, more pronounced stream degradation usually begins. When a watershed exceeds 30 percent imperviousness, extreme changes in stream morphology and major declines in water quality often occur. Limiting the amount of impervious surface to 10-15% helps to maintain a healthy watershed. Later sections of this report will include suggestions for ways to minimize the amount of impervious surface created by development.

5 - Natural Features of the Watershed

The following section will discuss several important environmental features within the OC watershed, including maps showing their location and a description of their function in relation to water quality.

5.1 - Wetlands

Wetlands are unique areas that usually exist at the transitional zones between upland habitat and aquatic habitat. Sometimes referred to as swamps, marshes or bogs, wetlands are characterized by:

- Standing water or water saturated to the surface at least two weeks during the growing season for most years
- Soils with a high water table (hydric)
- Hydric vegetation (water-loving plants) such as cattail, sedges and water lily

Wetlands provide many beneficial functions: surface water is filtered and purified as it passes through, thereby trapping sediments and improving water quality; wetlands serve as important wildlife and plant habitats; wetlands serve as natural storage basins for groundwater thereby aiding in groundwater recharge and the reduction of downstream flooding.

State protection is afforded to wetlands 12.4 acres and over including a surrounding 100foot buffer through the Freshwater Wetlands Act. These regulated wetlands are mapped by NYS DEC (see "Wetlands" map).



In addition to New York State regulated and mapped wetlands, there are also many smaller, unmapped wetlands throughout the watershed that may be regulated by the U.S. Army Corps of Engineers (see "Wetlands" map). These wetlands have no minimum size, though they must be hydrologically connected to a navigable water way. Identifying hydric soils from the county soil surveys and vegetation, or looking at the US Fish and Wildlife map of wetland habitats can help approximate the location of these smaller wetlands (see map #4). If there is a question of whether there is a wetland present on a site, DEC or the Army Corps of Engineers should be contacted to do a site-specific investigation and verification based on vegetation, soil, and hydrologic conditions.

5.2 - Flood Plains

Flood plains, when inundated, serve many functions and provide important habitats for a variety of fish and wildlife. They provide an area for water storage during high flows, helping to decrease flooding downstream. They also act as nutrient and sediment sinks,



improving water quality, and providing important spawning and rearing areas. Because of this, flood plains are relevant to water quality protection and restoration ³.

A 100-year flood plain is a belt of low, flat ground bordering a stream channel, on one or

both sides, which has a 1% chance of becoming inundated by stream waters every year. This flood usually occurs when an overabundance of surface water combines with the effects of a high water table to supply more runoff than can stay within the stream channel. Stream dynamics often change the course of a stream, which may also



change the boundaries of the flood plain.

³ EPA's Watershed Plan Builder

The "Floodzones" map below shows the location of the 100-year flood plain within the watershed.

Development in the 100-year flood zone is regulated through participation in the National Flood Insurance Program (NFIP). The NFIP is a federal program enabling property owners to purchase federally subsidized flood insurance once their community adopts and enforces flood plain management regulations consistent with federal requirements.

Development within the flood plain should be avoided, or if development takes place, specially engineered designs should be implemented. Hazards associated with flood plains could include bacterial contamination from saturated leach fields, overflowing septic tanks, and loss of property and/or life.

Moreover, development outside of floodplains may still impact flood plains by increasing impervious surfaces, thereby creating more surface runoff with faster runoff rates potentially leading to an increase in downstream flooding (See Section 4.3. - "Storm water Runoff and



Impervious Surfaces" for additional discussion). Floodplains are often not static; changes in stream dynamics, due to natural or human causes, can change the course of a stream and the boundaries of the flooplain.



5.3. - Steep Slopes

Steep slopes can be found throughout the watershed (see "Steep Slopes map). These are the areas having a slope of 15% or greater. In the northwestern portion of the watershed steep areas are mostly associated with shallow soils and exposed and fractured bedrock, while in the southeastern watershed steep slopes are typically covered by clay soils.

In most cases, development in these areas should be avoided as soil disturbance and rapidly moving stormwater runoff on steep slopes poses a high risk of soil erosion and pollution of waterways from sedimentation and other construction runoff. Steep slopes are also unsuitable locations for septic systems. Another hazard to consider is slippage and landslides when thick clay soils are present.



5.4. - Soils

Knowing the types of soils in a watershed is important to understanding the amount of erosion and stormwater runoff that are likely to occur in the watershed, as well as the suitability for various human uses and the importance for plants and animals. For this reason, soils in a watershed should be fully researched in order to prepare community plans, zoning, and site plan review procedures that protect sensitive soils and water quality.

Soils information can be found in the soil survey for Albany County published by the Natural Resource Conservation Service. Copies can be obtained from the County Soil and Water
Conservation District or on line at <u>http://websoilsurvey.nrcs.usda.gov/app/</u>. Soil surveys are scientific inventories based on soil properties and include aerial photographs with the soils indicated for all the land areas within the county. In addition, the soil survey contains interpretive tables with information on soil properties and their suitability for many different uses. These tables include information on limitations such as permeability, septic system suitability, depth to the water table, the degree of erosion hazard, as well as the suitability of soils for crop production, wildlife habitat, and recreational development among other things. By



examining these maps and tables, the unique features of the watershed soils can be determined.

The soils of the Onesquethaw Creek valley are some of the most productive soils for farming in Albany County. There are almost 5000 acres of prime farmland in the watershed, which can be used to produce high yields of crops such as corn, small grains, hay, and vegetables. These soils are located primarily in the flood plain of the Onesquethaw and Coeymans creeks, mainly in southern Bethlehem. There are also over 6,000 acres that are considered soils of statewide importance. These are soils that are also capable of producing a high yield of crops when managed properly.

A unique feature of the watershed is the area of shallow, calcareous soils in the western watershed. These soils provide a habitat that supports many unique and possibly endangered plants and animals including a variety of ferns and spleenwort, reptiles, and amphibians. These areas are highly erodible and sensitive to treading and invasion from invasive plant species so disturbance within these areas should be avoided.

Another area of sensitive soils is found in the clay ravines found along the full extent of Coeymans Creek. Many of ravines are covered by hardwood forest. In general, clay ravines are very prone to erosion, slumping, and sometimes sliding when disturbed. Protecting and maintaining forests and other vegetative cover can help stabilize the soils, while protecting rare species of plants still found along the sides of the ravines and elsewhere within the clay ravine habitat. Development within these areas should be minimal. Stormwater impacts and erosion will be particularly sensitive to construction activity.

The majority of the watershed is characterized by the soil survey as having severe limitations for locating septic systems due to poorly drained soils (see "Septic Limitations" map). It should be noted, however, that it is necessary to perform site-specific soil tests and an evaluation of other constraints in order to accurately ascertain the suitability of a particular site.



5.5 – Aquifers

An aquifer is a geologic formation composed of rock, till, sand, gravel, and/or sediment that is capable of storing and transmitting water in usable quantity to a spring or well. An unconsolidated aquifer is defined as an aquifer that is comprised of loosely formed geologic materials, such as sand and gravel⁴.

According to digital map data provided by the DOH, Bureau of Public Water Supply Protection, unconsolidated aquifers are located in several areas of the watershed (see "Aquifers and Public Water" map). These aquifers can produce between 10 and 100 gallons of water per minute. For this reason, it is important to know and consider the location of aquifers so that they can be protected from land uses that may pollute the water.

⁴ NYS Source Water Assessment Program Plan, NYS Department of Health (DOH), 1999, pp.45-48



5.6 - Karst Terrain

The word "karst" refers to a type of terrain formed by the dissolution of soluble carbonate rock (limestone and dolomite). Over millions of years, as flow routes are enlarged, carbonate aquifers change from diffuse-flow aquifers, with water moving very slowly through small openings, to high velocity conduit-flow aquifers with water moving quickly through well-developed conduit systems to discharge points at springs. As the water table lowers below the level of surface streams, the streams begin to lose water to developing cave systems below. As more and more of the surface drainage is diverted underground, stream valleys virtually disappear and are replaced by closed basins called sinkholes. Sinkholes vary from small cylindrical pits to large conical or parabolic basins that collect and funnel runoff into karst aquifers.

A large area of limestone bedrock underlies much of the Onesquethaw-Coeymans Watershed (see "Bedrock Geology" map). This area is primarily composed of karst terrain, which presents natural constraints for development.





The Onesquethaw Creek traverses two areas of karst terrain made up of limestone bedding planes, joints, faults and conduits. The first area of karst terrain (Onondaga limestone bedrock) extends from near Wolf Hill Dam down to Clarksville. This part of the stream is seasonally pirated ("disappears" from the above ground channel) through fractures into underground channels and caves.⁵ This phenomenon has led some people to believe that stream flow is not present, when in fact it is submerged and flowing underground, reemerging at Mill Pond in Clarksville (where the Onondaga limestone meets the Tristates shale and sandstone group). The underground channel flows reemerge aboveground within the surface channel during periods of higher water flow. This feature of the watershed results in cooler water, buffering of acidic rain, and improved habitat for cold-water fishes such as trout.

The second area of karst terrain (the Helderberg group limestones) begins at about Lower Flat Rock Road, where the stream is pirated during periods of low flow; it resurges near County Route 102, just below Hollyhock Hollow Sanctuary (where the limestone meets the Schenectady shale beds).

The nature of the groundwater flow system causes karst areas to be extremely vulnerable to groundwater contamination. Contaminants can be transported from the ground surface into underground creek channels in very short periods of time without the benefit of soil filtering. One study indicates during periods of high discharge, contaminants have the ability to travel from one end of the underground limestone aquifer to the other in less than one hour. ⁶ The most hydrologically vulnerable corridor in the watershed extends almost continuously from the Wolf Hill Dam downstream to just past the Hollyhock Hollow Sanctuary (karst terrain covers much of the watershed on both sides of the creek). This area, which is dominated by well-karstified carbonate aquifers, is considered hypersensitive to pollution due to the relatively small catchbasin, a thin soil mantle, and the significant flow reduction caused by the Wolf Hill Dam.⁷

Other serious hydro-geologic problems with karst landscapes include sinkhole flooding and sinkhole collapse⁸.

⁵ "Geomorphology, Paleoclimatology and Land Use Considerations of a Glaciated Karst Terrain; Albany, NY, 1995, by Paul Rubin, Thom Engel, and Michael Nardacci.

 ⁶ "Land-Use Planning and Watershed Protection in Karst Terrains," by Paul Rubin, 1991, a paper presented at the Third Conference on Hydrogeology, Ecology, Monitoring, and Management of Ground Water in Karst Terrains.
⁷ Ibid, and letters dated 10/20/98 and 11/5/98 to Roy Lamberton of the OCWC outlining watershed issues.

⁸ Engineering Geology Classification of the Soils of the Albany NY 15 minute quadrangle, by Robert H. Fickies and Peter T. Regan; NYS Museum Map and Chart Series No. 36.

The Helderberg Escarpment, which is one of Albany County's signature landscapes, intersects the western portion of the OC watershed. The Helderberg Escarpment Planning Committee published a planning guide for the escarpment in February 2002. This guide contains specific data about the escarpment, including a detailed discussion of karst topography, and offers various recommendations for the long-term management and protection of the escarpment as well as recommendations for minimizing the development impacts within karst landscapes; it is available from the Mohawk Hudson Land Conservancy (www.mohawkhudson.org).

5.7 – Water Bodies

The watershed is rich with surface water resources, which are used for drinking water and recreation and also serve as vital habitat. Significant water bodies within the watershed include Helderberg Lake and Lawson Lake. Several tributaries also feed the 19-mile main branch of the Onesquethaw-Coeymans Creek including Flat Rock Brook, Feuri Spruyt, Mosher Brook, and the Upper Coeymans Creek.

Streams in New York State are classified by the NYS Department of Environmental Conservation (DEC) based on the best use of the waterbody. These classifications affect standards and restrictions related to the water quality and use. Classified waters are regulated under the DEC Protection of Waters Program and special requirements apply to protect sensitive waters. Through this program, a permit is required for disturbing the bed or banks of a stream with a classification and standard of C(T) or higher. To find out more about stream classifications and the permit requirements of the state Protection of Waters Program visit the DEC website at http://www.dec.ny.gov/permits/6042.html.

There are several classifications of watercourses in the watershed (see "Stream Classification" map). The highest classification A waters are used for drinking water supplies, culinary or food processing, and contact recreation and fishing. These waters must also be suitable for fish propagation and survival. Class B waters are best used for contact recreation and fishing and should support fish propagation and survival. Class C waters are best used for fishing and support fish propagation and survival. The quality of Class C water should be suitable for contact recreation although other factors may limit its use for that purpose. Some class C waters have additional standards related to fish propagation and survival. Class C(T) waters may be suitable for trout survival while Class C(TS) may be suitable for trout spawning as well as trout survival⁹.



⁹ 6NYCRR, DEC Water Quality Regulations, Chapter X, Parts 700-706

The outflow from Lawsons Lake, to where that tributary enters Onesquethaw Cave, is the only stream in the watershed classified A. Only Helderberg Lake and one small tributary of the Feuri Spruyt are classified as B. The majority of the main branches of the Onesquethaw and Coeymans Creeks as well as the eastern half of the Feuri Spruyt are categorized as C(TS). There are also numerous manmade ponds and small or intermittent streams that are not classified or protected under the Protection of Waters Program.

5.8 – Land Cover

Land cover within a watershed can be classified using satellite imagery. The Capital District Regional Planning Commission performed a four-category analysis of the Capital District in the year 2000, using 1997 Landsat imagery. Landsat imagery has a resolution of 30 meters, which is a scale useful for watershed wide analysis, but not for site-specific analysis. The four land cover categories analyzed were: forests; fields; water; and non-vegetated, impervious and semi-impervious areas. Data from this analysis was extracted for the OC watershed.

The "Land Cover" map shows the distribution of these land cover categories. Forested areas make up approximately 65% of the watershed (22,278 acres), which is the largest share of land cover within the watershed. These forested areas contain a mix of deciduous and coniferous trees and underbrush, as well as, as mix of older trees and newer re-growth forests from land previously cleared for farming but left fallow over several decades.

Land classified as "fields" makes up approximately 24% of the watershed land (8,077 acres). The majority of this land is used for agricultural purposes, but also includes lawns and other low tree density vegetated lands.

Water features comprise approximately 1% of the watershed land (273 acres).

The final category, "Urban," makes up approximately 10% of the watershed land. This land includes buildings, paved surfaces, rail yards, exposed rock and soil, and other non-vegetated surfaces. This category corresponds with land considered impervious, or in the case of compacted soil, semi-impervious (see discussion under section 4.3 – Stormwater Runoff and Impervious Surfaces). The Selkirk Train Yards and adjacent industrial land, the Larfarge cement plant, and the Callanan mines make up approximately half the land included in this category.

Although this landcover analysis was conducted using 1997 data, the amount of development in the watershed has been relatively minimal since that time (see discussion under

section 6.2 – Population Growth and New Development), and is still representative of the general pattern of land cover within OC watershed.



6 – Human Impacts Within the Watershed

6.1 - Existing Land Use

The OC Watershed is characterized by a diverse range of land uses (see "Land Use" map). The northeastern portion of the watershed includes the Selkirk Rail Yards (run by CSX) and part of an industrial park that includes PG&E Corporation (energy products and services), GE Plastics (recently sold to Saudi Basic Industries Corp.), Selkirk Cogen (natural gas-fueled

cogeneration), and Owens Corning (glass fiber composites). The world's largest tattoo equipment manufacturer is located in the northwest portion. There are a number of regulated SPDES permit discharges in this area (see sections 6.4, 9.4 and Appendix 10.2). Concerns have been raised about the poor water quality of the stream tributary that flows through this area.



The watershed includes several hamlets – Clarksville, South Bethlehem, Feura Bush, Selkirk, Coeymans – which are areas with a small concentration of houses and some commercial uses. The village of Ravena is typical of the region's small villages, with a mix of housing, and commercial and industrial uses.

There are almost 200 parcels throughout the watershed used for agricultural production.

Housing outside hamlet and village areas is primarily large lot single-family units (rural residential), with a scattering of mobile, seasonal homes and single-family homes on smaller lots.

According to tax parcel maps classified using a modified version of the New York State property classification system (local assessor codes), vacant land makes up 26 percent of the watershed, which is the highest percentage of the different watershed land uses. With over 40 active farms in the watershed, agricultural uses comprise 19 percent of the watershed land. Single-family homes on less than 10 acres of land comprise the largest number of parcels in the watershed (almost 1,700), though they only utilize six percent of the watershed land. Rural residential parcels (ten acres or greater) utilize 18 percent of the watershed area. Housing of two or more units utilizes six percent of the watershed land. There are approximately 500 rural residential and multi-residential parcels in the watershed. Commercial uses utilize four percent of the watershed land, while industrial uses utilize 19 percent

There are several public parks within the watershed, as well as preserves at Bennett Hill, Copeland Hill, Lawson Lake, Hollyhock Hollow, and MHLC's Onesquethaw Creek Preserve (see "Parks, Preserves and Management Areas" map in section 9.8).

There are also more than twenty-five properties within the watershed listed on the National Historic Register, including those that are part of the Onesquethaw Valley Historic District.

6.1.1 Mining and Cement Production

The southeastern portion of the watershed includes a large paving materials plant (Lafarge) and extensive areas used for mining operations (Callanan Industries), which produce 1.8 million tons of cement and 1.2 million tons of crushed stone (sandstone, limestone, and dolomite limestone) annually (see "Mining Areas" map below). The Selkirk Yards, the adjacent industrial park, the Callanan mines and the Lafarge cement plant, comprise a little more than half of the non-vegetated, impervious (and semi-impervious) lands within the watershed (see sections 4.3 and 5.8). Due to the large footprint of the mining and cement plant operations, a more detailed discussion of those activities follows.



The New York State Department of Environmental Conservation regulates mining in New York State. According to the NY DEC, Mining is a \$1.5 billion industry in New York State, and New York is among the top third in the nation in value of minerals produced. The Division of Mineral Resources carries out the responsibilities of protecting the environment when minerals are extracted, and of seeing to it that the land is restored when mining is complete.

In New York, regulated mining operations have an approved mining plan that specifies how the mining will take place, and an approved reclamation plan that provides for return to productive use. Financial security submitted by the mining permit applicant ensures that the land will be reclaimed. The state Mined Land Reclamation Law was enacted in 1975.

Materials generated from limestone mining processing operations include lime kiln dust, scrubber sludge from lime kiln operations, lime hydrating materials, and other lime or limestone

mining, processing, or calcining materials associated with lime or limestone mining or processing. These byproducts are generally considered environmentally benign. They can be used to treat soil for ph balance and/or for stability.

More details about mining regulations can be found at: http://www.dec.ny.gov/lands/5020.html.

The Larfarge cement manufacturing plant produces portland cement, which is the generic term for a fine gray powder that binds sand and gravel into concrete. It is produced by combining limestone, clay and sand, blended to exact proportions, ground together, and then heated in a kiln to form the intermediate product - clinker. After cooling, clinker is ground with a small amount of gypsum to produce the portland cement product.

According to the US EPA, which regulates air emmissions from cement plants, particulate matter (PM and PM-10), nitrogen oxides (NOx), sulfur dioxide (SO^2), carbon monoxide (CO), and carbon dioxide (CO^2) are the primary emissions from the manufacture of portland cement.

Cement kiln dust (CKD) is the fine-grained, solid, highly alkaline waste removed from cement kiln exhaust gas by air pollution control devices. Because much of the CKD is actually unreacted raw materials, large amounts of it can and are, recycled back into the production process. Some CKD is reused directly, while some requires treatment prior to reuse. CKD not returned to the production process is typically disposed in land-based disposal units (i.e., landfills, waste piles, or surface impoundments), although some is also sold for beneficial reuse. CKD is categorized by EPA as a "special waste" and has been temporarily exempted from federal hazardous waste regulations under Subtitle C of the Resource Conservation and Recovery Act (RCRA). EPA is in the process of developing standards for the management of CKD and has published a set of proposed Subtitle D (i.e., non-hazardous, solid waste) regulations to govern CKD management.

Concerns have been raised about the toxic contact of slag waste from cement production, and about the high mercury content contained in the emmissions from cement manufacturing.

The Lafarge cement plant has numerous SPDES discharge permits, which allow regulated discharges into the Coeymans Creek (see sections 6.4, 9.4 and Appendix 10.2). More details about cement manufacturing can be found at: http://www.epa.gov/ispd/cement/index.html

6.2 - Population Growth and New Development

The analysis of population change using block-level data from the US Census Bureau indicates that between 1990 and 2000 the total watershed population increased from 6,833 persons to 7,016 (183 persons), which is a 2.7% increase. During this period the number of housing units within the watershed increased by 113 units from 2,716 to 2,829, a 4.2% increase. The number of households increased by 88, from 2,528 to 2,616, a 3.5% increase.

The watershed's 2.7% population growth rate from 1990 to 2000 was higher than Albany County as whole, which saw only a 0.6% increase during the same period; the overall Capital District population increased by 2.1%.

The majority of the new development within the watershed since 1990 has been singlefamily homes on large lots. Most of the parcel splits have been minor subdivisions of only one unit. There is a wide range in the value of the new homes from modest units below the regional median value to other more expensive units well above the regional median value.

In the hamlet areas the homes are often set close to the roads. However, most of the new homes are outside hamlets and are set back far from the public roads on long private driveways. This type of development creates much more impervious surface than do smaller parcels fronting public roads.

A map of new development within the watershed from 1995 to 2001 was created by analyzing aerial photography for these two periods. The general distribution, magnitude and type of development is indicated on the "New Development" map below.



6.3 – Nonpoint Source Pollution

Nonpoint source pollution generally results from precipitation, land runoff, infiltration, drainage, seepage, hydrologic modification, or atmospheric deposition. As runoff from rainfall or snowmelt moves, it picks up and transports pollutants resulting from human activity, ultimately depositing them into rivers, lakes, wetlands, and ground water.

Nonpoint source pollution enters a water body from diffuse origins rather than from discernible and discrete conveyances, such as pipes or ditches. According to the DEC, nonpoint source pollution is the primary source of contamination for more than 90% of the impaired waterbodies in New York State.

Examples of nonpoint source pollution are: street pavement, motor vehicles, atmospheric fallout (e.g. dust, automobile exhaust), vegetation, spills, litter, anti-skid components and chemicals (e.g. road salt), storm sewers, combined sewer overflow, septic systems, agriculture, sediment, thermal stress, nutrients (phosphorus and nitrogen), oxygen-demanding organic materials, toxic substances, and pathogens (bacteria and viruses). The examples are taken from the Watershed Planning Handbook for the Control of Nonpoint Source Pollution prepared by the NYSDEC and the NYS Soil and Water Conservation Committee. More detailed descriptions of nonpoint source pollution are found in the Glossary, Section 11.4.

6.4 – Point Source Pollution

Sources of discharges at specific locations from pipes, outfall, and conveyance channels are "point" sources. The SPDES program is intended to regulate point source discharges (see sections 8.2.3, 9.4 and 10.2). The program has been approved by the United States Environmental Protection Agency for the control of wastewater and stormwater



discharges in accordance with the National Clean Water Act. The SPDES program regulates point source discharges to groundwaters as well as surface waters. Under Chapter 6 of the New York Codes Rules and Regulations (6NYCRR), §750-1.1, a permit is required for the purposes of: Constructing or using an outlet or discharge pipe (point source) that discharges wastewater into the surface waters or ground waters of the state; or Constructing or operating a disposal system such as a sewage treatment plant. Copies of unpublished DEC documents for SPDES permits with the watershed were provided to the OCWC by the Permits Office at DEC Region 4. Based on the records reviewed, there are approximately 51 discharges to the Onesquethaw-Coeymans Creek under approximately 26 DEC SPDES permits. There are more discharges than permit numbers because one SPDES permit can apply to multiple discharges. For example, Lafarge North America Inc (cement plant) has 13 permitted discharges under one SPDES number. A chart listing more detailed data about each permit location is included in the Appendix Section 10.2-SPDES Permits.

As part of the SPDES permit process, the permit holder must monitor the discharges. The specific pollutants and parameters to be monitored vary, and depend on the waste being discharged. SPDES permits establish an acceptable range for a discharge based on the classified best use of a stream. The sources of the discharges vary considerably, and include: sanitary treatment effluent, oil separators, quarry pump out and runoff, dewatering, filter backwash, air scrubber, storm water, and rail yard impoundments. Permit holders within the watershed include small businesses and farms, trailer parks, a school, industrial processes, and the Selkirk rail yards. Specific pollutants that must be monitored include: benzene, toluene, oil, mercury, lead, arsenic, styrene, cyanide, phenols, phosphorus, nitrates, chlorine, ammonia, and E.coli.

6.5 - Water and Sewer

There are currently four areas within the watershed with access to public water systems (see "Public Water Districts" map). These areas include the Village of Ravena, the Hamlets of Selkirk and Clarksville, and the industrial areas of South Albany. These systems serve a total of approximately 1500 people. Except for the Village of Ravena, these water systems obtain their water supply from ground water sources. Water users in the remainder of the watershed (approximately 1300 households) rely on individual ground water supplies (wells) for drinking water and onsite septic systems for sewage disposal. The availability of public sewer services within the watershed is limited to the Village of Ravena and a small portion of the Town of Coeymans. Below is a table of public water supplies regulated by NYS DOH, which was obtained from the County Health Department.

	# of Wells	Population Served
Community PWS		
Clarksville	2	450
South Albany	1	100
Flemings MHP	2	250
Pine Ridge Ests MHP	2	175
Meilak's MHP	2	450
Miller Rd. Apts	1	35
Non-Community PWS		
Camp Pinnacle	4	variable
Stewarts	1	variable
Spaulding & Rogers	1	variable
Lawson lake	1	variable
Meads	1	variable
Mendels	1	variable
Lafarge Quarry	1	variable
Lafarge Plant	1	variable
Bella Pizza	1	variable
Deli Plus	1	variable
Midway Café	1	variable

Summary of Public Water Supply Wells in the Onesquethaw Watershed

Source: Albany County Department of Health

A combination of natural constraints including poorly drained and shallow soils and the environmental sensitivity of karst areas, limit the amount and density of future development that can be supported by on-site sewer and water systems. While the limited availability of public water and sewer currently discourage growth to a certain extent, extension of these services could be catalysts to higher-intensity growth.



6.6 – Water Diversions

The Vly Creek Reservoir was developed beginning in 1957 by impounding the Vly Creek and the east branch of the Onesquethaw Creek in the Town of New Scotland. The Water Resources Commission of the DEC approved two additional water resource development projects designed to provide additional water to the Vly Creek Reservoir in 1964. These projects include "Stage II," a water diversion from the middle branch of the Onesquethaw Creek, and "Stage III," a diversion of water from the west branch of the Onesquethaw Creek. Due to constraints related to the probable yield, Stage II has not been developed.

The Stage III diversion structure (known as the Wolf Hill Dam) is 6 feet high and fifty feet wide. The Town of Bethlehem is authorized to divert water at the Wolf Hill Dam during the

months of July through April. To protect downstream fisheries, no water diversion is permitted during the months of May and June, the normal annual low-flow period. Originally the Wolf Hill Dam was approved with flow restrictions during July and August as well. These two months were removed from the flow restrictions by the DEC in 1980 following a request for amendment by the town. During periods of diversion a release flow of 2.5 cubic feet per second must be maintained below the structure. The diversion flow is regulated through a manually operated 8.0-inch valve placed below the invert of the diversion main.

Due to the relatively small capacity of the Vly Creek Reservoir (safe yield of ~3.62 mgd), continued growth pressures, and period drought conditions, the reservoir has inadequate capacity to satisfy the Town of Bethlehem's current and long-term water needs. The Town has evaluated a number of alternatives to increase the capacity of the Vly Creek Reservoir. The most recent reports include a survey of the Wolf Hill Dam in April 2002 by Lawler, Matusky and Skelly Engineers; and a "Long-Range Water Supply Planning Study" by O'Brien and Gere Engineers in April 2003. The alternatives considered in these reports that could impact the Onesquethaw Creek include: 1) removing the restriction on stream diversion during May and June at the Wolf Hill Dam; 2) constructing the Stage II diversion; and 3) constructing "Stage IV" (an additional diversion of the Onesquethaw Creek). The first recommendation came from the report by Lawler, Matusky and Skelly Engineers. In June 2002 the town acted on this recommendation through an application to DEC, which sought to remove the May and June diversion restrictions. The DEC determined that the application was incomplete and that further study of potential impacts was required before additional diversions could be authorized.

The last two alternatives were among those considered in the subsequent O'Brien and Gere Engineers study.

The primary concern with all three of these potential actions is that they will reduce the flow of the Onesquethaw Creek. Flow reduction could negatively impact downstream fish populations by reducing the quantity of water necessary for mobility, feeding and propagation. The unnatural reduction of flow also reduces the stream's ability to transport bedload, which in turn can interfere with normal stream processes and reduce wildlife habitat (see Section 4.2). Flow reductions also diminish the ability of the stream to dilute any pollutants that may enter the stream, which could leave ground water, and therefore, well water vulnerable to contamination. The are a number of points along the upper Onesquethaw Creek where it is likely that pollutants

are entering the creek; without sufficient dilution, these pollutants could contaminate the shallow wells of residents along the creek.

6.7 – Landfills

Landfills are surface land areas, usually operated by municipalities, where garbage is disposed. While attempts are made to contain runoff and leachate from landfills, containment fails after time. Seeping leachate from landfills may contribute significant pollution to nearby water bodies.

Within the Onesquethaw-Coeymans Watershed, there are three closed landfills, two of which are known to be unlined. One formerly serving as the Town of Bethlehem's dump, the other a construction and demolition landfill known as the "Metz" site, and the third served as a land fill for the Town of New Scotland. The first two sites are located between Spawn Hollow and South Bethlehem within a quarter mile of each other and the Onesquethaw Creek, which flows between the two locations. The Town of Bethlehem currently operates a transfer station at the eastern end of the closed landfill site. The third site is located between North Road and Upper Flat Rock Road on a tributary north of Clarksville. A water main from the Clarksville central water system was extended up North Road because of contaminated individual wells along North Road. The source of the contamination reportedly was from petrochemical dumping years ago by a small business no longer in existence.

The Metz site is a former gravel quarry that was used from 1988 to 1992 for the disposal of construction and demolition debris. In 1991, the NYSDEC was notified by nearby neighbors that the site was smoldering and emitting foul-smelling fumes. Subsequent sampling by the NYSDEC identified hazardous toxins at the site, including lead, PCB's and the pesticide DDT. A consent order was issued in August 1991, which outlined closure procedures, including a methane gas venting system, which was subsequently upgraded to a flare system after the passive system proved ineffective. In 1993, eight nearby families initiated a lawsuit against Metz and Waste Management of New York, which was responsible for much of the waste that was disposed at the site. Local fisherman at the time were warned to stay away from the Onesquethaw Creek because of allegations that toxic leachate from the site was leaking into the creek.

Groundwater sampling performed by Dunn Engineering in 1993 indicated that with the possible exception of sulfate, and potentially manganese, the landfill had not impacted groundwater. A subsequent study performed by Rust Engineering in January 1996 came to a similar conclusion, though the possible exceptions included boron, bromide, chloride, sulfate and total dissolved solids (TDS). This report also notes that groundwater up gradient from the Metz landfill exhibits arsenic, barium, beryllium, iron, lead, magnesium, manganese and sodium concentrations that exceed the NYSDEC groundwater standards, which means that the elevated metal concentrations are attributed, at least in part, to sediment load and may not be related to the landfill.

The experiences of the Metz property indicates that landfills, even so-called "clean fill" landfills, have the potential to leak toxins. Although this site may continue to pose a potential threat to the purity of the Onesquethaw Creek and nearby groundwater, the issue of landfills is also relevant because another landfill has been proposed within the watershed, this time within close proximity to the Coeymans Creek.

The city of Albany initiated a landfill siting investigation in 1991. In May of 1992, the city of Albany, on behalf of the ANSWERS Solid Waste Management Planning Unit, retained C.T. Male Associated, P.C. to complete the landfill siting process. This firm issued a final site selection report in August 1994, which included the three most desirable sites for a future city landfill. Two of the three sites, including the preferred site (referred to in the report as site C2), are located within the OC watershed. The preferred site (C2) is located in the town of Coeymans between the western side of Interstate 87 and the Coeymans Creek and consists of 343 acres. The City began the SEQRA process by filing for a permit in 1994. In 1995, DEC designated itself as the lead agency for the review of the facility. A scope for a Draft Environmental Impact Statement (DEIS) was approved by DEC in January 1996. To date, no DEIS has been submitted by the City. In December 2007, the city of Albany purchased the land for this site.

In response to a request by the city of Albany to the US Army Corps of Engineers for a wetland determination on the preferred site, the Army Corps responded, noting that site visits along with a wetland delineation report by Clough, Harbour and Associates, LLP, dated May 2004, and revised on July 18, 2005, concludes that the site contains 101.5 acres of jurisdictional wetlands as well as the presence of 4,030 linear feet of defined stream channels that are part of the tributary system to the Coeymans Creek.

6.8 – Trout Stocking

Where habitat is suitable, the stocking of trout for recreational fishing is often undertaken by the State (or others under State permit). Records at DEC indicate that beginning in 1924 the OC has been stocked with trout at various locations and times.

Lower Coeymans Creek was stocked from 1924 through 1934 at unspecified locations between the Hudson River and the confluence with Onesquethaw Creek with 3,000 Rainbow Trout (RT) and 100 Brown Trout (BT) fingerlings. Records indicate there may have been no stocking after 1934 due to survey comments that the stream appeared polluted. After a survey in 1957, Coeymans Creek was stocked below its confluence with Onesquethaw Creek with 120 BT yearlings. Subsequent stocking occurred as follows: 120 BT yearlings per year from 1958-59, and with 220 BT per year from 1960-62. Following another survey in 1962, which reported that Coeymans Creek was too polluted, it appears that stocking of lower Coeymans Creek ended thereafter. No stocking of upper Coeymans Creek above the confluence with Onesquethaw Creek has ever occurred or been recommended due to pollution.

Onesquethaw Creek was stocked from 1924 through 1933 at unspecified locations with 109,560 BT and 15, 050 RT fingerlings. A 1955 survey recommended stocking with 390 BT yearlings per year. A 1976 survey recommended stocking 600 BT between Clarksville and Flat Rock Road near NY 32. Guideline records suggest 1200-1600 BT yearlings were stocked per year after 1981. The most recent annual stocking target is 1100 yearlings and 100 two-year olds in the Clarksville area from Tarrytown Bridge Road downstream about 3 miles to Winne Lane; however, some of these sites are no longer stocked due to posting.

Feuri Spruyt was stocked from 1929-31 with 2150 brook trout fingerlings. There is no specific data after that until 1955, when a report recommended that no trout be stocked due to gravel washing operations (the stream runs through and under a large quarry). There is no record of stocking after 1931.

DEC fish surveys (Section 7.4 – Fisheries Monitoring) indicate healthy, self-sustaining populations of wild trout. Technical studies¹⁰ indicate that indiscriminate stocking of hatchery

¹⁰ Vincent, E. Richard, "Effects of Stocking Catchable-Size Hatchery Rainbow Trout on Two Wild Trout Species in the Madison River and O'Dell Creek, Montana", North American Journal of Fisheries Management, 7:91-105, 1987. State of Pennsylvania Website, "Management of Trout Fisheries in Pennsylvania Waters", 2008,

http://www.fish.state.pa.us/trman98.htm

fish can reduce wild trout populations. Evaluation of potential impacts is made by DEC in determining stocking guidelines for the Creek. Most of the stream is not stocked. In addition, there has been no formal public fishing access on the stream and some land, where informal access was previously allowed, has recently been posted.

6.9 – Dams and Barriers

Dams and other barriers, such as culverts, can change stream flow pattern, interrupt sediment and bedload transport, prevent migration of fish and other aquatic fauna, and increase concentration of some toxic chemicals. There are numerous natural and manmade barriers within the OC creek system. Waterfalls and sections with underground flow are natural barriers to fish movement.

There are at least four waterfall sites (Coeymans Falls at NY 144, Gregory Falls, Clarksville Falls, and the falls in the Upper Clarksville Ravine). During much of the year, the Onesquethaw flows through underground karst conduits in at least two areas (above Clarksville and above Rarick Road); the Lawson Lake tributary flows through Onesquethaw Cave; and the Copeland Hill tributary flows underground for a short section. Despite the considerable barriers, the American eel has been found all the way to Clarksville, and reportedly in the underground pools in the Clarksville Cave.

Human activity has resulted in the Feuri Spruyt tributary running under a stone quarry for about ¹/₄ mile, and the Upper Coeymans Creek running under the Selkirk Rail Yards for about ¹/₄ mile. There are a considerable number of culverts and undersized bridges throughout the system, which have not yet been inventoried. Known dams include the Wolf Hill Dam, which is used to divert water out of the watershed, the Helderberg Lake dam, the Lawson Lake dam, and the small dam on Mill Pond in Clarksville.

6.10 – Agriculture

Agriculture is a predominant land use in the watershed, especially in areas of prime soils. There are currently approximately 2500 acres of farmland producing hay, corn, and grain. Three of the largest dairy farms and one of the largest beef feedlots in New York State also operate in the watershed. Because of the productive soils, history of farming in the community, and

countywide interest in preserving farmland and encouraging agricultural economic development, it is expected that agriculture will continue to be a dominant land use in the watershed.

Farmers have access to several state and federal programs to assist them in implementing management practices on their land to protect and improve water quality, enhance wildlife habitat, and control soil erosion (see Appendix 10.8-Agriculatural Programs). Several agencies including Albany County Soil and Water Conservation District (SWCD), Cornell Cooperative Extension, USDA Farm Service Agency, and USDA Natural Resources Conservation Service, provide technical assistance to help farmers evaluate their operation and identify grants and programs that will meet their needs. All of the dairy and most of the livestock farms in the watershed have developed nutrient management plans through these programs.

Using a voluntary incentive-based program called Agricultural Environmental management (AEM) the SWCD has inventoried approximately 20 farms in the watershed and identified and prioritized environmental practices and concerns on 17 farms. This information was used to identify the highest priorities. SWCD will guide high priority farms through the AEM process, assisting them in developing a plan to address environmental concerns and implementing the recommended practices. These practices may include improvement of manure storage facilities and manure spreading practices, drainage improvements, and stream buffers.

While agricultural activity may be viewed, in some cases, as having a potential impact on water quality there is also a tremendous opportunity to work with farmers, who are stewards of large areas of undeveloped land, toward shared goals of water quality improvement and stream corridor protection. Implementation of AEM and other environmental programs has the potential to improve the water quality of the Onesquethaw and Coeymans Creeks and their tributaries and participation should be encouraged and supported.

The Albany County Soil and Water Conservation District (SWCD) is a local governmental subdivision established to implement programs for soil and water conservation and use, and the development of related resources. Programs provide information service, technical, and financial assistance to agricultural, rural, urban and suburban residents.

The US Department of Agriculture (USDA) provides a variety of programs to landowners and farmers to improve water quality, enhance wildlife habitat, and control soil erosion. These programs, administered by the Farm Service Agency (FSA), provide financial

incentives to participants through conservation cost sharing for the installation of practices, and annual payments for acreage enrolled in enduring practices such as stream corridor buffers.

The Natural Resources Conservation Service (NRCS, originally the Soil Conservation Service) provides technical support and leadership. NRCS programs are voluntary and involve technical and financial assistance to land owners, communities, and government agencies. Technical expertise is provided in areas such as clean water, ecological science, engineering, resource economics, social science, and soil surveys. Assistance with these programs is available at the NRCS and FSA offices in Voorheesville.

The following is a summary of the land conservation and management programs provided by the USDA and/or NYS. A more complete description is set forth in the Appendix 10.8–Agricultural Programs.

Agricultural Environmental Management (AEM) – A voluntary, incentive-based program which uses a five-tiered approach to identify potential environmental concerns on farms and develop and implement comprehensive, site-specific plans to address these issues. AEM also link farmers with programs and funding to make improvements to address water quality concerns.

Conservation Reserve Program (CRP) – The FSA's CRP is a voluntary program available to agricultural producers to help them safeguard environmentally sensitive land.

Conservation Reserve Enhancement Program (CREP) - CREP is a voluntary land retirement program that helps agricultural producers protect environmentally sensitive land, decrease erosion, restore wildlife habitat, and safeguard ground and surface water.

Conservation Security Program (CSP) - CSP is a voluntary program that provides financial and technical assistance to promote the conservation and improvement of soil, water, air, energy, plant and animal life, and other conservation purposes on Tribal and private working lands.

Debt for Nature Program (DFN) - DFN, also known as the Debt Cancellation Conservation Contract Program, is a unique program for eligible landowners that protects important natural resources and other sensitive areas while providing a debt management tool.

Emergency Conservation Program (ECP) - ECP provides emergency funding and technical assistance for farmers and ranchers to rehabilitate farmland damaged by natural

disasters and for carrying out emergency water conservation measures in periods of severe drought.

Environmental Quality Incentives Program (EQIP) - EQIP offers financial and technical help to assist eligible participants to install or implement structural and management practices on eligible agricultural land.

Grassland Reserve Program (GRP) - GRP is a voluntary program offering landowners the opportunity to protect, restore, and enhance grassland, rangeland, pastureland, shrubland and certain other lands and provides assistance for rehabilitating grasslands.

Wetlands Reserve Program (WRP) – WRP is a voluntary program offering landowners the opportunity to protect, restore, and enhance wetlands on their property. The NRCS provides technical and financial support to help landowners with wetland restoration efforts.

Wildlife Habitat Incentives Program (WHIP) - WHIP is a voluntary program for people who want to develop and improve wildlife habitat primarily on private land. The NRCS provides both technical assistance and up to 75 percent cost-share assistance to establish and improve fish and wildlife habitat.

7 – Monitoring and Observations

7.1 - Water Quality and Biomonitoring

NYS Department of Environmental Conservation

Biomonitoring is the sampling of benthic macroinvertebrates (BMI - aquatic insects living on the stream bottom). Since BMI are sensitive to impacts resulting from pollution, sedimentation, turbidity, and changes in water temperature, the diversity and abundance of these organisms are used as a measure of water quality. Since 1984, various sites on the OC Creek have been sampled and evaluated for water quality by the DEC's Stream Bio-Monitoring Unit. A detailed description of the process can be found at the DEC website http://www. dec.ny.gov/chemical/23847.html. The numbers and types of BMI provide data for an assessment of overall stream ecosystem health and water quality.

A review and summary of stream surveys made by DEC at various sites in 1984, 1987, 1996, 1998, and 2002 are as follows:

* Overall water quality of Onesquethaw Creek above the confluence with Coeymans Creek is good with some slight impacts from nonpoint source pollution. Due to thin soil layers overlying limestone bedrock, there is poor filtering protection and the creek is especially vulnerable to water pollution.

* A small tributary near Clarksville was assessed in 1996 as severely impacted by animal waste. However, miles downstream at the confluence with Coeymans Creek, Onesquethaw Creek is assessed as having excellent water quality.

* The upper Coeymans above the confluence with Onesquethaw Creek has moderately impacted water quality resulting from unknown toxic inputs, possibly from industrial uses. The stream also experiences increased turbidity and conductivity, and decreased dissolved oxygen. During fish surveys DEC staff notes in a 1972 report "Two miles downstream of the railroad yards there are steep mud slides, mud and oil sludge bottom, grossly polluted, oil film. Immediately upstream of the railroad yards is much improved over the polluted downstream section." Current visual observations are consistent with the 1972 report.

* The 1984 Survey, "Biological Assessment of Coeymans Creek from Feura Bush to South Bethlehem", by Robert Bode and Karl Simpson, issued February 15, 1985 by the NY DEC Division of Water, was completed in affiliation with the DOH Wadsworth Center for Laboratories and Research (survey date of October 5, 1984). The conclusions of the 1984 Survey state: Water quality in Coeymans Creek was assessed as moderately impacted...gray and turbid ... and supported primarily pollution-tolerant species...problems in this reach appeared to be toxic, as opposed to organic...Onesquethaw Creek...yielded a substantially better fauna ...Worksheets in the survey dated August 24, 1984, listed heavy metals, PCB, oil and grease for Upper Coeymans Creek.

* Below the confluence of the Onesquethaw and Coeymans Creeks, now called the Lower Coeymans, an unnamed tributary from the Selkirk train yards contained high levels of iron in 1987. Parts of the Lower Coeymans have slightly impacted water quality with increased turbidity and conductivity, and decreased dissolved oxygen. Possible sources of impacts are nonpoint source nutrient enrichment and municipal and/or industrial inputs.

A memo entitled "Biological Assessment of Onesquethaw Creek Tributary", from Robert Bode (head of Stream Monitoring Unit, Division of Water, NYS DEC), dated November 22, 1996, reports findings of BMI sampling done at sites above and below the Hill Top Farm feedlot

along Stove Pipe, Flat Rock, and North Roads near Clarksville. The memo states: Substantial impact was documented immediately downstream...The indices from this site reflect severe water quality impact...In summary, the stream exhibits full-blown effects of farm animal wastes...This situation presents a good opportunity for the study of agricultural effects and possible documentation of any remedial action.

In January 2001, DEC's Stream Monitoring Unit, Bureau of Watershed Assessment and Research, Division of Water, published the "Biological Assessment of Tributaries of the Lower Hudson River" ("Assessment"). The Assessment was funded by a grant from the Hudson River Estuary Program. For Coeymans Creek (p. 16 of the Assessment), the sampling point was 200 meters upstream of the NY 144 bridge (lat 42°28' 39" / lon 73*47' 40"). Coeymans Creek was rated as having a "Biological Profile Scale of Water Quality" of 6 on a scale of 1 to 10, which is rated on the border between good and poor. Good indicates "fauna slightly limited by water quality; mostly nonpoint source nutrient enrichment." Poor indicates "fauna moderately limited by water quality; mostly municipal and/or industrial inputs." Tables within the Assessment (pp. 6, 7, 11, and 13) indicate that contaminants in invertebrate tissue exceeded levels of concern for copper in hellgramites and pyrene in crayfish (PAH - polycyclic aromatic hydrocarbons). The overall assessment of Coeymans Creek was "slightly impacted." An "Inorganic Analysis Data Sheet" (p. 63) showed arsenic and copper present at levels of concern.

"30 Year Trends in Water Quality of Rivers and Streams in New York State Based on Macroinvertebrate Data 1972 - 2002", published in 2004 by DEC's Stream Biomonitoring Unit, Division of Water, ("Trends"), indicates a decline and/or severely impacted water quality at several locations on Onesquethaw Creek. Evaluating the various locations sampled in 1984, 1987, 1996, 1998, and 2002, Trends states water quality in Coeymans Creek from Bethlehem Heights to Coeymans is assessed as slightly impacted, based on macroinvertebrate sampling in 1998. Probable stressors are nonpoint source nutrient enrichment, municipal/industrial inputs, and siltation. "The Bethlehem Heights assessment represents an apparent decline in water quality compared to non-impacted conditions documented in 1987."

In 2006, nine sites were sampled as part of a study by the Hudson Basin River Watch as part of a Hudson River Estuary Watershed Assessment and Outreach Project, funded by the HREP. The assessed water quality ranged from very good to very poor, with seven sites assessed as very good, one as good, and one as very poor. The site assessed as very poor was

located on an unnamed tributary near the intersection of North Road and Upper Flat Rock Road near Clarksville. This is the same area where severely impacted water quality was noted by DEC in 1996.

In July of 2007, DEC Fisheries staff collected a number of trout to test for contaminants in fish tissue. The results of that testing has not been released, or possibly not completed, to date.

Graduate Student Monitoring

From December 2002 to May 2003, a SUNY Albany graduate students performed chemical analyses using SUNY Albany Ion Chromatography equipment¹¹. Sampling upstream from the Hudson River, sodium levels were about 60 ppm in the lower Coeymans Creek, decreasing to 40 ppm in the lower Onesquethaw Creek, and increasing again to 60 ppm near Clarksville. Chloride levels were about 110 ppm in Lower Coeymans Creek, decreasing to 74 ppm, then up to 111 ppm near Clarksville. Average nitrate levels were approximately 4.0 ppm at six sites along the creek mainstem. The nitrate level doubled to approximately 8.0 ppm at one site south of Clarksville, near the Tarrytown Road bridge. It is suspected that the elevated nitrate levels are due to nonpoint source pollution. Typical natural freshwater levels are less than 1.0 ppm.

Summary

The 2001 study of lower Coeymans Creek, which included assessment of invertebrate tissue, indicated contaminants exceeding levels of concern for copper, pyrene, and arsenic. The DEC biological assessments indicate toxic pollution in upper Coeymans Creek. These findings raise concerns over the poor condition of the stream and the risks to wildlife and recreational users of the stream in this area. The upper Onesquethaw is slightly impacted by nonpoint source pollution, except for the tributary below Hill Top Farm, which is severely impacted. There are no apparent trends noted other than the 2004 DEC "Trends in Water Quality" which observes the section from Bethlehem Heights to Coeymans shows an apparent decline in water quality from 1987 to 1998.

¹¹ Heinzen, Nancy 2003

7.2 – Stream Flow Data

Monitored stream flows show the range of watershed discharge, and can be used to measure a stream's response to rainfall, snow melt, and land use over time. Stream flow data is important for watershed modeling.

The US Geological Survey (USGS) monitored stream flows from August 29, 1967 through September 30, 1977; the average daily stream flow in cubic feet per second (cfs) during this period is available at the USGS website. Peak stream flows for various dates are also available for the period May 29, 1968 through September 16, 1999 on the website.

The data is available at the website (<u>http://nwis.waterdata.usgs.gov/ny/nwis/</u>) at site no. 01359902 "Coeymans Creek Near Selkirk NY". The gaging station no longer operates, but remnants can be found downstream of the Pictuay Road crossing at latitude 42°31'38" and longitude 73°49'14". The watershed drainage area upstream of the gaging station is 35.1 square miles, or 67% of the total watershed area of 52 square miles. A table setting forth the raw data for the ten years is contained in Appendix 10.6 – Stream Flow Data.

Below is a table summarizing high, low, average, and median average daily flows, instantaneous peak, and total annual discharge in each of the monitored years.

The flows measured from 1967 – 1977 indicate a large variability, with average daily flow ranging from 0.6 cfs on July 27, 1976 to 1,490 cfs on June 30, 1973. The highest instantaneous peak was estimated to be 4,800 cfs on September 16, 1999 (Hurricane Floyd).

USGS Flow Data for Site # 01359902, Coeymans Creek near Selkirk

-	-			(CFS)		_		TOTAL
	_		cubic	feet per	second			CU.FT.
	DATE	PEAK	HI Avg	LOW Avg		AVG Annual	MEDIAN	in
			Daily	Daily			Annual	millions
1967	8/29-12/31					16.8		181.8
	12/12/67		280.0					
(4 months)	09/05/67			1.6				
1968						36.2	19.0	1,142.6
	03/18/68		493.0					
	08/28/68			1.2				
	5/29/68	1,530						
1969						50.6	20.0	1,594.5
	12/11/69		864.0					
	10/25/69			2.7				
	04/23/69	1,500						
1970						40.9	17.0	1,290.0
	04/02/70		900.0					
	08/29/70			1.5				
	04/02/70	2,030						
1971						49.7	14.0	1,566.3
	12/11/71		590.0					
	08/23/71			1.7				
	04/03/71	720						
1972						79.9	41.0	2,519.6
	11/26/72		736.0					
	10/05/72			2.7				
	06/24/72	1,300						
1973						65.7	23.0	2,070.7
	06/30/73		1490.0					
	11/26/73			2.1				
	06/30/73	3,240						
1974						44.5	28.0	1,404.1
	07/03/74		570.0					
	08/20/74			1.8				
	12/21/74	1,840						
1975						69.5	29.0	2,193.2
	04/03/75		911.0					
	09/17/75			3.7				
	04/03/75	1,760						
1976						49.4	17.0	1,557.1
	01/28/76		701.0					
	07/27/76			0.6				
	10/19/76	2,110						
1977	1/1-9/30					56.1		1324.2
	03/14/77		1330.0					
(9 months)	09/07/77			3.5				
	03/13/77	1,700						
1996	01/19/96	3,550						
1999	09/16/99	4 800						

August 29, 1967 - September 30, 1977 for continuous monitoring

The USGS maintained a gaging station on Coeymans Creek downstream of the Pictuay Road crossing, from August 29,1967 through September 30, 1977. The greatest discharges (flows) occurred in 1972, with an average daily flow of 79.9 cfs, a median flow of 41 cfs, and a total annual discharge of 2.5 billion cubic feet (this amount is estimated by multiplying the average daily discharge in cfs by 60 sec/min x 60 min/hr x 24 hrs/day x 365 days/yr). Peak stream flows as measured by a gage height were at historical highs of 3,550 cfs on January 19, 1996 and 4,800 cfs on September 16, 1999 (Hurricane Floyd).

7.3 - Temperature Monitoring

Water temperature is important to cold water species like trout. Temperatures exceeding 75°F for extended periods are often lethal to trout. The effects of temperature on fish are also impacted by riffle oxygenation, water quality, fish condition, and the presence of seeps and springs. It has been noted in studies within the Delaware and Batten Kill River systems that wild trout can move great distances for spawning and habitat conditions, such as lower temperatures.

Starting in 2001, volunteer members of Trout Unlimited began monitoring stream temperature using Onset temperature loggers. The data recorded is sporadic but is set forth here to give indications of temperature ranges. The monitored sites are listed in the table below starting at the Pearsall site near Clarksville (at the top of the table), and proceed downstream to the Lawler site at the confluence with the Hudson River (bottom of table).

The numbers shown indicate the number of days the daily peak temperature exceeded the temperature shown; e.g. "75-11" means the peak daily temperature exceeded 75°F on 11 different days during 2006.

The Pearsall site is upstream on the Onesquethaw, near Clarksville, while the Lawler site is at the base of a series of falls, one falls above the Hudson River tidal pool. As expected, the water warms as it flows downstream to the Hudson. There are sites along the stream where water is cooler because of underground flow. Observed resurgence of stream flow during low flow periods occurs in Clarksville, the tributary at the Pearsall site, and at the ASNY (Audubon Society of NY) site.

The recorded temperatures indicate that temperature is not likely a limiting factor to trout survival, and that trout populations can exist throughout the entire length of the stream, especially given that fish movement is not restricted through most of the main stem. This is confirmed by fisheries monitoring (Section 7.4).

Location	Logger Ser. No.	2001	2002	2003	2004	2005	2006	2007
Pearsall- Onesquethw	681761						80-1 75-11 70-36	
Pearsall - tributary	530060						80-0 75-0 70-12	
NY 32	472422				75-2 70-21			
Onesq Cr Rd	224542		70-15 (1)					
ASNY	280615	70-0 (2)						
Pocket Park	472725		70-0					
Barbers - Coeymans	530061						75-13 70-58	75-3 70-38
Old Ravena Rd	224523 133505	80-6 (3) 75-25 70-69	80-0 75-15 70-42				80-0 75-0 70-23	80-0 75-3 70-40
Upstream NY 144	224546	80-8 (3) 75-35 70-80	80-1 75-21 70-60					
Lawler	659628						80-0 75-13 70-29	

(1) The logger stopped recording August 2, 2002.

(2) The logger operated from August 15, 2000 to May 12, 2001. This site is downstream from a resurgence of creek flow; during low flows the stream is underground above the resurgence and is cooled.

(3) The data had 3 suspicious spikes near or over 90°F. The logger may have been out of or in very shallow water.

7.4 - Fisheries Monitoring

Fish found in the OC include the American eel, rated a "species of greatest conservation need" by DEC, stickleback, sculpin, dace, sucker, and brown trout. As a valued sport fish, the trout has received special attention, and the OC has a healthy self-sustaining population of wild trout.

The DEC Region 4 Fisheries Unit has been monitoring OC trout since August 1934. The most recent survey was conducted in August 2007 at Coeymans Creek sites. With the exception of the 2007 data, which is not yet available, the survey data and related information was provided

to OCWC volunteers who compiled and analyzed it with the help of current DEC Fisheries staff. The information is summarized here:

- Onesquethaw Creek was surveyed at various locations and dates from August 1934 to August 1999. Generally, trout populations increase upstream from the mouth until they peak in the vicinity of County Route 102 (Old Quarry Road) in the Town of Bethlehem. County Route 102 is immediately east of Hollyhock Hollow Sanctuary, where cooled water resurges from underground karst conduits. The numbers decrease further upstream towards Clarksville in the Town of New Scotland, where natural water flowrates are reduced by the Wolf Hill diversion dam. Trout found were always brown trout with one notable exception: in 1955 the records state two brook trout were captured along with 27 brown trout at County Route 102.
- Upper Coeymans Creek, upstream of the confluence with the Onesquethaw Creek to the Coeymans source in the Town of Bethlehem, was surveyed in 1972 and 1982. No fish, trout or otherwise, were found.
- Lower Coeymans Creek was also variously surveyed from 1934 to 2007, from the confluence with the Onesquethaw Creek downstream to one mile above the confluence with the Hudson River in the Town of Coeymans. Brown trout were found the entire length of the lower creek. In 2007, trout captured one mile above the Hudson River included a fingerling, which indicates trout are spawning in that area. The largest concentration of fish, including trout, was at a site 0.2 miles below the Onesquethaw Creek confluence near NY Route 396 (Bridge Street) in the Town of Bethlehem.

The data indicates the OC is capable of providing recreational angling for wild trout within a short distance of nearby densely populated areas. However, opportunities for access have decreased markedly as locations fishermen have freely used for generations have been posted, and additional posting is likely as urban and suburban dwellers continue to relocate to rural areas. Additionally, water quality monitoring indicates there may be a need for further evaluation of the safety of consuming fish caught in certain sections of the creek.
7.5 – Stream Stability

Report by the Albany County Soil and Water Conservation District (ACSWCD)

A report by the Albany County Soil and Water Conservation District (ACSWCD)¹² was prepared in response to the need for emergency stream bank stabilization on the Coeymans Creek near State Route 396 in South Bethlehem (an area known as the Barber property). The report noted: The unique stream morphology within the OC watershed creates conditions of stream channel instability, particularly at the confluence of the Onesquethaw and Coeymans Creeks; unique juxtaposition of landforms may predispose this reach of the Coeymans Creek to long-term, continuous bank erosion as the incised valley slowly widens to attain a stable meander beltwidth. Bank erosion continues to present a widespread problem in the Onesquethaw and Coeymans Creeks, and the problem is more widespread than previously expected; bank erosion rates are very high throughout the entire stream corridor between Old Quarry Road and Route 9W. The report concluded that, without bank armoring, the Barber Property portion of the Creek will rapidly erode, threatening a home and highway embankment and misaligning the stream with an existing bridge; given the apparent level of instability in the Onesquethaw and Coeymans Creeks, it is certain that accelerated rates of bank erosion will continue into the future unless actions are taken to halt these trends. The report further concluded the stream corridor from Old Quarry Road to Route 9W would benefit from natural channel restoration, and recommended that steps be taken to identify funding sources and partnerships to carry out this action.

Graduate Student Study

A 2002 graduate student study¹³ mapped the extent of erosion along a 3.5-mile portion of the Onesquethaw Creek entirely in the Town of Bethlehem, and examined the usefulness of GIS and GPS for such analysis. The project began at the Audubon Society of New York, Hollyhock Hollow Sanctuary, and ended at the Barber property where the Onesquethaw and Coeymans Creeks join together. Maps and a table of eroded sites are contained in Appendix 10.9.

¹² Greco, Brandon. 2005. Onesquethaw Creek/Coeymans Creek Stream Stability Assessment. The Albany County Soil and Water Conservation District.

¹³ Kisby Clark, Staci, December 7, 2002, entitled "Use of GIS and GPS to Determine the Extent and Possible Causes of Erosion Along the Onesquethaw Creek, Albany County, NY"

Along the 3.5-mile section of the creek studied, a total of 44 sites were found to have eroding banks. Either mixed forest or deciduous trees immediately surrounded the majority of the sites. However, due to study limits, the width of these buffers was not recorded. Several sites occurred along private property. Erosion sites were spread along the entire portion of the study area although many sections of the Creek had little to no erosion. In regions where erosion occurred, other sites were clustered nearby. Seven sites occurred near the Audubon office and were mainly surrounded by vegetated areas. A few eroded sites varied significantly from the path of the creek. These variations could be due to a new path of the stream.

The report concluded there was little correlation between erosion sites and slope angle or impervious surface from a qualitative standpoint; however, the data provided a basic understanding of the existing problem, which could be used to direct future studies. It was suggested that some of the instability may have been caused by an alteration in stream flow, such as flows produced by Hurricane Floyd in 1999 and the high winter flow of 1996. A more thorough assessment of steam bank and channel conditions would be beneficial and was highly recommended.

7.6 - Watershed Biodiversity

Biodiversity, as defined in Hudsonia's Biodiversity Assessment Handbook, is the variety of life and its processes. This includes all levels of variation in nature, from ecosystems to genes, as well as the interactions of organisms with each other and with the non-biological components of their environments, such as soil, water, air, and sunlight.

Watershed plans offer an ideal opportunity to consider conservation of the habitats that support the diversity of flora and fauna in the watershed. The plants, animals, and habitats, or biodiversity, of the Onesquethaw-Coeymans watershed are a significant part of the region's character. Forests, fields, wetlands, lakes and streams, and riparian areas are not only important wildlife habitats, but also help protect water quality and control flooding. Given this relationship, activities that protect biodiversity also protect water resources.

The first step in conserving valuable habitats is identifying the priority areas. These are areas where there is abundant habitat and a diversity of species and also areas that are home to threatened and endangered species. While there is no comprehensive natural resources inventory available for the watershed, there has been data collected about flora and fauna in certain areas. The findings of previous studies are summarized below.

Part of the watershed lies in an area known as the Helderberg escarpment. This area is included in the Hudson Valley Limestone and Shale Ridges habitat identified as a significant biodiversity area in DEC's Hudson River Estuary Wildlife and Habitat Conservation Framework. Most of the natural areas and wildlife that can be found in this portion of the watershed are indicators of high quality habitat.

The karst topography in this area is defined by shallow soil depth to bedrock, steep slopes, caves, sinkholes, fissures, and underground streams. These conditions offer preferred habitat for rare bats such as the Eastern small-footed bat, a NYS Species of Special Concern, as well as eastern pipistrelle and Keen's bat, which are known to hibernate in watershed caves.

The limestone cliffs support a diversity of plants, which thrive in calcareous soils including columbine, maidenhair and ebony spleenwort, blood root, Canada moonseed and mayapple. In addition, there are small portions of high quality woodland communities in the northern watershed including areas of cedar, red maple-hardwood swamp, chestnut oak forest, and Appalachian oak-hickory, which provide quality habitat to a diversity of birds and mammals.

The lower portion of the watershed, from the confluence of Coeymans Creek with the Hudson River upstream to the falls near State route 144, is designated by the New York State Department of State, Division of Coastal Resources, as a significant coastal fish and wildlife habitat. The habitat is essentially a sheltered tidal cove, containing wetland vegetation, mudflats, and shallow areas. This part of the creek provides spawning habitat for anadromous fish that travel from the ocean to the Hudson River and its tributaries to spawn, including alewife, blueback herring, white perch, and American shad. Shortnose sturgeon also use the Hudson River off Coeymans Creek's mouth as a spawning area (NY Natural Heritage) and may use the tidal portion of the Coeyman's Creek as a refuge during high spring flows. Submerged aquatic vegetation in the Hudson is located just beyond its confluence with the creek. This vegetation is very important for river fish, providing habitat for macroinvertebrates on which they feed. They also add oxygen to the water and provide protection for juvenile fish.

The tidal wetlands and mudflats along the river shoreline at Coeymans Creek provide resting and feeding areas for a variety of waterfowl during spring and fall migrations. Species

found in the area include double crested cormorant, great blue heron, green heron, Canada goose and belted kingfisher. Map turtles have also been found in this area.

Several species of fish have been found to inhabit the fresh waters of the Creek. DEC electro-shocking studies have found blacknose dace, white sucker, longnose dace, brown trout, sculpin, stickleback, cutlips minnow, creek chub, common and spot tail shiners, and American eel. The cool waters of the Onesquethaw and Coeymans Creek offer prime conditions for trout spawning and survival. Trout require cool (<70 degrees F), clean, oxygenated water with a pH between 6.5 and 8.2 to survive. Ideal waters have little turbidity, adequate habitat (overhanging trees, rocks, cobble), and food. Trout are often the first fish species to disappear if a water body becomes polluted (or warmed). See Section 7.2. Fish Surveys.

Appendix 10.5 - Table of Animals and Habitat, summarizes information obtained from various publications about significant animals, plants, and habitats found in the watershed. The table was provided by biologists from the NYS DEC.

Appendix 10.10 – Where the Coeymans meets the Hudson, describes in greater detail the relation between the Hudson and Coeymans.

Biodiversity Assessment Training

In January 2005, the OCWC received a grant from the DEC HREP and Hudsonia to conduct biodiversity assessment training in the watershed. This program was intended to teach participants about habitats of ecological significance and how to use various methods to identify, map, and protect these areas. The study area included approximately 4700 acres along 10 miles of the Onesquethaw-Coeymans Creek from Hollyhock Hollow Sanctuary on Rarick Road in the Town of Bethlehem, downstream to the confluence of Coeymans Creek and the Hudson River in the Town of Coeymans. This area was chosen for its diversity of habitats and land uses as well as the potential for development pressure. The mix of land uses in the study area includes industrial, commercial, agriculture, mining, residential, and parkland. There are also diverse habitats such as woodland, tidal and non-tidal wetland, meadows, and the confluence of the Onesquethaw-Coeymans Creek and the Hudson River.

Several participants in this program were land use planners active in the watershed including members of the Bethlehem Planning Department, Coeymans Planning Board, and the Albany County Office of Natural Resources. Using Hudsonia's Biodiversity Assessment

Manual and training from Hudsonia staff, the group focused on map interpretation using soils maps, topographic and geologic maps, and aerial photographs to look for areas that may be ecologically significant (habitats that are rare or declining in the region or support species that are rare or declining) and then conducted field work to verify the existence of ecologically significant habitat, plants, and animals. At the conclusion of the training, a draft report and map of habitats in the study area was prepared.

The habitats found in the study area represent typical habitats found throughout the watershed. In the future, the biodiversity assessment techniques that were learned through this training program may be applied to create a habitat map for the entire watershed. A summary of the significant habitats within the watershed is presented below.



The predominant habitat was found to be deciduous forest, which includes forests of moderate size and age as well as old growth forest with some trees reaching about 150 feet.

Deciduous forests frequently occur adjacent to agricultural fields where meadows transition to shrubland, then young forest, then to more mature forest. Some of the best examples of upland deciduous forest containing old growth trees were found in areas of clay ravines and crest ledge in the southern watershed where the potential for development is limited due to soils and slopes. Species identified and commonly found include beech, sugar maple, black cherry, American hornbeam, hop horn beam, American elm, eastern cottonwood, basswood, ash, and red oak. Species such as aspen and birch are common in previously farmed areas. Mulberry, slippery elm, red maple, and aspen most likely represent successional growth from agricultural use. In areas of old growth forest in the southern watershed, large silver maple, and shagbark hickory were found. There are also small areas of coniferous forest. One notable area is a stand of hemlock forest at Hollyhock Sanctuary. Other small areas of coniferous forest consisting primarily of white pine and red pine can be found among larger areas of upland deciduous and mixed forest. A large portion of forested land in the southern study area includes clay ravines, characterized by narrow ridges, clay soils, and steep sided ravines cut by small streams. Deciduous trees observed in this area included American beech, sugar maple, Eastern cottonwood, American hornbeam, and hop hornbeam. Other plants, including hog peanut, drop seed and barberry were also observed.

There were large areas of hardwood swamp in the riparian areas along the creek and in other low-lying areas subject to frequent flooding. These wetlands are dominated by hardwood deciduous trees and support breeding populations of amphibians. Both the state listed blue spotted salamander and the regionally listed four-toed salamander have been recorded in the vicinity of the study area. Wood frogs were also frequently spotted during fieldwork. Typical trees that were found in this habitat include mature elm, sycamore, ash, cottonwood, and basswood. A diversity of wildflowers, including trout lily, trillium, columbine, and dutchman's breeches were also found in riparian areas.

A unique carbonate crest ledge habitat was found in an area of exposed limestone bedrock and shallow soils in the vicinity of Hollyhock Sanctuary, along Rarick Road. A field trip to the Preserve confirmed both the presence of rocky land features and calcareous soils. Several species that thrive on the calcium-rich soils here were identified including woodland sedge, bladdernut, red baneberry, May apple, squawroot, Canada moonseed, maidenhair spleenwort and ebony spleenwort.

Probably due to a tradition of farming in the area, there were an abundance of meadows, many supporting plants that indicated wet, clay soils. Wet meadows are extremely important due to the fauna and flora they support. The plants found included reed canary grass, purple loosestrife, New England and other asters, goldenrod, Joe-Pye weed, cattail, numerous sedges and shrubs, and grey and silky dogwood. Among the wildlife noted were birds such as red winged blackbird, swallows, red tailed hawk, and great blue heron. Mammals such as rabbits and white tail deer, monarch butterflies, and other fauna including snails and green frogs were identified.

Because of the geology, portions of the study area have been extensively mined but can still serve as habitat for some wildlife. Large areas of previously mined land support grasses and shrubs, which are favorable for small mammals. In addition, the edges of mines are good habitat for nesting birds such as the bank swallow, which was seen visiting a nest site at one abandoned mine in the northern portion of the study area. Because of the impervious rock at or near the surface, wet meadows and small pools are commonly found in these areas.

The aquatic habitat includes both a non-tidal stream and a small tidal area at the confluence of the Creek with the Hudson River. Typical riparian vegetation was found in these areas. While no aquatic organisms were sampled at the time, previous studies have documented a diversity of fish and macroinvertabrates living in the stream (see Sections 7.1. and 7.2.).

7.7 – Climate and Precipitation

Climate data provides information that is critical in evaluating the hydrology of an area. Information about temperature, rainfall, snowfall, and evapotranspiration, is used to simulate rainfall-runoff processes in watershed models. Local climatological data helps to better understand the local water budget for the region and also helps for modeling purposes.

The table below is a summary of historic temperature data for Albany County. Average Maximum Temperature

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Year
°C	-1.0	0.6	6.6	14.1	20.9	26.1	28.8	27.4	22.8	16.5	9.2	1.6	14.5
°F	30.2	33.1	43.9	57.4	69.6	79.0	83.8	81.3	73.0	61.7	48.6	34.9	58.1

Source: ALBANY COUNTY AP, ALBANY COUNTY data derived from NCDC TD 9641 Clim 81 1961-1990 Normals. 30 years between 1961 and 1990

Average Minimum Temperature

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Year
°C	-11.6	-10.1	-4.1	1.7	7.4	12.5	15.3	14.3	9.6	3.6	-0.7	-7.6	2.5
°F	11.1	13.8	24.6	35.1	45.3	54.5	59.5	57.7	49.3	38.5	30.7	18.3	36.5

Source: ALBANY COUNTY AP, ALBANY COUNTY data derived from NCDC TD 9641 Clim 81 1961-1990 Normals. 30 years between 1961 and 1990

The table below is a summary of historic precipitation in Albany County.

Average Rainfall in Albany County

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Year
mm	62.9	59.9	70.4	70.8	85.7	96.5	95.6	89.6	85.6	77.7	75.5	67.2	938.1
inches	2.5	2.4	2.8	2.8	3.4	3.8	3.8	3.5	3.4	3.1	3.0	2.6	36.9

Source: ALBANY/ALBANY CO., NY. Data derived from GHCN 1. 1968 months between 1826 and 1989.

Rainfall data for individual years was not readily available. If this data could be secured, it could be correlated with stream discharge readings (which have been monitored), and with land uses to gage their impact on flash flow and downstream flooding.

8 – Laws and Regulations Related to the Watershed

The purpose of this section of the report is to assess the level of protection, in the form of existing regulations and requirements, which each community within the watershed enforces when new development is proposed. The regulation of development activities at the local level is typically done through the use of zoning ordinances, subdivision laws, site plan ordinances, and other specific local laws, such as soil disturbance and storm water management ordinances. In addition, there are federal and state laws and programs that directly and indirectly regulate development impacts.

8.1. - Federal

8.1.1. - The National Environmental Policy Act (NEPA)

The National Environmental Policy Act (NEPA) was passed in 1969 and was revised by the Council on Environmental Quality in 1971. Under NEPA, federal agencies are required to

prepare preliminary environmental assessments to determine if proposed federal actions will significantly affect the quality of the environment. A more comprehensive environmental impact statement (EIS) may then be required to mitigate the environmental impacts of the proposed action.

8.1.2. - The Clean Water Act (CWA)

The Clean Water Act (CWA) is the primary statute for protecting the quality of ground and surface waters in the United States. Section 208 of the Federal Water Pollution Control Act of 1972 called for states to develop best management practices (BMP's) to control nonpoint source pollution. Amendments to the CWA in 1987 formally listed reduction in nonpoint source pollution as a national goal and called for states to develop assessment reports and management programs to address nonpoint source pollution. The CWA also provides that storm water discharges associated with industrial activity from point sources to waters of the United States, as well as storm water discharges from certain construction activities are unlawful, unless authorized by a National Pollutant Discharge Elimination System (NPDES) permit. In addition, Section 404 of the CWA prohibits the discharge of dredged or fill material into federally designated wetlands ("Waters of the United States") without first obtaining permit approval from the US Army Corps of Engineers.

8.1.3. - Federal Mandates for Agriculture: The SWCS

The Natural Resource Conservation Service (NRCS, formerly the Soil Conservation Service) and the Agricultural Stabilization and Conservation Service (ASCS) were established in 1935 and 1936 under the Department of Agriculture, to address soil erosion from agricultural practices. Soil and Water Conservation Districts were established throughout the country to control soil erosion and to conserve water resources and protect water quality. The districts provide assistance to landowners in voluntary application of best management practices for controlling nutrients, pesticides, and sediments from farm operations. Various programs provide funding for these initiatives, including the federal Environmental Quality Incentives Program (EQIP) and the state's Agricultural Environmental Management (AEM) program.

8.2. - New York State

8.2.1. - The New York State Environmental Quality Review Act

The NY State Environmental Quality Review Act (SEQRA) became law in New York State on August 1, 1975. Part 617 of 6 NYCRR are the statewide rules and regulations created to implement the act. SEQRA is a process that introduces the consideration of environmental factors into the early planning stages of public and private actions that are directly undertaken, funded or approved by local, regional and state agencies. If it is determined that a proposed action may have a significant effect on the environment, then a Draft Environmental Impact Statement is prepared to explore alternative ways to minimize adverse impacts to the environment.

8.2.2. - The New York State Pollution Discharge Elimination System General Permit for Storm Water Discharges from Construction Activity

The New York State Pollution Discharge Elimination System (SPDES) permit requirements for construction activities were issued in 1993, pursuant to Article 1, Titles 7,8 and Article 70 of the Environmental Conservation Law. The NY SPDES permit program was created to administer the NPDES permit program. A SPDES general permit is currently required for storm water discharges associated with construction activity involving five or more acres of land. The general permit, among other things, requires that the discharger develop a storm water pollution prevention plan for construction activities at each site to be covered by the permit. The applicant must submit a completed Notice of Intent (NOI) form approved and provided by the NY State Commissioner of Environmental Conservation.

Phase II of the storm water program began on March 10, 2003. DEC released final versions of two new general permits that are part of the SPDES and cover Municipal Separate Storm Sewer Systems (MS4s) and construction activities disturbing one or more acres. The general permits require applicants to identify and implement specific stormwater management practices and regulations that best protect the environment.

The main goal of the construction permit is to ensure that stormwater pollution prevention plans have been developed and are being implemented before and during construction activity. The site developer is responsible for creating, implementing and maintaining the plan.

The main goal for MS4s is to design a program that reduces the discharge of pollutants, protects water quality, and satisfies water quality requirements of the federal Clean Water Act. MS4s are required to develop stormwater management plans that include the following control measures:

- Public education and outreach
- Public involvement and participation in program development and implementation
- Detection and elimination of illicit discharges
- Control of runoff from construction sites disturbing one or more acres, including development, implementation and enforcement of an erosion and sediment control program
- Control of post-construction runoff and
- Pollution prevention/good housekeeping, including training of staff on pollution prevention measures and techniques such as regular street sweeping, reducing the use of pesticides and road salts, and frequent cleaning of catch basins.

There are two municipalities within the watershed that are MS4s: Bethlehem and New Scotland. They both have filed the required NOI, which identifies the specific ways in which MS4s will carry out their program. MS4s have five years from the filling of the NOI to fully implement the program requirements. Both communities are making progress toward final program implementation.

8.2.3. - New York State Pollution Discharge and Elimination System (SPDES) Point Source Permits

The Clean Water Act also provides that point source discharges of wastewater, including those associated with industrial activity, to waters of the United States are unlawful unless authorized by a NPDES permit. In New York State, the program again is administered by New York State's SPDES program. This is in addition to addressing stormwater discharges (see Section 8.2.2.). Authorization for such point source discharges must be obtained from DEC under a permit system. DEC sets maximum contaminant levels for the permitted discharges, and

the discharges are self-monitored by the permittee at specified intervals. Periodic reports showing the results of test sampling are required to be submitted to DEC by the permit holder.

For data and information obtained about SPDES permits within the watershed, see Section 6.4. – Point Source Pollution, and Appendix 10.2. – SPDES Permits.

8.2.4. - The New York State Department of Environmental Conservation Protection of Waters Program

The NY State Department of Environmental Conservation Protection of Waters Program was set fourth in the Environmental Conservation Law (ECL) Title 5 of Article 15. Under this program, the disturbance of the bed or banks of a "protected stream" or other watercourse is a regulated activity. The bank of a stream is considered to be the area within 50 feet horizontally of the mean high water line. Waters of the state are classified and protected on the basis of their existing or expected best use. The highest classification, "AA" or "A" is assigned to protect waters for uses including drinking and cooking. The outflow from Lawsons Lake, to where the tributary enters Onesquethaw Cave, is the only stream in the watershed classified as A. The next category, "B," is protected for uses including swimming and other contact recreation, but not for drinking water. Only Helderberg Lake and one small tributary of the Feuri Spruyt are classified as B. Classification "C(T)" indicates waters protected at a level which will support trout populations, and the "C(TS)" classification is similar to "C(T)" except that these waters also support trout spawning.

Most of the main branches of the Onesquethaw and Coeymans Creeks, as well as the eastern half of the Feuri Spruyt, are categorized as C(TS). Below C(T) there is a "C" classification which means the stream is suitable for fish existence (though not trout). Most of the tributaries within the OC Watershed are classified as "C." A stream without any classification is not protected under the Protection of Waters Program. See section 5.7 – Water Bodies.

8.2.5. - New York State Freshwater Wetlands Act

Freshwater wetlands are regulated in New York State pursuant to ECL Article 24 and DEC's implementing regulations. Freshwater wetlands are classified by the DEC according to their ability to perform wetland functions and provide wetland benefits. NYS DEC protected

wetlands are a minimum of 12.4 acres in size, however, smaller wetlands of unique environmental value may also be protected (See "Wetlands" map and further discussion on page 16). Statewide minimum land use regulations provide for development on each class of freshwater wetlands. These regulations provide a list of activities which are designated with respect to each class of wetlands as either: exempt from regulation, compatible, usually compatible, usually incompatible, or incompatible. Activities designated as exempt do not require approval. Activities designated as compatible require merely a letter of permission. Other activities require a permit. Once it is determined that the proposed activity is regulated, the applicant must seek DEC approval by obtaining either a permit or a letter of permission.

The law also provides for the delegation of authority to local governments (concurrent with the state) for the permit program under Municipal Home Rule Law, so long as such regulations are at least as stringent as the state law.

8.2.6. - New York State Department of Health – Appendix 75-A – Wastewater Treatment Standards for Individual Household Systems

Section 201(1)(1) of the New York State Public Health Law regulates on-site wastewater treatment systems for residential properties. Appendix 75-A defines the standards for the use of such systems. The Albany County Department of Public Health exercises the local regulatory review of on-site septic systems within the OC Watershed on behalf of the DOH. The full Appendix 75-A can be found at:

http://www.health.state.ny.us/environmental/water/drinking/appendix_75a.htm#a1

8.3. - Local Regulations

Local laws regulating land use and site design, as well as regulations pertaining to soil erosion, sedimentation and storm water runoff are found in zoning ordinances, subdivision laws, site plan regulations, or in stand-alone laws. Just as there is a wide variation in the development pressures facing each municipality in the watershed, there is a broad range in the way the communities regulate land use, site design, and the impacts of erosion, sedimentation and storm water runoff. In many cases, requirements for protecting communities from the impacts of erosion, sedimentation, and nonpoint source pollution are not found in separate ordinances, or even in a separate section of an ordinance but, rather, they are often found in various places throughout the different ordinances. For example, a zoning ordinance may have sections on site plan review for certain uses (often commercial and industrial), special permit requirements for certain uses (which often require site plan review), planned unit development, cluster development, wetland disturbance, flood plain restrictions, stream buffers, parking and road width standards, conservation overlay districts, and excavation practices, each directly or indirectly addressing erosion, sedimentation and storm water runoff impacts. This variation in the actual location of the requirements within each regulation as well as the variation in the requirements themselves are confusing and may leave water quality impacts insufficiently considered.

Relevant excerpts directly from the land use regulations of each community in the watershed as they relate to water quality protection, including erosion/sedimentation, and/or preand post-construction runoff requirements, are found in the Appendix, Section 10.3-Local Laws and Regulations.

The Center for Watershed Protection provides guidelines for evaluation of community regulations and their impact on water quality. These are found at http://www.cwp.org/cow_worksheet.htm and http://www.cwp.org/cow_worksheet.htm and http://www.cwp.org/better_site_design.htm.

One document is called "Assessing Your Community's Stream Buffer Regulations". This document considers criteria such as stream buffer width, delineation on plans, design, crossings, storm water, and long-term management. It also considers flood plain, incentives for good construction practices, and development site plans as they relate to a waterbody and its buffer, native plants, signage, enforcement, and conservation agreements.

A second document is a "Code and Ordinance Worksheet" which provides guidance for an in-depth review of standards, ordinances, and codes. A point system develops an overall score. Copies of these documents are set forth in the Appendix, Section 10.7-Municipal Code Rating Worksheet.

Using the above guidance, a tabular summary and comparison of local laws affecting water quality, by town, is shown below.

Category	Berne	New Scotland	Bethlehem	Coeymans	
Town Conservation Board	Y	Ν	CACC*	Ν	
Development					
Street pavement width LT 22'	s.170 24 ▲	s.164-34 24'	c.103-26	s.145-19 24'	
Street ROW width LT 45'	s.170 50▲	s.164-33 50'		s.145-19 50'	
Curbs & gutters not required	R		c.103-26 R	s.145-19 R	
Parking lot landscaping	s.V.B.10	s.190-25		s.160.10 J	
Parking lot bioretention	Ν	Ν	Ν	Ν	
Min. residential lot size	Ν	Ν	Ν	Ν	
Steep slope restrictions			c.128-50.D 20%		
Vegetation preservation requirements	s.170-18.F			s.145.23 B	
Open Space					
Open space preservation	s.170-19.F	s.190-53	c.103-29.C c.103-30		
Cluster development allowed		s.164-50 s.190-22	c.103-18.C c.128-42		
Min. building setback LT 20' from road					
Stormwater					
Sidewalks required			c.103-26		
Direct discharge to waterbody prohibited				s.134.9	
Waterbody Buffers					
Stream buffer ordinance	s.170-15.S 20'		c.128-51 100'	s.145.19.5 20'	
Wetlands buffer	s.114 100'		c.72 100'	s.96.1 100'	
Floodplain restrictions	s.170-18.D		c.128-51	s.93.2 C, s.145.22 D	
Buffer incentives					

Comparison of town ordinances and regulations affecting water quality

* = Citizens Advisory Committee on Conservation

Only the Town of Berne has an active conservation board or advisory council. The Town of Bethlehem has a less formal Citizens Advisory Committee. The table indicates municipal regulations could be strengthened in the areas of parking lot bioretention, reduced requirements for curbs and gutters, vegetation preservation, cluster development, stream and wetland buffers, floodplain restrictions, and prohibition of direct discharges to water bodies.

9 – Issues and Conclusions

The intent of this report has been to document the natural and manmade features within the watershed; to describe the relationship between land use, the natural environment and water quality; to document growth trends within the watershed; to summarize the important water quality related information that has been collected by OCWC in a variety of different reports and documents; to provide a summary of federal, state and local regulations that affect water quality; to identify key issues and threats within the watershed that may affect water quality, and to offer recommendations for mitigating water quality impacts and protecting and improving the integrity of the watershed.

The material in this report will form the basis of a broader management plan for the watershed. However, while most land use planning is carried out at the municipal scale, watersheds don't coincide with municipal boundaries. As this report has noted, there are five municipalities within the OC Watershed. Moreover, Albany County, New York State, and the Federal Government exercise partial regulatory oversight as well. There is no government or agency whose jurisdiction is solely the OC Watershed. This jurisdictional fragmentation makes the implementation of a watershed management plan difficult. One way to compensate for this fragmentation is to formulate a watershed coalition. Watershed coalitions are usually made up of diverse watershed stakeholders. They usually hold regular meetings. The main function of watershed coalitions is usually to communicate watershed issues. Some coalitions seek to coordinate watershed development by advocating for water quality best management practices. Some coalitions develop watershed compacts to formalize the roles and responsibilities of the coalition participants. One of the advantageous circumstances within the OC Watershed is that a watershed coalition already exists: the Onesquethaw-Coeymans Watershed Council.

9.1 - Issues and Recommendations for Municipalities

The local land use regulations currently in place within the OC Watershed are inconsistent across the watershed and as whole may not adequately regulate development in an ecological, sustainable fashion. All of the communities in the watershed fall short of the impervious surface standards recommended by the Center for Watershed Protection. Large lots, large setbacks, overly wide roads, and oversized parking lots are required, creating the potential for unnecessary, excessive impervious surfaces. So far, there have not been any large-scale residential subdivisions within the watershed; however, even with the small-scale development that has occurred, many of the new houses have been built with long private roads and/or driveways that add extensive impervious areas to the watershed in relation to the few households they serve.

Although a few of the watershed towns utilize several appropriate water quality regulatory tools (particularly New Scotland and Bethlehem) to help protect individual resources such as wetlands, flood zones, streams, or drinking water reservoirs, in general, the towns in the watershed rely on zoning and subdivision techniques that create disconnected developments (culde-sacs and highway commercial strips), which are both segregated by use (pods of exclusive use, such as housing only) and land intensive (low density/large lot), leading to auto-dependant growth (i.e. sprawl).

Across the country more and more communities are starting to recognize that the suburban zoning and subdivisions regulations that have become standard over the last halfcentury are in need of revision because they essentially require sprawl-type growth (while making smart growth illegal). Smart growth means encouraging development at higher densities in key areas and limiting it in others. Smart growth is growth that is compact, connected, diverse (mixed-uses) and designed for both autos and non-auto mobility. The comprehensive plans, zoning laws, and subdivision regulations currently being applied in the watershed are not designed to efficiently facilitate this type of development.

Water quality impacts from new development can be greatly mitigated with the use of smart growth land development practices.

"If smart growth is to be successful, jurisdictions will need to review environmental regulations and development standards designed for 20th century suburban development, and make necessary changes. New environmental policies should continue to protect residents from known health hazards, but should be flexible enough not to impede a jurisdiction's ability to implement smart growth strategies that meet the future needs of growing communities and promote good health and well-being of residents over the long term."¹⁴

¹⁴ William Halligan, VP of Environmental Services, Costa Mesa Planning Center, "Environmental Protection or Smart Growth?" Urban Land magazine January 2008

Municipalities within the watershed and beyond are urged to consider water quality impacts when planning for the amount of new growth allowed in the watershed, particularly large-scale projects.

Suggesting smart growth as the preferred type of development does not mean that individual homes cannot be built in rural areas. For people who want to live on large rural lots and do not prefer to live in cities or villages, this right should be preserved. However, large-scale subdivisions, which are allowed in much of the watershed, would undermine the existing rural character of the rural towns within the OC Watershed as well as greatly impact natural resources. Land use codes currently in place in the OC Watershed should be examined to ensure that they are not allowing much more potential development than the watershed can accommodate from environmental perspective, particularly given the sensitive karst terrain and the poor soils for onsite septic systems.

Although there has not been a large amount of new housing development within the watershed, the potential exists for major new growth in the future. There are two major new highways planned in the town of Bethlehem – the completion of the Slingerlands Bypass and a Selkirk Bypass – that will in all likelihood become the catalysts for additional development in the town and throughout the southern urbanized portion of the region. The Slingerlands Bypass will connect to a new office park called the Vista Technology Park, which will attract commuting workers from throughout the region, many of which may choose to move closer to their work (especially when fuel prices become much more costly). The Selkirk Bypass may lead to a new NY State Thruway exit in the town of Bethlehem, which is actively being pursued by the town and if completed would likely inspire much more development in southern Bethlehem and the surrounding area, including the industrial areas near the Selkirk Rail yards (which this bypass is in part meant to service). Although both bypasses, the technology park, and the potential new thruway exit are outside the OC Watershed, the undeveloped land within the watershed is in close proximity to these areas and could become a valued location for new housing subdivisions as well as new commercial and industrial development.

There are a number of critical water quality development practices that the watershed communities should consider incorporating into their local land use laws to implement growth which conserves and protects human and natural resources within the watershed. They are as follows:

1. **Protect Sensitive Environmental Areas**: Prevent development from occurring in floodplains, wetlands, steep slopes, mature forests, critical habitat areas, sensitive karst areas near water sources, and in riparian corridors adjacent to stream banks. In addition, standard on-site septic systems should not be allowed on soils that can't adequately filter septic effluent.

2. Establish Stream and Wetland Buffers: Establish vegetative buffers adjacent to the stream channels and adjacent to significant wetland areas, including those designated by NYS DEC (a 100 ft. non-disturbance area is currently part of the requirement for state regulated wetlands) and other significant wetland under the jurisdiction of the U.S. Army Corps of Engineers. These buffers should be at least one hundred feet wide from the stream angle of repose or from the springtime extent of the wetland areas. No structures or clearing, including lawn mowing, should be allowed in these buffer zones. In the case of farmland, a farm-level analysis should be undertaken to determine actual runoff flow patterns so as to minimize the buffer, if necessary, in areas where flows are away from streams. A stream buffer overlay zone could be incorporated into the local zoning codes. In cases where no viable use is left for a parcel, the municipality should seek open space grants to purchase the land.

3. Reduce Impervious Surfaces Through Smart Growth: Less impervious cover means less stormwater runoff, less downstream flooding, and lower pollutant loadings. Reducing impervious surfaces can also significantly reduce the overall cost of the development by reducing the amount of pavement and the length of utilities. The techniques used to reduce impervious surfaces can also reduce suburban sprawl by creating development patterns that are less land intensive and less reliant on automobiles.

There are a number of smart growth subdivision and/or zoning code modifications that should be considered by all the watershed municipalities to reduce impervious surfaces, preserve land and rural character, save on infrastructure costs, and better protect environmental resources. The most important recommendations are as follows:

- A. Reduce road width standards for roads within new housing subdivisions to twenty feet for residential streets.
- B. Modify commercial parking requirements to reduce the size of parking lots and pursue opportunities for shared parking (particularly in commercial areas). Allow 25 percent of required parking spaces to be left in a natural state

for one year to determine whether the spaces are needed before paving. Encourage the use of pervious surfaces.

- C. Reduce setback requirements to reduce driveway and private road lengths.
- D. Pursue opportunities for expanding existing hamlets and/or creating new hamlets in environmentally appropriate areas. These areas should be situated on a connected network of streets with sidewalks. Hamlets should include a mix of housing types, neighborhood-scale commercial, and civic uses. These areas should be served by public infrastructure. Within hamlets, allow higher densities, which will reduce road frontage per housing unit, cut down on unnecessary land consumption, capitalize on public infrastructure capacities, and help to create areas with a better sense of place that are less reliant on automobiles.
- E. Downzone (reduce allowable density) in outlying areas outside of hamlet and village areas and limit infrastructure expansion in outlying areas.

4. **Control Erosion From Construction Activity**: Sediment accumulation and soil movement – erosion – are influenced by five primary factors: soil erodibility, vegetative cover, topography, climate and season. When a site is considered for development, each of these factors must be evaluated in order to minimize erosion from construction activities. Planning boards should assess the variations in soil structure, texture, and percentage of organic matter with particular attention paid to highly erodible soils. Steep slope areas should be avoided, as should ground clearing in the spring when the surface soil first thaws and the ground underneath remains frozen. Most importantly, developers and landowners must minimize vegetative cover removal (phased construction and clearing restrictions) and quickly establish new vegetative cover in cleared areas. Finally, communities must inspect construction sites to ensure that erosion plans are being properly implemented and maintained.

In order to properly mitigate erosion and sedimentation from construction activities, all the watershed communities should require the submission of a detailed erosion and sedimentation prevention plan for any development that will disturb one acre or greater. The Department of Environmental Conservation, under the Phase II SPDES General Permit for Stormwater Discharges from Construction Activity, is now requiring that such plans must be implemented.

However, the DEC is not currently requiring that the erosion plans be locally reviewed and approved. All communities within the OC Watershed should incorporate the Phase II Construction Permit requirements into their local land use codes, so that the individual municipalities can review and approve erosion/sediment control and stormwater plans, and local building inspectors can inspect construction sites to ensure proper plan implementation and maintenance. A more detailed discussion of erosion and sedimentation plans is included in Appendix 10.1-Sediment and Erosion Control.

5. Manage and Treat Post-Construction Runoff: An important component of any water quality strategy will be to implement methods of treating the quantity and quality of stormwater runoff generated by impervious surfaces from new development. The general goal of post-construction stormwater management is to try and replicate predevelopment stream hydrology and water quality to prevent downstream flooding and limit offsite nonpoint source pollution. All the watershed communities should require a post-construction stormwater management plan for development activity that disturbs one acre or greater. As part of this requirement, each community should institute an inspection and maintenance program to ensure proper compliance and functionality. The specific stormwater management practices utilized would depend on the particular conditions present at the development site. Following are the most common general stormwater management practices:

- *A. Stormwater Ponds*: Practices that have either a permanent pool of water or a combination of permanent pool and extended detention capable of treating the water quality storage volume.
- *B. Stormwater Wetlands*: Practices that include significant shallow marsh areas, and may also incorporate small permanent pools and extended detention storage to achieve the full water quality storage volume.
- *C. Infiltration Practices:* Practices that capture and temporarily store the water quality storage volume before allowing it to infiltrate into the soil.
- *D. Filtering Practices:* Practices that capture and temporarily store the water quality storage volume and pass it through a filter bed of sand, organic matter, soil, or other acceptable treatment media.

E. Open Channel Practices: Practices explicitly designed to capture and treat the full water quality storage volume within dry or wet cells formed by check dams or other means.

A more detailed discussion on how to properly manage stormwater runoff can be found in the *New York State Stormwater Management Design Manual* available from the New York State Department of Environmental Conservation: <u>http://www.dec.ny.gov/chemical/29072.html</u>.

9.2 – Issues and Outreach for Communities

In addition to the recommendations above, the watershed communities should consider creating local programs to:

1. Detect and Eliminate Illicit Discharges: Illicit discharges are discharges that are not directly attributable to precipitation runoff, or are discharges not properly treated and permitted, such as untreated sanitary wastewater, septic tank effluent, car wash wastewater, laundry wastewaters, roadway spills, improperly disposed auto and household toxics. Although the New York State Department of Environmental Conservation's MS4 Phase II permit requires a program to detect and eliminate illicit discharges in the MS4 areas of Bethlehem and New Scotland, this report recommends the expansion of that requirement to the entire OC Watershed. As part of the illicit discharge program, watershed communities should:

develop and maintain a map showing the location of all outfalls and the receiving water body;

legally prohibit illicit discharges into the storm sewer system (no dumping laws);

offer dye testing for suspected failing septic systems;

and establish local stream cleanup programs (which could also assist in identifying illicit discharge points).

There are over 1,600 on-site septic systems in use within the OC Watershed. Although the individual maintenance practices used for each of these systems are unknown, the potential for water pollution is of particular concern given the susceptible nature of the karst terrain to contamination.

2. Educate the Public About Water Pollution Prevention Practices: All the residents living in the OC Watershed should be aware of the affect their private decisions can have on water quality. It should be the responsibility of all planning board members to become aware of

the impacts that development has on water quality, particularly in sensitive karst terrain areas, and to understand the best management practices that mitigate such impacts. In addition, local elected officials should be aware of development-induced water quality impacts so that the need for regulatory changes is understood and endorsed.

Watershed municipalities are urged to work with the Onesquethaw-Coeymans Watershed Council (OCWC) to help in the process of educating residents about water quality impacts. The OCWC has a wealth of data and knowledgeable members that can offer local municipalities technical assistance, speakers, and educational programs focused on water quality issues (A more detailed discussion of the OCWC is included in the introduction). Watershed municipalities may want to consider appointing a representative to serve on both the OCWC and the Albany County Water Quality Coordinating Committee, which is a countywide volunteer group focused on water quality issues. This representative(s) could report back to the municipal board with information about water quality. Local municipalities may also consider providing water quality tips and information to residents by including educational materials with tax bills, such as fliers which discuss septic system maintenance, lawn care practices, pest waste management, and proper auto and home product disposal.

3. Discourage the Unnecessary Use of Pesticides. Dangerous pesticides are still used in large quantities even though less hazardous alternatives exist for virtually all pesticide uses. Eliminating these needless risks will require both that people choose non-pesticide strategies for their own homes and gardens, and that policy-makers adopt reforms that address the problem. Homeowners should be encouraged to institute soil rebuilding and natural lawn programs, which could include: aeration and compost applications, seeding with grasses best suited to your area, corn gluten for pre-emergence weed control, biological controls for insects if necessary, and one or more applications annually of a slow-release nitrogen organic fertilizer. Additional steps could include mowing lawns high at 2 to 3 inches, deep watering early in the morning, and performing periodic soil tests to determine needed amendments such as lime or rock dust. Lastly, homeowners need to learn to accept "weeds" as a normal component of the natural environment.

9.3 – Land Fills

Land fills can be a source of surface and ground water contamination. Riparian buffers reduce runoff and pollution (section 4.2-Stream Processes). For the three existing inactive landfills, there is an opportunity to provide vegetative buffers. Partnerships could be formed with community groups and agencies for recreational access to the stream and cooperative efforts to establish riparian vegetated areas.

The Metz Landfill has been monitored by NYS. In the future, the historical and current data and information about this site should be gathered and summarized, along with any evaluations made by State experts.

For the closed Town of Bethlehem and New Scotland Landfills, information should be gathered about the site, such as years of operation, amount and type of materials dumped, closeness to the stream, and the results of any monitoring.

Studies have been made at the site of the proposed City of Albany Regional Landfill. The results of these studies have not been released to the public, but they should be made part of this study later as an addendum, once they are released. From the standpoint of water quality, the main concerns with a landfill adjacent to the Coeymans Creek are: potential for underground leachate leakage into the creek and/or into nearby wells; removal of vegetative cover and subsequent soil erosion into the creek; nonpoint surface pollutants washing off into the creek and infiltrating into the groundwater; and garbage dispersal (such as paper and plastics blown off the site) into the creek. All of these concerns should be addressed if this proposed landfill is constructed.

9.4 – Industrial Activity and Point Discharges

The watershed contains the heaviest industrial activity in Albany County, if not in the Northeast. The Upper Coeymans Creek is affected by the Selkirk Rail Yards and several large industrial plants. At the confluence with Onesquethaw Creek, the Upper Coeymans is very turbid, in sharp contrast to the clear waters of the Onesquethaw. Agency monitoring indicates toxic contaminants (section 7.1-Water Quality). Two tributaries to Lower Coeymans Creek, the Feuri Spruyt and Mosher Brook, are affected by large limestone quarries. An unnamed tributary from the rail yards, entering below NY Route 396, adds more pollutants. Downstream of that,

the Lower Coeymans is impacted by the Lafarge Cement Plant and sedimentation from other cleared tracts of land. In total, there are over 50 permitted point discharges to the Upper and Lower Coeymans Creek under the NYS SPDES program (section 6.6-Point Source Discharges). Monitoring by NYS and others indicates aquatic wildlife is being negatively impacted. Toxic substances found in aquatic animals can be expected to work up the food chain. There may be danger to human health, especially to recreational anglers who eat their catch.

A concentrated effort should be made to evaluate the sources of toxic and other contaminants, the cumulative effects of point discharges, and whether partnerships can be formed to find financially viable solutions to mitigate pollutant sources and impacts. One approach could be investigation of created wetlands to mitigate the impacts of inputs, discussed by the Center for Watershed Protection (<u>http://www.cwp.org/wetlands/articles.htm</u>)

9.5 – Barriers and Water Diversions

Volunteers have identified 5 waterfalls and 2 areas which flow underground during low flow periods. There is one dam which is used to divert water to Vly Reservoir for drinking water for the Town of Bethlehem (Wolf Hill Diversion Dam). Dams also have created Lawson Lake, Helderberg Lake, and Vly Reservoir in the headwaters, and Mill Pond in Clarksville.

There are several culverts that can be viewed from a road. The Feuri Spruyt tributary travels about ¹/₄ mile under a rock quarry. Upper Coeymans Creek also travels about ¹/₄ mile under the Selkirk Rail Yards. This culvert is on private property and cannot be seen from a road. Since natural barriers are significant, starting at the Hudson River, an inventory of barriers is not considered a priority compared to other issues such as reducing toxic inputs.

The impact of the Wolf Hill Diversion Dam on natural stream processes is not known. With the expansion of fluvial geomorphology and the understanding of stream processes, it would appear the water diversion at Wolf Hill may impact stream bedload movement, flood plain dynamics, and other stream process not previously considered. If a future opportunity presents, the impacts of the diversion dam should be technically evaluated.

9.6 – Impervious Surfaces

Analysis of Landsat satellite imagery indicates that impervious surfaces comprise approximately 10% of the watershed land area (section 4.3-Stormwater Runoff and Impervious Surfaces). 5.4% of this imperviousness is attributed to the Selkirk Rail Yards, the quarry sites, and the Lafarge cement plant. Since these areas are largely bare ground, they are not totally impervious and their use as a percent of the total watershed area may be overstated. The developed areas, about 4.6%, consist of rooftops and paved roads, parking lots and driveways, and are truly impervious. Technical studies indicate that streams generally become noticeably impacted (increased flooding and erosion, reduced summer flows) when impervious surfaces exceed 10% (section 4.3). The watershed therefore appears covered with less than 10% impervious surfaces; however, the watershed contains natural soil and bedrock conditions, which are less pervious (sections 4.3, 5.4, 5.6). The shallow limestone bedrock (Karst topography) of the upper watershed, and the steep clay ravines of the lower watershed, already produce significant rapid runoff. The addition of impervious surfaces can only worsen this condition.

The communities and agencies should consider an evaluation of the relation of stream discharge to rainfall and land use, and how that compares to other stream systems.

9.7 – Stream Stability

This report concurs with the study by the Albany County Soil and Water Conservation District (section 7.5), which recommends that the stream corridor from Old Quarry Road to NY Route 9W would benefit from natural channel restoration. This initiative would require considerable resources, effort, and funding.

The Kisby Study (section 7.5) recommends that a number of actions be considered:

- 1. Make a thorough assessment of stream bank and channel conditions.
- 2. Collect historical data about past flooding patterns and build up of surrounding land.
- 3. Perform a study to determine desirable vegetative buffer widths.
- 4. Prepare a detailed land use and land cover map.
- 5. Continue to monitor the 44 eroded sites found in the study.
- 6. Restore existing eroded sites.
- 7. Identify surrounding wetlands as possible correction tools.
- 8. Study the long-term pattern of channel migration and land use.
- 9. Study stream discharge and precipitation using hydrologic models.

The Study also suggested the use of a number of modeling tools. Performing these studies can be difficult because of the needed level of expertise, information, and funding. A digital copy of the Kisby Study can be obtained from the OCWC.

9.8 – Public Access

The stream corridor contains beautiful natural features such as waterfalls, caves, and gorges. The stream itself contains a healthy population of wild trout, which could be a significant recreational resource for the residents of the capital district. There are several parcels of riparian land owned by municipalities, but the majority of riparian land is privately owned. While the amount of posting is not considered significant, observed trends of more posting have been noted, especially after land is sold.



Currently, Trout Unlimited volunteers have started an initiative with Region 4 staff at DEC to acquire public fishing rights or other forms of more formal recreational access. There is also the possibility that the Mohawk Hudson Land Conservancy may acquire additional properties providing access to unique natural features. Community organizations, local municipalities, and agencies should be aware of opportunities to obtain land and easements for public benefit.

9.9 – Riparian Buffers

There are several areas where riparian buffers could be enhanced with partnerships and efforts with landowners, community and recreational organizations, and agencies. Sites include, but are not limited to, the closed landfills, the long section of stream behind the cement plant, and several farms. Such efforts could be combined with recreational access, stream bank stabilization, and wildlife habitat enhancement.

9.10 – Land Conservation

As development progresses in the watershed, it is difficult to restrain the amount of impervious surface created. It is therefore desirable to work proactively to protect important vegetated open space, as well as sensitive Karst terrain and unique natural features. Some protected land may be created as part of conservation subdivisions resulting from smart-growth decisions, other parcels may be offered by landowners who wish to protect their land. If a parcel serves a particularly important buffering function or would protect a unique natural feature, it may be important to raise the money to protect that land (see "Parks, Preserves and Management Areas" map above).

Land can be acquired in fee, such as MHLC's Onesquethaw Creek, Holt and Bennett Hill preserves and Audubon's Hollyhock Hollow. Acquiring land in fee takes it off the tax rolls, but surrounding land tends to increase in value, and it provides valuable public amenities such as open space for public recreation (as well as watershed protection). Or an easement can be placed on the land, such as the 111-acre easement owned by MHLC on the top of Wolf Hill. An easement does not remove the land from the public tax roles, but conservation easements do not normally provide public access.

Several land trusts operate in the area and can be called upon to partner with municipalities (or act on their own) to protect important land in the watershed; these include the Open Space Institute, the Mohawk Hudson Land Conservancy, the Catskill Center and New York Audubon. In addition to acquiring land (or an easement) as a gift or through purchase, land trusts must be able to protect properties they acquire and enforce the terms of easements in perpetuity. To do this, land trusts generally request an endowment (a contribution to their stewardship fund) for each property or easement. Interest from the fund is used for annual stewardship while the principal may serve as a legal defense fund.

9.11 – Agriculture

There is considerable agricultural land use in the upper watershed (section 6.1 - Land Use). There are a number of Agricultural Programs (Appendix 10.8) that are available and which have been explored. The FSA provides extensive voluntary programs with financial assistance to help landowners protect natural resources, including those in the OC watershed. This is an area that needs further initiatives and focus. It is a complicated issue and the role for conservation or community groups in this effort is not clear. The Albany Farm Bureau should encourage its members to make more use of these opportunities.

10 – Appendices

Appendix 10.1 – Sediment and Erosion Control, Storm Water Management Guidelines and Best Management Practices

Many of the negative impacts from new development can be greatly minimized or avoided by the implementation of proper erosion and sediment control and storm water management measures. This appendix includes a summary of erosion and sediment control guidelines and common erosion and sediment control and storm water management practices (best management practices) for new development.

The publication, *New York Guidelines for Urban Erosion and Sediment Control*, distributed by the Empire State Chapter of the Soil and Water Conservation Society contains excellent comprehensive information regarding erosion and sediment control measures and guidelines and should be consulted for more details. These guidelines provide information on minimizing erosion and sediment problems on land undergoing urban development. They show how to use soil, water and plants to improve the quality of our environment. The manual contains standards and specifications commonly used on construction sites including both vegetative and structural measures. This manual is a valuable tool for planners, engineers, local officials, contractors and others involved in development activities. Listed below are a sampling of guidelines and management practices contained in this manual.

THE SITE PLANNING PROCESS

The following procedure is recommended to develop a plan that will efficiently control erosion and sedimentation throughout the site development process.

• Plan the Development to Fit the Site

Assess the physical characteristics of the site to determine how it can be developed with the smallest risk of environmental damage. Minimize grading by utilizing the existing topography wherever possible. Avoid disturbing wetlands or other environmentally sensitive areas. Minimize off-site impacts by maintaining vegetative buffer strips between disturbed and adjacent areas.

• Determine Limits of Clearing and Grading

Decide exactly which areas must be disturbed in order to accommodate the proposed construction. Pay special attention to critical areas (e.g. steep slopes, highly erodible soils, surface water borders) which must be disturbed. Staged clearing and grading should be considered as an alternative to massive clearing and grading.

Divide the Site into Natural Drainage Areas

Determine how runoff will drain from the site. Consider how erosion and sedimentation can be controlled in each small drainage area before looking at the entire site. Remember, it is more advantageous to control erosion at the source and prevent any problems than to design perimeter controls to trap sediment.

<u>Select Erosion and Sediment Control Practices</u>

Erosion and sediment control practices can be divided into vegetative and structural controls.

- <u>Vegetative Controls</u> The best way to protect the soil surface and limit erosion is to preserve the existing vegetative ground-cover. Where land disturbance is necessary, temporary seeding or mulching should be used on areas which will be exposed for long periods of time prior to construction. Permanent stabilization should be performed as soon as possible after completion of grading. Erosion and sediment control plans must contain provisions for permanent stabilization of disturbed areas. Seed type, soil amendments, seedbed preparation, and mulching should be described on the plans. Selection of permanent vegetation should include the following considerations for each plant species:
 - 1. establishment requirements;
 - 2. adaptability to site conditions;
 - 3. aesthetic and natural resource values;
 - 4. maintenance requirements.
- <u>Structural Controls</u> Structural sediment control practices may be necessary when disturbed areas cannot be promptly stabilized with vegetation. Structural practices should be constructed and maintained in accordance with the guideline standards and specifications found in the *New York Guidelines for Urban Erosion and Sediment Control*.

SITE MANAGEMENT

Site management for effective implementation of erosion and sediment controls involves the following:

- Clear only what is required for immediate construction activity. Large projects should be cleared and graded as construction progresses. Mass clearing and grading off the site should be avoided.
- Re-stabilize disturbed areas as soon as possible after construction is completed. Certain sections of large construction projects may be completed before others and be ready for stabilization before the total project is completed. Waiting until the end of the project to commence all site stabilization may leave areas exposed for an unnecessarily long duration.

- Divert off-site runoff from highly erodible soils, steep slopes; and disturbed land and convey to stable areas.
- Physically mark off limits of land disturbance on the site with tape, signs, or other methods, so the workers can see areas to be protected.
- Make sure that all workers understand the major provisions of the erosion and sediment control plan.
- Designate responsibility for implementing the erosion and sediment control plan to one individual.
- Implement a daily inspection program to determine when erosion and sediment control measures need maintenance or repair. Pay particular attention to the inspection following rainfall events.

The following sample of Best Management Practices for controlling erosion, sedimentation and storm water runoff, as described in part, in *A Guide on Soil and Water Management for Local Officials* by the USDA Soil Conservation Service, can also be utilized as a means of controlling or avoiding the negative effects of land clearing for new development. In addition, detailed information about the means of controlling stormwater runoff can be found in the *New York State Stormwater Management Design Manual* and *Reducing the Impacts of Storm Water Runoff from New Development* available from the NYS Department of Environmental Conservation.

COMMON EROSION AND SEDIMENT CONTROL PRACTICES

- **Diversion:** A channel to intercept runoff constructed across a slope with a supporting ridge on the lower side. Diversions are effective for erosion control on steep or long slopes and are a key practice in controlling runoff. Each diversion must have a stable outlet and adequate capacity to carry peak runoff without eroding or overtopping.
- **Drop Structure:** Carries runoff through a sudden change in grade or elevation. The structure is usually made of concrete, aluminum or timber. It is used with a waterway or a diversion.
- **Filter Strips:** Removes sediment and other pollutants from runoff water by filtration, deposition, infiltration, absorption, decomposition, and/or volatilization. Slope and soil type are important factors to evaluate before using this practice. Also consider the type and volume of pollutants that pass through the filter strip. Protect against erosion where flow enters a stream or channel.
- **Gabions:** Rectangular, rock-filled baskets. Gabions are used to line the bed and/or banks or streams or to divert flow away from eroding streambank sections. Gabions should be used with caution in corrosive environments, such as acidic soils.

- **Grassed Waterways:** A natural or constructed channel that is shaped or graded to required dimensions and established in suitable vegetation for the safe conveyance of runoff. Grassed waterways may be used to carry runoff from diversions or other water concentrations. The most critical time in installing grassed waterways is when vegetation is being established. Usually mulch or erosion netting is needed to help stabilize the channel during this critical establishment time.
- **Mulching:** The application of plant residues or other suitable materials to the soil surface. Straw is the most common mulch, but erosion fabrics and nettings are also available. Mulching is effective in preventing soil erosion caused by raindrop impact on soil. Mulching alone will not control erosion due to concentrated runoff. However, mulch anchored with netting, peg and twine or other erosion control fabric will protect the soil from concentrated flows.
- **Riprap:** A permanent, protective layer of stones to protect soil from erosion or slippage in susceptible areas. Riprap is used in areas of concentrated flows where the velocities are too high for vegetation to protect the soil. Rock size is determined by the expected runoff velocity. Blocky rock should be used on steep slopes since rounded rocks are likely to be unstable.
- Sediment Basin: An impoundment that temporarily stores sediment-laden runoff. Sediment basins are relatively effective for trapping medium and coarse grained sediment particles like sands and silts. Fine silts and clays suspended in runoff are difficult to remove. Approximately 70% sediment trapping efficiency can be achieved with a typical sediment basin.
- **Storm Drain Inlet Protection:** A sediment barrier placed around a storm drain inlet. This practice provides good removal of coarse and medium grained sediment from runoff. Straw bales, gravel and filter fabrics are usually used for the barrier. Erosion control practices should be used to limit sediment movement from construction areas.
- Straw Bale/Fabric Sediment Trap: A row of entrenched and anchored straw bales or filter fabric installed to detain and filter sediment-laden runoff. This type of sediment trap removes coarse sediments from small amounts of runoff before it leaves the site. Straw bales and filter fabric are not recommended in areas of concentrated flow.
- Streambank Protection Measures: Vegetative and/or structural measures to stabilize eroding streambanks. Planting of grasses and deep-rooted shrubs are vegetative ways of stabilizing streambanks. Structural measures are used in areas of higher water velocity and include riprap, gabions, sacked concrete, and timber or metal pilings. Bioengineering is a new approach that combines the use of vegetation and structures.
- **Stream flow Deflectors**: Used to deflect high velocity flows away from the streambank. Deflectors are made of large rock, rock-filled gabions, logs or pilings.

• **Temporary Seeding:** The establishment of temporary vegetative cover on disturbed areas by seeding with suitable fast growing annual vegetation. It is used to stabilize construction areas that will be bare for more that 45 days but less that a year. Temporary seeding are only effective once the vegetative cover is established.

COMMON STORM WATER MANAGEMENT PRACTICES

The loss of natural ground cover increases the volume of storm water runoff in a watershed. The goal of good storm water management is to have no more water runoff leave the site after development as compared to the pre-development conditions. The primary purposes of controlling runoff in developing areas are to: minimize flooding; handle storm discharges in a safe manner; and to keep erosion and sedimentation to a minimum. The following storm water management practices describe the various ways in which runoff is controlled.

- **Detention Basin:** Impoundment that temporarily stores runoff water. It can be dry or have a permanent pool. The basin holds storm water runoff and releases it at a safe rate that minimizes downstream flooding. A side benefit of this practice is the removal of some sediment from the runoff.
- **Diversion:** A channel with a supporting ridge on the lower side to carry flows across a slope. A diversion carries runoff to places where it can be used or disposed of safely.
- **Drop Inlet Structure:** A catch basin that collects surface flow, traps some sediment, and transfers all or a portion of the flow to subsurface conduits or pipes. This practice effectively transfers prolonged flows to an underground pipe, eliminating down-slope wetness and erosion.
- **Infiltration Trench:** A shallow, excavated trench, usually 2 to 10 feet in depth, back-filled with stones or gravel. This allows the temporary storage of runoff in the space between the stones. The stored runoff slowly infiltrates into the soil. Trenches are often placed at the edge or under a portion of a driveway or parking lot.
- Lined Channels: Channels with an erosion resistant lining of rock, concrete, asphalt or other structural material. It conveys runoff water safely to a discharge point. It is useful in areas of prolonged flow or where flow velocities exceed those allowable for grassed waterways.
- **Parking Lot Storage:** Water storage area that is within and a part of the parking lot. It is useful in controlling runoff from small areas up to several acres. It is often used with roof-top storage, infiltration trenches and grass filter strips.
- **Retention Basin:** A basin designed to store storm water runoff by collection as a permanent pool of water without release except by means of evaporation, infiltration,

or attenuated release when runoff volume exceeds the permanent storage capacity of the permanent pool. A retention basin, also known as a wet pond, is usually designed to achieve peak flow attenuation as well as pollution removal. Other benefits of wet pond include: creation of wildlife habitat, increased recreational opportunities, landscaping opportunities, and enhanced property values.

Appendix 10.2 – Compilation of SPDES Permits in Onesquethaw-Coeymans Watershed, May 1, 2007, by Roy Lamberton

- (2): j=major; n=minor
- (3): caf=CAFO; Ind=Industrial; san=sanitary; sso=sanitary sewer overflow; sto=stormwater.
- 1 mgd=694 gpm =93 cfs
- (4): d=daily; w=weekly; m=monthly; y=yearly
- (5): b=Bethlehem; bn=Bern; c=Coeymans; n=New Scotland; r=Ravena
- (6): a=ammonia; b=bod; cl=clorine; d=dissolved oxygen; e=e.coli; f=fluorides; I=iron; n=nitrogen; o=oil; p=pH; r=rainfall; s=solids; t=temperature; v=visual; z=zinc; *#=footnotes

	SPDE S No.	DEC No. (1 Applcn Faci ID Perm e) Discł lity No. litte	n Disch To	(2)	(3) Typ e	Daily Discharge Monitoring Report	Avg MGD	Peak MGD	Te st Fr eq (4)	Vi ola tio ns	Latitu de	Longitu de	To wn (5)	(6) Paramete rs	Permit Comments
1	00050 37	4-0124- LaFarge 00001/0 0057	e 001A	Moshe r Brook	j	ind	quarry pump out to Mosher Bk		3	w		42°29' 20"	73°49' 20"	с	f o p s	Stream improvement plan (veg, cover, habitat struct) by 1/30/07
2	00050 37	" LaFarge	e 003	?			treatment system effluent			w c					cl f o p s t	temperature- upstr, dnstr, dischg
3	00050	" LaFarge	e 003A	Plant	j	ind	sewage			w				c	f p d cl	sewage
4	00050 37	" LaFarge	e 004A	trib	j	ind	quarry sewage sand filter dischg	1						c	b d f n o p s	traatmant
5	00050 37	" LaFarge	e 005M	trib	j	ind	quarry garage oil separator							c	f o p	
6	00050 37	" LaFarge	e 006M	с	j	ind	aggregate processing runoff							c	fops	
7	00050 37	" LaFarge	e 007M	с	j	ind	northern watshd clay mine runoff							c	f o p s	
8	00050 37	" LaFarge	e 008M	hanna	j	ind	Becraft Pond dewatering dischg							с	f p s	
9	00050 37	" LaFarge	e 03AA		j	ind	sewage treatment plant effluent							с	b c cl f p	
10	00050 37	" LaFarge	e 03BM		j	ind	non-contact water (categorical))						c	f	
11	00050 37	" LaFarge	e 03CM		j	ind	material storage (categorical))						c	f	
12	00050	" LaFarge	e 03NM		j	ind	total non-							c	f	
	37							categorial flow								
------	-------------	------------------------------	-----------------	--------------	---------------------	---	-----	--	-------	-------------	----------	---------------	---------------	---	--------------------	-------------------------------------
13 (00050 37	"	LaFarge	009	gdwat	j	ind	primary rock crusher							none reqd	
14 (00070 72	4-0122- 00007/0 0308-0	GE	01A	с	j	ind	air scrubher outfall 01A: treated process, cooling, sanitary, ctorpwatar			w- 6m	42°30' 30"	73°46' 47"	b	f p b s z *2	impoundmen t areas
15 (00070		GE	001T		j		combined discharge								
16 (00070 72	"	GE	002X		j		2nd stormwat emergency overflow							f s p o toc	
17 (00070 72		GE	003V		j		action levels								
18 (00070 72	"	GE	003X		j		stormwater #6 oil dike							f o p benzene	
19 (00070 72	"	GE	004V		j		action levels								
20 (00070 72		GE	004X		j		stormwater, rail yard impounding							f o p phenolics	
21 (00070 72	"	GE	01AM		j		cooling, sanitary & stormwater								
22 (00070 72	"	GE	01BM		j		Selkirk Cogen Facility								
23 (00070 72		GE	01BS		j		Selkirk Cogen Facility								
24 (01031 61	4-0124-00021/0	Willowbr ook	001	c trib	n	san	wastewater sand filter		0.002 6	w- y	42°31' 05"	73°49' 21"	c	f b s p a d v	
25 (02053 54		G & P Restrt	001	c trib	n	san	G&P Restaurant, septic & sand filter	1.4	0.001	W	42°31' 25"	73°48' 40"	c	b s a d p	visual, septic & sand filter
26 (00783 28	4-0214-00005/0	Meilak's	001	c trib 3	n	san	extended aeration,		0.019 5	d- w	42°48' 05"	73°43' 40"	c	f b s a d p t	
27 (02605 41	4-0124- 00057/0	Petersons	001	Moshe r Brook	n	san	septic, sand filter,		0.000 9	6 mo	42°30' 18"	73°49' 17"	c	f b s p	daily visual
28	00367 57	4-0124- 00010/1-	Pantages	001	с	n	san	sewage treatment	0.032		d- m	42°30' 45"	73*49' 00"	c	f s p n b d	
29 (01040 51	0 4-0122- 00033	Fleming	001 & 002	c c	n	san	nlant sewage treatment	0.009		w- y	42*30' 55"	73°48' 50"	c	f p b s t	north & south filter
30 (01029 62	4-0124-00017/0	RCS HS	001	Moshe r	n	san	septic sand filter		0.024	w- y	42°29' 10"	73°49' 14"	c	f p b s t	outflows sanitary sand filter
31 (01029 62	"	RCS HS	002	Moshe r	n	*	oil/water separator,			w- y	42°29' 10"	73°49' 14"	c	p o *1	oil-water separator
32 (01029 62	"	RCS HS	003	Brook Moshe r	n	*	noor drain pool backwash			m- y	42°29' 10"	73°49' 14"	c	p f s t cl	pool filter backwash
33 (02685 85	4-0122- 00224/0	Swift	001	Brook c trib	n		combined sanitary &			q-y	42°34' 04"	73°50' 48"	c	pfobsa d*1	DEC permit says
34 (02057 45	0001 4-0122- 00059/0	Huttig	001	c trib 13	n	san	oil-water septic sand filter		0.001 25	w- y			c	f b s a d p	Vlooman weekly visual

35	02236	4-0134- Flach	001	c	n	san		0.001		W-	42°34'	73°53'	b	fbsptd	daily visual
	20	00040/0						2		У	44"	40"		а	
36	02245	4-0134- Stewarts	001	c	n	san	septic, filter,		0.000	у	42°34'	73°52'	n	fbspat	monthly
	96	00047/0 2					sand filter,		575		30"	30"		d	visual
27	02406	0001 4 0124 Sr	001	0		con	surface								pormit covo
57	02400 99	4-0134- 31 00062/0 Housing	001	C	п	san	disposal for						п		Vloman Kill
	//	0001-0					24 ant units								man shows
38	00842	4-0122- Airco	001			ind	cooling				42°34'	73°52'	n		need more
	71	00005/0					tower				50"	25"			detail &
30	00842	0002-0 " Airco	002	ardwat			hlowdown								monitoring
39	71	Alleo	002	giuwai			info								
40	00842	" Airco	003	C			lino								
-0	71	Alleo	005	C											
41	02608	4-0122- Air	001	c trib		ind	cooling	0.07	0.1	d-	42°34'	73°52'	b	pfatofl	transfer from
	60	00151/0 Liquide	001	• 110		ma	water	0.07	0.1	m	56"	19"	Ũ	i cl s	ALIG LLC
42	02608	" Air	002	c trib		san	sentic		0.000	w-	42°34'	73°52'	b	nfhs	transfer from
	60	Liquide	002	e uno		Juli	septie		455	q	56"	19"	U	P100	ALIG LLC
43	01001	4-0122- Albany	001	0		ind	Feura Bush			m	42°33'	73°52'	n	s cl p	treatment
	45	00063/0 C.					treatment				05"	10"		1	plant waste
	00000	002	0.01	.1.1			nlant	0.000			100001	720401			water
44	02606	4-0122- KJ	001	wetld	n	san		0.000		У	42°32	/3°49'	b	sdap	apparently
	06	00129 Corman						Z			41	04			discha
45	00077	Callanan	001	f						m	/2°31'	73°51'	c	sotn	disch into
75	90	#1	001	1						111	40"	00"	C	sorp	Feuri Spruvt
															from ?
46	02610	4-0124- Gruss	001,2	c trib	n	san		0.001		w	42°31'	73°49'	с	f	disch thru
	68	00069/0									05"	21"			sand filter,
47	00702	0001	001			• •				1	400221	720501	1	c 1 ·	then mixino
47	00/23	4-0122- CSX	001	с		ind				a	42°33' 25"	/3°50°	b	I d S O I a	treatment
	/1	0000370								m	23	05		Z 3**	effluent:
		0001													evaluation of
															performance
18	00723	4 0122 CSX	002	C		ind				m				for	J 2001
40	71	00003/0	002	t		mu								10 p	read to
	/1	0001													submit
49	00723	" CSX	003	с		ind				m				f o p	outfall sign
	71									q					reqd API "B"
50	00723	" CSX	004	с		ind				m				fop	mo DMR
	71														rept reqd,
51	01025	4-0124- Ravena	001	с	n	sso				d	42°28'	73°48'	r	sofd	storm
01	12	00004/0	501	c		000					27"	05"	•		overflow
		0001													from sewage

Footnoted Parameters (6):

*1 benzene, toluene, xylene

*2 organic carbon, phenolics, copper, mercury, chloroform, methylene cl, acrylonitrile, cadmium, nickel, lead, toluene, arsenic, chromium, barium, selenium, antimony,

beryllium, dicholorethylene, trichloroethylene, ethylbenzene, styrene, cyanide, tricholroethane, d(n-butyl)phthalate

*3 phenols, surfactants, iron, lead, phosphorus, 1,1,1 trichloroethane

(1) Facility Permittees, full name and contact information

0260860 Air Liqu	ide Air Liquide Large Industries US LP, 1297 Feura Bush Rd
0084271 Airco	Airco Industrial Gases, Rt 32, Feura Bush, Larry Hoose, Airco Inc, Rt 32, Feura
	Bush, NY 12067 518 438-8187
0100145 Albany	C. City of Albany Water Board, Commr of Water Supply, Feura Bush Water Treatment
	Plant, 25 Quackenbush St, Feura Bush, NY 12067
0007790 Callana	In#1 Callanan Industries Inc, C.A. Stokes, VP, Plant #1, CR 101, So. Bethlehem, NY 12161
0072371 CSX	Consolidated Rail Cpn (CSX Transpn Inc), 1 Bell Crossing Rd, Selkirk, JM Samuels, vp, 2001 Market St, Philadelphia, PA 19101-1415, Frank Bruno, Selkirk, 518 767-6254
0223620 Flach	Flach Development & Realty Inc, Feura Bush, H J Digeser, PO Box 274, Rt. 9W, Glenmont, NY 12077
0104051 Fleming	g Fleming Mobille Home Park, Rt. 9W, Selkirk, Eloise Catalano, PO Box 83, Schuylerville, NY 12871
0205354 G & P Restrt	G & P's Restaurant, Rt. 9W, George Tsirakis, Lot 46, Four Seasons Trailer Court, Ravena, NY 12143
0007072 GE	General Electric Plastics-Selkirk Operations, Noryl Ave, Selkirk, Ken Eckroth, GE Plastics-Selkirk Ops, Plastics Ave, Pittsfield, MA 01201
0261068 Gruss	Gruss Property, Dan Gruss, 19 Kruger Rd, Selkirk, NY 12158
0205745 Huttig	Huttig Building Products, Sandy Huffman, 421 Creble Rd-CR 55, Selkirk, Thomas McHugh, 555 Maryville Univ Dr, Chesterfield, MO 63141
0005037 Lafarge	 Lafarge North America Inc, Lorraine Roberts, PO Box 3, Rte 9W, Ravena, NY 12143 518 756-5026
0078328 Meilak's	Meilak's Mobile Court, Old Ravena Road, Charles Meilak, RD #2, Selkirk, NY 12158 518 767-3500
0036757 Pantag	es Pantages Mobile Home Park, Rt. 9W, Selkirk, Jennie Pantazis, Pantages Homes Inc. Rt. 9W. Selkirk, NY 12158 518 767-9685
0260541 Peterso	Petersons Place, Rt. 9W, Ravena, NY, Charles Golding, RR 2, Box 46, Selkirk, NY 12158
0102512 Ravena	Van Hoeson St retention basin overflow, Mayor John Bruno, Vlg of Ravena, 15 Mountain Rd. Ravena, NY 12143
0102962 RCS H	S Ravena-Coeymans-Selkirk High School, Rt. 9W, Ravena, NY 12045, RCS Central School District, 26 Thatcher St, Selkirk. NY 12045
0260606 RJ Corr	man RJ Corman Railroad Company, Speeder Rd, Bethlehem, Paul Deaton, Box 788, Nicholasville, KY 40356
0240699 Sr Hou:	sing Feura Bush Senior Housing, New Scotland Ave, Feura Bush, Barbara Lamphere, Voorheesville Housing Cov I, 6320 Fly Rd, E Svracuse, NY 13057 315 437-1808
0224596 Stewar	 Stewarts Shop 304, Rt 32 & Railroad Ave, Feura Bush, Brandon Myers, Stewarts Ice Cream Company, PO Box 435, Saratoga Springs, NY 12866
0268585 Swift	Swift Transportation Co, Inc, 435 Crebel Rd, Selkirk, Gary Weinburger, 2200 So 75th Ave, Phoenix, AZ 85043
0103161 Willowb	prook Willowbrook Mobile Home Park, Miller Road, Ann M. Frinks, 23 Kruger Road, Selkirk, NY 12158, Paul J. Frinks, Miller Rd, RD #2, Box 287, Selkirk, NY 12158

Appendix 10.3 – Local Laws and Regulation Related to the Watershed

Town of Berne

The town of Berne has adopted zoning and subdivision regulations as well as Municipal codes on flood damage prevention, freshwater wetlands, and solid waste. However, additional sections of the general municipal code also have water quality impacts and have been included within this review:

Chapter 16 General Code: Conservation Board

§ 16-5 Powers and duties of Board.

D. It shall keep an inventory and map of all open areas within the Town with the plan of obtaining information pertinent to proper utilization of such open lands owned by the state, and other municipality within the state or by the Town itself.

E. It shall keep an inventory and map of all open water, streams, marshlands, swamps and other wetlands, in a like manner, and may recommend to the Town Board a program of ecologically suitable utilization of all such areas.

Chapter 75 General Code: Animals

§ 75.4 Restrictions

It shall be unlawful for any owner of any dog in the Town of Berne to permit or allow such dog to:

(5) Create a nuisance by defecating, urinating or digging on public property or private property other than the property of the owner or harborer of said dog.

Chapter 109 General Code: Flood Damage Prevention

§ 109-2 Purpose.

A. Regulate uses which are dangerous to health, safety and property due to water or erosion hazards which result in damaging increases in erosion or flood heights or velocities.

C. Control the alteration of natural floodplains, stream channels and natural protective barriers which are involved in the accommodation of floodwaters.

D. Control filling, grading, dredging and other development which may increase erosion or flood damage.

E. Regulate the construction of flood barriers which will unnaturally divert floodwaters which may increase flood hazards to other areas.

§ 109-11 A floodplain development permit is hereby established for all construction and other development undertaken in areas of special flooding hazard in this community for the purpose of protecting its citizens from increased flood hazards and ensuring new development is constructed in a manner that minimizes its exposure to flooding. It shall be unlawful to undertake any development in an area if special flood hazard, as shown on the Flood Insurance Rate Map enumerated in § 60-6, without a valid floodplain development permit. Application for a permit shall be made on forms furnished by the local administrator and may include but not be limited to plans, in duplicate, drawn to scale and showing the nature, location, dimensions and elevations of the area in question, existing or proposed structures, fill, storage of materials, drainage facilities and the location of the foregoing.

109-14 General Standards

The following standards apply to new development, including new and substantially improved structures, in the areas of special flood hazard shown on the Flood Insurance Rate Map designated in § 60-6:

- A. Subdivision proposals. The following standards apply to all new subdivision proposals and other proposed development in areas of special flood hazard (including proposals for manufactured home and recreational vehicle parks and subdivisions):
 - (1) Proposals shall be consistent with the need to minimize flood damage.
 - (2) Public utilities and facilities such as sewer, gas, electrical and water systems shall be located and constructed so as to minimize flood damage.
 - (3) Adequate drainage shall be provided to reduce exposure to flood damage.
- B. Encroachments.
 - (1) Within Zones A1-A30 and AE, on streams without a regulatory floodway, no new construction, substantial improvements or other development (including fill) shall be permitted unless:
 - (a) The applicant demonstrates that the cumulative effect of the proposed development, when combined with all other existing and anticipated development, will not increase the water surface elevation of the base flood more than one foot at any location; or
 - (b) The Town of Berne agrees to apply to the Federal Emergency Management Agency (FEMA) for a conditional FIRM revision.
 - (2) On streams with a regulatory floodway, as shown on the Flood Boundary and Floodway Map or the Flood Insurance Rate Map adopted in §60-6, no new construction, substantial improvements or other development in the floodway (including fill) shall be permitted unless:
 - (a) A technical evaluation by a licensed professional engineer shows that such an encroachment shall not result in any increase in flood levels during the occurrence of the base flood; or
 - (b) The Town of Berne agrees to apply to the Federal Emergency Management Agency (FEMA) for a conditional FIRM and floodway revision.

§109-15 Standards for all structures.

- (3) Enclosed areas.
 - (a) For enclosed areas below the lowest floor of a structure within Zone A1-A30, AE or AH and also Zone A, if base flood elevation data is available, new and substantially improved structures shall have fully enclosed areas below the lowest flood that are usable solely for parking of vehicles, building access or storage in an area other than a basement

and which are subject to flooding designed to automatically equalize hydrostatic flood forces to exterior walls by allowing for the entry and exit of floodwaters.

(C) Utilities.

(1) Machinery and equipment servicing a building must either be elevated to or above the base flood level or designed to prevent water from entering or accumulating within the components during a flood...When located below the base flood elevation, a professional engineer's or architect's certification of the design is required.

(3) New and replacement sanitary sewage systems shall be designed to minimize or eliminate infiltration of floodwaters. Sanitary sewer and storm drainage systems for buildings that have openings below the base flood elevation shall be provided with automatic backflow valves or other automatic backflow devices that are installed in each discharge line passing through a building's exterior wall.

(4) On-site waste disposal systems shall be located to avoid impairment to them or contamination from them during flooding.

Chapter 114 General Code: Freshwater Wetlands

§ 114-1 Authority to Regulate.

Pursuant to §24-0501 of the New York State Freshwater Wetlands Act (Article 24 of the New York Environmental Conservation Law) the Town of Berne shall fully undertake and exercise its regulatory authority...in all areas adjacent to any such freshwater wetland up to 100 feet from the boundary of such wetlands.

Chapter 153 General Code: Sewers

§ 153-9. Distances.

No sewage disposal system shall be installed unless every part of such installation shall be more than 10 feet from the boundary line of the property on which it is located and more than 25 feet from any lake, reservoir, stream or watercourse not protected by rules enacted by the State Commissioner of Health; nor shall the leaching parts of such installation be located on the direct line of drainage to, nor less than 100 feet in a horizontal direction from, any source of domestic water supply systems which are located on watersheds.

§ 153-10. Exposure to sewage prohibited

No person, either as owner, lessee or tenant of any property, dwelling, building or place, shall construct or maintain any sewage disposal system so as to expose or discharge the contents or effluent therefrom to the atmosphere or on the ground nor so as to enter any source of drinking water nor to discharge into any watercourse, storm sewer drain, or body of water.

§ 153-14. Pit privies

Outdoor pit privies are permissible only in porous sandy soils where the ground water level is at least two feet below the bottom of the pit.

Chapter 164 General Code: Solid Waste Facilities § 164-4. Prohibited disposal

(D) No person shall throw or deposit any garbage, rubbish, yard and garden waste, solid waste or foreign matter of any kind whatsoever in any pool, pond, river, lake, stream, culvert, reservoir, or its tributaries or watershed, or any body of water in a park or elsewhere within the Town. This provision shall not prohibit authorized treatment of pools or bodies of water to control or regulate water purity or aquatic vegetation by persons having all required permits issued by state, county, Town or watershed authorities having jurisdiction over such treatment.

General Code: Chapter 170: Subdivision of Land

Declaration of policy.

It is declared to be the policy of the Planning Board to consider land subdivision plats as part of a plan for the orderly, efficient and economical development of the Town. This means, among other things, that land to be subdivided shall be of such character that is can be used safely for building purposes without danger to health, or peril from fire, flood or other menace; that proper provision shall be made for drainage, water supply, sewerage and other needed improvements.

§ 170-15 Street Design

A. Widths of rights-of-way. Streets shall have the following widths:

]	Minimum Right-of-way	Minimum Pavement Width
Major Streets	66 feet	24 feet
Collector Street	ts 60 feet	24 feet
Local Streets	50 feet	24 feet

B. Improvements. Streets shall be graded and improved with pavements, curbs and gutters, sidewalks, storm drainage facilities, water mains, sewers, street lights and signs, street trees, and fire hydrants, except where waivers are requested.

J. Watercourses.

(2) Where a subdivision is traversed by a watercourse, drainageway, channel or stream, there shall be provided a stormwater easement or drainage right-of-way as required by the Town Engineer, and in no case less than 20 feet in width.

§ 170 – 18 Drainage improvements

- A. Removal of spring and surface water. The subdivider may be required by the Planning Board to carry away by pipe or open ditch and spring or surface water that may exist either previous to, or as a result of the subdivision. Such drainage facilities shall be located in the street right-of-way where feasible, or in perpetual unobstructed easements of appropriate width.
- B. Drainage structure to accommodate potential development upstream. A culvert or other drainage facility shall, in each case, be large enough to accommodate potential run-off from its entire upstream drainage area, whether inside or outside the subdivision. The Town Engineer shall approve the design and size of the facility based on anticipated run-off from a ten-year storm under conditions of total potential development permitted by Chapter 190, Zoning, in the watershed.
- C. Responsibility from drainage downstream. The subdivider's engineer shall also study the effect of each subdivision on the existing downstream drainage facilities outside the area

of the subdivision; this study shall be reviewed by the Town Engineer. Where it is anticipated that the additional run-off incident to the development of the subdivision will overload an existing downstream drainage facility during a five-year storm, the Planning Board shall notify the Town Board of such potential condition. In such case, the Planning Board shall not approve the subdivision until provision has been made for the improvement of said condition.

- D. Land subject to flooding. Land subject to flooding or land deemed by the Planning Board to be uninhabitable shall not be platted for residential occupancy, nor for such other uses as may increase danger to health, life or property, or aggravate the flood hazard, but such land within the plat shall be set aside for such uses as shall not be endangered by periodic or occasional inundation or improved in a manner satisfactory to the Planning Board to remedy said hazardous conditions.
- F. Preservation and protection of natural areas. The Planning Board shall designate to the subdivider/developer what natural or unique features shall be preserved and/or protected, including, but not limited to large trees or groves, watercourses and falls, wetland, beaches, unique and interesting geological formations, historic or archaeological sites, vistas and similar irreplaceable assets. The following standards shall be adhered to:
 - (1) Vegetation. No tree with a diameter of eight inches or more as measured four feet above the base of the trunk shall be removed unless such trees shall be subject to the approval of the Planning Board. In no case however, shall a tree with a diameter of eight inches or more as measured four feet above the base of the trunk be removed without prior approval of the Planning Board.
 - (2) Soil limitations. When land with moderate and severe soil limitation as shown by interpretive data on file with the Albany County Soil and Water Conservation District is subdivided, such subdivision shall be carried out in such a way that no detrimental effect will occur to persons or property of any land owner.
 - (4) Flooding. Floodplains, as indicated by an area expected to be flooded by a one-hundred-year frequency storm, are to be reserved for uses that are consistent with their natural functions.
 - (5) Water resources areas. The environmental quality of water, lakeshores, streams and springs is to be conserved. Land use is to be planned so as to maintain or enhance the quality of water resources. Significant recharge areas and Karst features, such as sinkholes, must be protected.
 - (6) Freshwater wetlands. If any freshwater wetlands lie within the boundaries of the proposed subdivision or within 100 feet of the proposed subdivision, the subdivider must comply with the requirements of the New York State Freshwater Wetlands Act and the local laws of the Town pertaining to freshwater wetlands, if such local law exists. Such compliance must be stated on the preliminary and final plats before they can be approved by the Board.

§ 170-19 Parks, open spaces and natural features.

B. (2) The Board shall require that not less than three acres of recreation space be provided per 50 dwelling units shown on the plat. However, in no case shall the amount be more than 10% of the total area of the subdivision.

F. Preservation and protection of natural areas. The Planning Board shall designate to the subdivider/developer what natural or unique features shall be preserved and/or protected, including but not limited to large trees or groves, watercourses and falls, wetland, beaches, unique and interesting geological formations, historic or archeological sites, vistas, and similar irreplaceable assets. The following standards shall be adhered to:

(1) Vegetation. No tree with a diameter of eight inches or more as measured four feet above the base of the trunk shall be removed unless such tree is within the right-of way of a street as shown on the final plat. Removal of additional trees will be subject to the approval of the Planning Board.

(3) Soil stability. Building or other permanent facilities are to be confined to soils that are not subject to slippage or other conditions of soil instability.

(4) Flooding. Floodplains as indicated by an area expected to be flooded by a onehundred-year frequency storm, are to be reserved for uses that are consistent with their natural functions.

(5) Water resources areas. The environmental quality of water, lakeshores, streams and springs is to be conserved. Land use is to be planned so as to maintain or enhance the quality of water resources. Significant recharge areas and Karst features, such as sinkholes, must be protected.

(6) Freshwater wetlands. If any freshwater wetlands lie within the boundaries of the proposed subdivision or within 100 feet of the proposed subdivision, the subdivider must comply with the requirements of the New York State Freshwater Wetlands Act and the local laws of the Town pertaining to freshwater wetlands, if such local law exists. Such compliance must be stated on the preliminary and final plats before they can be approved by the Board.

Chapter 190 General Code: Zoning

Section I: Title and Scope

C. Enactment Clause and Purposes

4. To create a suitable system of open spaces and recreation areas, and to protect and enhance existing wooded areas, scenic areas, and waterways.

Section V: Supplementary Regulations.

A. General Provisions.

2. *Excavations* - Any proposed excavation adversely affecting natural drainage or structural safety of adjoining buildings or lands shall be prohibited. Excavation shall not create any noxious or injurious substance or condition, or cause public health hazard.

In any district, excavation relating to the construction, on the same lot, of a building or structure for which a building permit has been issued shall be permitted. In the event that construction of a building or structure is stopped prior to completion, and the building permit is allowed to expire, the premises shall immediately be cleared of any rubbish, or building materials, and any excavation with a depth greater than two feet below existing grade shall be immediately filled in

and the topsoil replaced, or all such excavations shall be entirely surrounded by a substantial fence at least six feet high that will effectively block access to the area in which the excavation is located.

Any area of land, having an area of more than one acre from which topsoil has been removed shall be filled or covered over, and such area shall be seeded to provide an effective crop cover within the first growing season following the start of said operation.

3. Sanitary Disposal and Water Supply – ... The Planning Board or Zoning Board of Appeals may require an applicant to provide evidence of water availability, and may require professional hydrological studies sufficient to establish that a proposed development will have adequate supplies of potable water and will not adversely affect water supply or quality in the surrounding area.

4. *Landfills* – dumping of refuse, waste material and other substances is prohibited in all districts in the Town except as specified in Town of Berne Local Law No. 1 of 1969; as amended.

6. Activity Standard – In any district, the following standards for activities shall apply:
c. There shall be no discharge, in the form of either liquid or solid wastes, into any stream or body of water or any public or private disposal system or into the ground, of any material of a nature that may contaminate any water supply, including ground water supply.

B. Off Street Parking and Loading Regulations

(c) The environmental, scenic or historic sensitivity of the site. In proposals located in sensitive areas, the Planning Board may require a reduction in size of the parking lot.
 10. Landscaping – at least eight percent of the area of the lot usable for off street parking shall be devoted to landscaping with lawns, trees, shrubs or other plant material.

D. Industrial District Regulations

4. Performance Standards

a) General Standards - The following general standards are hereby adopted for the control of uses in an Industrial district and no use shall be permitted, established, maintained, or conducted therein which shall cause or be likely to cause:

(3) Any pollution by discharge of any waste material whatsoever into any watercourse, open ditch or land.

(4) Discharge of any waste material whatsoever into any sanitary disposal system or sewerage system except in accordance with the rules of and under the control of public health authorities or the public body controlling such sewerage system, Any chemical or industrial waste which places undue loads, as determined by the Town Engineer or the Building and Zoning Administrator shall not be discharged into any municipal system and must be treated by the industrial use.

I. Conditions for Uses Requiring Special Use Permits.

2. Conditions and Standards

c. Automotive Wrecking Yards

(9) The storage area cannot be located in a flood plain, or other environmentally sensitive area.

h. Gasoline Filling Stations

(11) Construction, maintenance and inspection of any gas filling station shall use all applicable federal, state and county environmental protection and mitigation requirements relative to installation, use and removal of tanks and pumps.
(12) The Town may require a bond to cover costs related to possible future cleanup of underground tanks, contaminated soils, or site restoration.
(14) Applicants shall prepare and maintain on site, an acceptable Spill Prevention, Control and Countermeasure Plan prepared under the supervision of a professional licensed engineer.

(18) Applicants shall evaluate site conditions and provide information, analysis, and evidence that the proposed gasoline filling station will not degrade the quality of groundwater. Mitigation measures including, but not limited to use of steel above ground tanks encased in concrete, shall be implemented to reduce or eliminate risks to groundwater.

k. Kennels and Veterinary/Animal Hospital Clinic

(5) The site plan shall contain provisions for adequate measures to prevent offensive noise and odor and disposal of all animal wastes.

m. Mobile Homes and House Trailers

2. Trailer Park Regulations:

(g). All sewerage and other water-carried waste shall be disposed of into a municipal sewerage system whenever possible. In trailer parks in which such connections are not available, disposal systems shall comply with applicable regulations of the Town, the New York State and Albany County Departments of Health, the New York State Department of Environmental Conservation, and other government authorities. When a water-carried system of sewage disposal is used, each unit shall be provided with a sewer connection for the combined liquid waste outlet or outlets of each house trailer. A water-and-odor-tight connection from the trailer water drainage to the sewer connection shall be provided and such connections shall remain at all times while the house trailer remains parked in such trailer park. Sewer connections in unoccupied units shall be closed so that they shall emit no odors. No sewerage shall be allowed to fall upon the ground.

3. Recreational Trailer Parks:

(c) Site Improvement Requirements

(2) Soil and ground cover. Exposed ground surfaces in all parts of every recreational trailer park shall be paved or covered with stone screenings or other solid materials or protected with a vegetative growth that is capable of preventing soil erosion and of eliminating objectionable dust.

(3) Site drainage requirements. The ground surface in all parts of every recreational trailer park shall be graded and equipped to drain al surface water in a safe, efficient manner.

(f) Recreational Trailer Pads

(5) The pad shall be suitable graded to permit rapid drainage.

o. Sewage Disposal

(4) All proposed sewage disposal facilities shall be approved by the New York State Department of Environmental Conservation prior to construction. Effluent from sewage treatment facilities shall not be discharged into any waters of the state, except with prior approval of the New York State Department of Environmental Conservation.

t. Solid Waste Handling

(1) Each recreational trailer park shall provide appropriate facilities for the collection of recyclables and equipment sufficient to prevent littering of the grounds with rubbish, garbage and refuse, and shall be equipped with fly-tight depositories of sufficient size and number to contain all the refuse and garbage which may accumulate between removals from the recreational trailer park.

Section VII: Building Permits, Site Plan Approval and Certificates of Occupancy B. Site Plan Approval

10. General Criteria and Standards - In review and approval of site plans, the Planning Board shall follow the following standards:

a. Ecological considerations. The development shall insofar as practicable:

(1) Result in minimal degradation of unique or irreplaceable land types and in minimal adverse impact upon the critical areas such as streams, wetlands, areas of aquifer recharge and discharge, steep slopes, highly erodable soils, areas with a high water table, mature stands of vegetation and extraordinary wildlife nesting, feeding or breeding habitat.

(2) (b) Landscape. The landscape shall be preserved in its natural state, insofar as practicable and environmentally desirable, by minimizing tree and soil removal. If development of the site necessitates the removal of established trees, special attention shall be given to the planting of replacements or to other landscape treatment. Any grade changes shall be in keeping with the general appearance of neighboring developed areas.

e. Surface Water Drainage. A proposed development shall be designed so as to provide for proper surface water management through a system of controlled drainage that, wherever practicable, preserves existing natural drainage patterns and wetlands and enhances groundwater recharge areas and that protects other properties and existing natural and artificial drainage features from the adverse effects of flooding, erosion and the depositing of silt, gravel or stone. All requirements of the New York State Department of Environmental Conservation related to the State Pollution Discharge Elimination System shall be met.

Town of Bethlehem

The Town of Bethlehem has adopted zoning, subdivision, flood damage prevention, and freshwater wetlands regulations. Additional sections of the general municipal code also have water quality impacts and have been included within this review:

General Code Chapter 61: Dogs

§ 61.5 Restrictions

It shall be unlawful for any owner of any dog in the Town to permit or allow such dog to: H. Deposit any dropping or fecal matter upon the premises on any private property, Town of Bethlehem public roadway and sidewalk or that portion of a front lawn owned by the Town and maintained by the landowner as a front lawn (without the consent of the owner).

(2) Such soiling action shall be deemed prevented and not a violation of this article if such person shall immediately clean up all such fecal matter and droppings by causing the same to be gathered in a suitable container and disposed of in a safe and sanitary manner.

General Code Chapter 69: Flood Damage Prevention

Purpose: to minimize public and private losses sue to flood conditions by provisions designed to:

- A. Regulate uses which are dangerous to health, safety and property due to water or erosion hazards or which result in damaging increases in erosion or in flood heights or velocities.
- B. Require that uses vulnerable to floods...be protected against flood damage.
- C. Control the alteration of natural floodplains, stream channels and natural protective barriers which are involved in the accommodation of floodwaters.
- D. Control filling, grading, dredging and other development that may increase erosion or flood damages.
- E. Regulate the construction of flood barriers which will unnaturally divert floodwaters or which may increase flood hazards to other lands.

§ 69-13 General Provisions for flood hazard reduction.

C. Utilities

(4) On site waste disposal systems shall be located to avoid impairment to them or contamination from them during flooding.

General Code Chapter 72: Freshwater Wetlands

Within an officially designated wetland, any person proposing to conduct or cause to be conducted any of the activities specified below...shall be required to file an application for a permit with the Town Clerk. These activities are subject to regulation whether or not they occur upon the wetland itself or otherwise affect the wetlands; provided, however, that no regulation

shall apply to any area situated more than 100 feet from the boundary of such wetland or any such greater or lesser distance therefrom as determined by the Planning Board. Activities requiring such a permit are as follows:

- A. Erecting any structures, roads, the driving of pilings or placing of any other obstructions whether or not changing the ebb and flow of the water.
- B. Any form of pollution, including but not limited to installing a septic tank, running a sewer outfall, discharging sewage treatment effluent or other liquid wastes into or so as to drain into a freshwater wetland.
- C. Any form of draining, dredging, excavation or removal of soil, mud, sand, shells, gravel or other aggregate.
- D. Any form of dumping, filling, or depositing of any soil, stones, sand, gravel, mud, rubbish or fill of any kind, either directly or indirectly.
- E. Any other activity which impairs any of the several functions served by freshwater wetlands or the benefits derived therefrom.

General Code Chapter 76: Garbage, Rubbish and Refuse.

§ 76.3 Storage of rubbish or garbage outside buildings.

No person shall place or deposit, or permit or cause to be placed or deposited, any rubbish or garbage outside any building...unless the garbage is properly and carefully contained...so as to prevent the same from falling out, being blown about or in any way removed from said receptacle or enclosure except for transmittal to a proper place of disposal.

General Code Chapter 87: Pesticides

§ 87-4 Application on Town property prohibited.

A. No Town department or any contractor or subcontractor for pest control purposes shall apply on property owned, operated or maintained by the Town of Bethlehem any pesticide classified as Toxicity Category I by the United States Environmental Protection Agency or any pesticide classified as a known, likely or probable human carcinogen by the United States Environmental Protection Agency except as provided for in § 87-5 or § 87-6 of this chapter.

B. No Town department or any contractor or subcontractor for pest control purposes shall apply on property owned, operated or maintained by the Town of Bethlehem any pesticide classified as Toxicity Category II by the United States Environmental Protection Agency or any pesticide classified as a known, likely or probable human carcinogen by the United States Environmental Protection Agency except as provided for in § 87-5 or § 87-6 of this chapter.

C. No Town department, or any contractor or subcontractor employed by the Town, shall apply any pesticide on any property owned, operated or maintained by the Town, except as provided in § 87-5 or § 87-6 of this chapter.

General Code Chapter 91: Sewers

§ 91- 2 Deposit of waste on public or private property prohibited.

It shall be unlawful for any person to place, deposit, or permit to be deposited upon public or private property within the district, or in any area under the jurisdiction of said district, any human or animal excrement, garbage or other objectionable waste.

§ 91-3 Untreated discharges to natural outlets prohibited.

It shall be unlawful to discharge to any natural outlet, either directly or through any storm drain, within the district, or in any area under the jurisdiction of the district, and sanitary sewage, industrial wastes or other polluted waters, except where suitable treatment has been provided in accordance with subsequent provisions of this chapter. The use of separate storm drains and sanitary sewers is mandatory.

§ 91-4 Septic tanks and cesspools restricted.

Within the limits of the established sewer district, the use of septic tanks or cesspools is prohibited, except by permit.

§ 91-36 Prohibited discharges (the code includes lengthy list not repeated here).

General Code Chapter 97: Solid Waste

§ 97-2 Use of public dump required.

No land within the Town of Bethlehem shall be used for the discharge, disposal, deposit or burial of rubbish, garbage or solid wastes, as defined in this chapter, unless operated as a public dump by or on behalf of the Town.

§ 97-2.1 Waste excavation material

Waste excavation material of any kind shall not be discharged, disposed of, deposited or buried within the Town of Bethlehem unless said material is clean and uncontaminated by any hazardous or toxic substance and does not include solid waste or construction and demolition materials or debris.

§ 97-3 Prohibited disposal.

No person shall throw, bury, deposit, discharge or cause to be thrown or deposited any garbage, rubbish, waste excavation material or solid waste in, upon or under any land, including any public highway, in the Town of Bethlehem other than at a public dump.

§ 97-32 Solid Waste Facilities Design Standards.

(10) Storage pits and/or floors of compost processing, curing and storage areas shall be designed with leachate control and storage systems. Fluid levels in sumps or storage tanks shall be monitored by external monitoring devices.

General Code Chapter 100: Streets and Sidewalks.

§ 100-10 Minimum width of street right of way.

The right-of-way of a proposed street or highway shall not be less than 50 feet in width, and a greater width may be required by the Town Board.

§ 100-13 Phases of construction to be completed prior to acceptance.

B. That portion of the storm drainage system which has been determined by the Town Board to be necessary for the drainage of surface water... shall have been installed.

General Code Chapter 103: Subdivision

§ 103-18 Conservation Subdivisions.

C) Purposes. This section encourages flexibility in the design and development of land in order to promote its most appropriate use and to preserve as permanent open space important natural features and resources, wildlife habitat, water resources, ecological systems, and scenic areas for the benefit of present and future residents. A conservation subdivision plan may involve grouping development...in order to achieve on or more of the following specific purposes:

- 1) Long term protection of natural and man-made resources.
- 6) Protection of ground and surface water, regulated wetlands, steep slopes, floodplains
- or unique areas of natural, scenic or historic significance.
- 9) Protection of designated Critical Environmental Areas.

F) ... Conservation Subdivision plans are specifically encouraged when:

1) State and/or federal freshwater wetlands cover 25% or more of the site.

2) Slopes of greater than 20% occupy 25% or more of the site.

3) The site contains a Flood Plain or Flood hazard area as mapped by the Federal

Emergency Management Agency's Flood Insurance Maps.

4) The site contains a Critical Environmental Area.

- 6) The total amount of land included in the subdivision is 50 acres or more.
- 8) The lot or parcel is included within an Agricultural District.
- 9) The lot or parcel is under a Forestry Management Plan.

§ 103-20 Review of Land Divisions.

A) Standards

6) Each new lot shall also meet the requirements of § 128-62, "Lots Bordering Streams", of the Zoning Law, and all local, state, and federal standards regarding the protection of freshwater wetlands and Phase II Stormwater regulations.

§ 103-24 Requirements and Standards.

A) ... The Planning Board shall further require that all lots shown on the plats shall be adaptable for the intended purpose without danger to health or peril from flood, fire, erosion or other menace.

C) Existing features which would add value to the development, such as large trees, watercourses, historic sites and similar irreplaceable assets, should be preserved, insofar as possible.

§ 103-25 Buildable Yield – Major Subdivisions.

A) The maximum number of residential units that may be developed on a parcel may be calculated in two ways:

1) Formula Plan. To determine the "base" number of allowable residential units under a conventional layout...the developable acreage of the site shall be calculated by deducting from the total site acreage the following percentages:

a) Mapped floodways and flood hazard areas 100%

b) Mapped 100 year floodplains	100%
c) Slopes of 20% or greater	100%
d) Waterbodies	100%
e) Regulated freshwater wetlands	100%

2) Yield Sketch Plan...containing proposed lots, streets, rights-of-way, sewage disposal system and water supply locations and setbacks, easements, and parkland areas, and depicting the location of the constrained land areas...identified in (A)(1)(a) - (f) above. If the parcel is not proposed for connection to central sewage disposal facilities the calculation shall also include and assessment by a Professional Engineer as to the suitability of the soils to accommodate individual sewage disposal systems.

§ 103-26 Layout of Streets and Roads.

B) Streets. Streets shall be graded and improved with pavement...sidewalks...curbs, gutters, trees...storm drains.

D) Grading and storm water improvements. Site grading and improvements related to management of storm water quality and quantity shall conform to Town specifications...In addition, development of the parcel shall conform with the State Pollutant Discharge Elimination System (SPDES) Phase II Storm Water requirements.

F) Trees. A conscious effort shall be made to preserve all worthwhile trees and shrubs which exist on site.

§ 103-29 Park Land Reservation and Fee Requirements.

C) The amount of land reservation. The minimum amount of land to be reserved for public park, playground or other recreational purpose shall be determined by the number of new residential units located within the proposed residential development according to the following schedule:

Unit Type	Amount of Land to be Reserved
	(Square feet/dwelling unit)
(a) Single Family detached	1,550
(b) Single Family attached	1,100
(c) Two- to Four Family unit	1,150
(d) Multi-family units	925

General Code Chapter 106: Swimming Pools

§ 106-11 Area of pools.

Swimming pools shall not occupy more than 10% of the total area of the premises. General Code Chapter 115: Trailers and Trailer Camps

§ 115-7 Regulations for trailer camps.

- A. Drainage and grading. All lands used as a trailer camp shall be well drained, of ample size and free from heavy or dense growth of brush or weeds. The land shall be properly graded to ensure proper drainage during and following rainfall and shall at all times be so drained as to be free from stagnant pools of water.
- B. ...Camp units shall contain at least 5,000 square feet. Each camp unit shall have a concrete or macadam base on which the trailer shall be placed, having a minimum size of 10 x 50 feet...shall have a minimum front yard of 20 feet, a minimum side yard of five

feet and a minimum rear yard of 25 feet. The camp units shall be grouped in blocks, with streets at least 50 feet wide between each block.

D. Disposal of sewage and other water-carried wastes.

(1) All sewage and other water-carried wastes shall be disposed of into a municipal sewerage system whenever available. In house trailer camps in which such connections are not available, disposal shall be into a private system which includes a sanitary means of disposal.

(2) ... No water or waste shall be allowed to fall on the ground from a house trailer.

E. Garbage disposal. Each such trailer camp constructed, altered, or expanded after the effective date of this chapter shall provide equipment sufficient to prevent littering of the grounds and premises with rubbish, garbage and refuse.

General Code Chapter 128: Zoning

§ 128-08 Purpose and objective of chapter.

- A) To guide the future growth and development of the Town in accordance with the Town of Bethlehem Comprehensive Plan by encouraging the establishment of population densities that will reflect a beneficial influence considering the most appropriate use of land relative to population trends, existing land use, environmental considerations, topographical features, soil types, economic activity, building development, and recognizing such conditions and trends both within the Town and in surrounding areas.
- F) To safeguard natural, agricultural, historic and scenic resources; prevent the contamination of public and private drinking wells and aquifers, lakes and ponds, and freshwater wetlands and watercourses; and preserve the integrity, stability, and beauty of the community.

§ 128-24 Rural District

E (10) Major modifications to the existing landscape such as extensive grading, clearcutting of trees, or other similar activities should be avoided.

§ 128-25 Residential "A" District; 128-26 Residential "B" District; 128-27 Residential "C" District; 128-28 Core Residential District

E (11) Major modifications to the existing landscape such as extensive grading, clearcutting of trees, or other similar activities should be avoided.

§ 128-30 Rural Riverfront District

D(1) A minimum 100 foot setback from all surrounding property lines is required for marinas, campgrounds and other outdoor recreation facilities. The setback shall not apply to a property line along the edge of the Hudson River.

E(2) Encourage the preservation of a minimum of 50% open space in new subdivision design through the use of conservation subdivision.

E (9) All new streets on the Rural Riverfront District should be designed with rural characteristics including minimal tree clearing, minimal grading and filling of existing topography, and usage of natural drainage where practicable.

E(10) Major modifications to the existing landscape such as extensive grading, clearcutting of trees, or other similar activities should be avoided.

- § 128-42 Conservation Subdivisions.
 - (A) Statement of policy. The Town of Bethlehem hereby establishes a policy of encouraging the use of conservation subdivision design to preserve open space, agricultural land, water supplies, and other environmental resources.
 - (C) Purposes. This section encourages flexibility in the design and development of land in order to promote its most appropriate use and preserve as permanent open space important natural features and resources, wildlife habitat, water resources, ecological systems, and scenic areas for the benefit of present and future residents. A conservation subdivision plan may involve grouping development...in order to achieve one of the following:
 (6) Protection of ground and surface water, regulated wetlands, steep slopes, floodplains or unique areas of natural, scenic or historic significance.
 - (7) Mitigation of significant environmental impacts.
 - (F) ... Conservation subdivision plans are specifically encouraged when:
 - (1) State and/or federal freshwater wetlands cover 25% or more of the site.
 - (2) Slopes of greater than 20% occupy 25% or more of the site.
 - (3) The site contains a Flood Plain or Flood hazard area as mapped by the Federal Emergency Management Agency's Flood Insurance Maps.
 - (6) The total amount of land included in the subdivision is 50 acres or more.
 - (8) The lot or parcel is included within an Agricultural District.
 - (9) The lot or parcel is under a Forestry Management Plan.

§ 128-44 Planned Development District

(9) Criteria for rezoning to Planned Development District. In determining whether or not to approve a Planned Development District, the Town Board shall consider the extent to which, consistent with the intent and objectives of this Chapter, the proposed district and development meets the following criteria:

c) Whether the proposal is conceptually sound in that it meets a community need and conforms to accepted design principles in the proposed functional roadway system, land use configuration, open space system, drainage system and scale of the elements.e) Whether the site will be served by both public water and public sanitary sewer facilities, and said facilities shall be adequate to accommodate the additional demand placed upon them by the proposed development.

f) Whether the site will be well drained, and stormwater generated by the development of the site shall not place an undue burden on existing facilities or contribute to downstream flooding.

§ 128-50 Swimming Pools.

(E) Drainage. All drainage from a swimming pool, as defined in this Chapter, shall be discharged in such a manner that sewage cannot be siphoned, flooded, or otherwise discharged into the swimming pool.

§ 128-51 Grading, Erosion, and Sediment Control.

B) Intent. It is the intent of the Town of Bethlehem to ensure that all activities involving land disturbance in all areas of the own are carried out so as to ensure the maximization of benefits to the public and the residents of the Town and the protection of the natural and man-made environment, by ensuring that soil erosion is controlled to the maximum extent practicable. C) Regulated activities.

1) Land disturbance of one-quarter (0.25) acre or more of land within the designated MS4...and one (1) acre or more of land outside of designated MS4.

2) Land disturbance within one hundred (100') feet of the bank of the following streams or within one hundred year flood zone of said streams:

a) Normans Kill Creek

b) Vloman Kill Creek

c) Onesquethaw Creek

d) Phillipin Kill Creek

e) Dowers Kill Creek south of Route 32

f) As used herein "bank" refers to the location of the mean high water level.

3) Excavation or filling which exceeds a total of two hundred (200) cubic yards of material per acre within any parcel or any contiguous parcels in any 12-month period.D) Prohibited Activities. The following activities are prohibited and a no Grading, Erosion and Sedimentation Control Permit shall be issued:

1) Construction of improvements and land disturbance activities on an area within the angle of repose of 20% or greater.

2) Land disturbance activities that would alter or change the direction and/or quantity of water flow within any established drainage channel, or that would change the direction and/or quantity of water flow across neighboring properties.

H) Criteria for granting permit. In granting a Grading, Erosion and Sediment Control Permit, the Town Engineer shall find that all of the following conditions have been met:

1) The proposed activity will not result in creep, sudden slope failure or additional erosion;

2) The proposed activity will preserve and protect existing watercourses, floodplains and wetlands;

3) The proposed activity will not adversely affect existing or proposed water supplies or sewage disposal systems; and

4) The proposed activity will stabilize all earth cut and fill slopes by vegetative or structural means. Maximum exposed soil slopes shall be thirty-three percent (33%) unless otherwise approved by the Town Engineer.

P) All construction, land disturbance, and land clearing activities, whether undertaken pursuant to an erosion control permit or otherwise, shall be undertaken in a manner designed to minimize surface runoff, erosion and sedimentation.

§ 128-53 Telecommunications Facilities.

F) Special Use Permit Facilities

12) Existing mature trees and natural landforms at the site shall be preserved to the maximum extent practicable.

13) ...Road construction shall at all times minimize ground disturbance and vegetation cutting. Road grades shall closely follow natural contours to assure minimal visual

disturbance and soil erosion potential. Except to the extent that the Planning Board shall determine to apply its own road criteria as the same may exist from time to time, the applicant shall adhere to the standards for unpaved forest roads set forth in New York State Department of Environmental Conservation Unpaved Forest Road Handbook – ECH-8409.11.

§ 128-55 Vacation Campgrounds.

A) Density. Density shall be four to eight campsites per acre.

D) 6) No camping space shall be within ...100 feet of any watercourse that is part of any public water supply.

F) ...One water spigot with a soakage pit or other disposal facilities shall be provided for each 10 campsites without individual water facilities.

G) Sewage disposal. The site shall be provided with a municipal or approved private sanitary sewage disposal system.

K) Solid waste disposal. The owner of the campground shall provide for the collection of refuse and garbage daily. Refuse containers shall be cleaned, covered and maintained.

§ 128-60 Park Land Reservation and Fee Requirements.

C) The amount of land reservation. The minimum amount of land to be reserved for public park, playground or other recreational purpose shall be determined by the number of new residential units located within the proposed residential development according to the following schedule:

Unit Type	Amount of Land to be Reserved
	(Square feet/dwelling unit)
(a) Single Family detached	1,550
(b) Single Family attached	1,100
(c) Two- to Four Family unit	1,150
(d) Multi-family units	925

§ 128-62 Lots Bordering Streams.

A) No building permit shall be issued for the construction or installation of any permitted or accessory use in any district within one hundred feet of the bank of the following streams or within the one hundred year flood zone of said streams:

1) Normans Kill Creek

2) Vloman Kill Creek

3) Onesquethaw Creek

4) Phillipin Kill Creek

5) Dowers Kill Creek south of Route 32

B) An application for a building permit for lots bordering streams shall be accompanied by a plot plan prepared and certified by a Professional Engineer or Registered Landscape Architect. The intent of the design plan shall be to ensure that there will be no movement, storage or stockpiling soil, sand, gravel, organic material or any other material that may potentially:

1) Cause silt and eroded material to enter the stream during storm events or as a result of wind movement.

2) Affect the efficiency or the capacity of the stream.

3) Increase flood heights.

- 4) Cause an increase in water flow velocity.
- § 128-69 Special Use Permit Review and Approval.

F) 9) Discharge of Water. No polluting or objectionable waste shall be discharged into any stream or other natural drainage channel or upon the land that will in any way interfere with the quality, operation or continuation of these natural systems or contribute to their despoliation. F)16) Sewage Treatment and Water Supply. The adequacy of available sewage disposal and water supply services supporting the proposed activity or use shall be sufficient to meet the needs of the proposed activity or use...and adequate means to protect surface and groundwater from pollution.

§ 128-70 Site Plan Review and Approval.

3) Landscape, Buffering and Site Treatment

g) ... The interior areas of a proposed parking area shall be appropriately landscaped, and such landscaping shall comprise not less than fifteen (15%) percent of the land area of the proposed parking facility.

9) Ecological Considerations

a) If the site contains wetlands that meet the criteria for classification as federal jurisdictional wetlands, the site plan shall include a recent (not more than two years old) delineation of the on-site wetlands together with a tabulation of the amount of disturbance, if any, to the onsite wetlands. If the amount of the proposed disturbance exceeds the threshold for coverage under the US Army Corps of Engineers (ACOE) Nationwide Permit Program the application shall also include a jurisdictional determination by the ACOE.

b) If the site contains wetlands that are classified as state protected freshwater wetlands, the site plan shall include a delineation of the on-site wetland and the wetland buffer, and shall include the signature of the New York State Department of Environmental Conservation personnel charged with verifying the extent and location of the wetland boundary.

c) The proposal shall conform with the existing geological and topographic features, to the end that the most appropriate use of land is encouraged.

10) Drainage. The proposed development shall be so designed as to provide for proper surface water management through a system of controlled drainage that preserves the existing drainage patterns and protects other properties and the environment. The storm water management design shall include controls for water quantity and water quality as required under the Phase II Storm water program in accordance with the latest State Pollutant Discharge Elimination System permit. All drainage plans shall be reviewed and approved by the Town Engineer.

§ 128-74 Mining and Mineral Extraction

A. Purpose

3) ... This goal requires that adverse effects to the environment, such as excessive noise and dust, degradation of water resources, and other hazards to the public be mitigated or avoided entirely.

§ 128-8.25 Senior Residence Lot and Bulk Requirements

A. Minimum Permitted lot area shall be 5 acres.

C. Principal and accessory buildings shall not together cover more than 20% of the lot area.

D. Impervious surface area shall not cover more than 40% of the lot area.

Town of Coeymans

The Town of Coeymans has adopted zoning and flood damage prevention laws. Sections of the code which have potential impacts on water quality have been excerpted below:

\$14.5 Town of Coeymans has established an Environmental Conservation Board to advise the Town Board on matters of preservation, development and the use of the natural and man-made features and conditions. Educate the public, undertake studies, and maintain an inventory of environmentally critical areas within the Town.

Chapter 60 General Code: Animals

§ 60.2 Prohibited Acts.

It shall be unlawful for any owner of or any person harboring any dog in the Hamlet of Coeymans...to permit or allow such dog to:

C....commit a nuisance by defecating or urinating upon the premises of a person other than the owner or person harboring such a dog.

Article II: Disposal of Dog Waste

§ 60.9 Removal of feces required.

Any person owning or in charge of any dog which soils, defiles, defecates on or commits any nuisance on any common thoroughfare, sidewalk, passageway, play area, park or any place where people congregate or walk or upon any private property, without the permission of the owner of said property, shall immediately remove all feces deposited by any such dog in a sanitary manner.

§ 60.10 Disposal.

The feces removed from the aforementioned designated areas shall be disposed of by the person owning or in charge of any such dog in a sealed, nonabsorbent, leakproof container. In no event shall any feces be deposited in sewers or drains, whether storm or sanitary.

Chapter 93 General Code: Flood Damage Prevention

§ 93.2 Statement of Purpose.

A. Regulate uses which are dangerous to health, safety and property due to water or erosion hazards, or which result in damaging increase in erosion or in flood heights or velocities.

C. Control the alteration of natural floodplains, stream channels and natural protective barriers which are involved in the accommodation of floodwaters.

D. Control filling, grading, dredging and other development which may increase erosion or flood damages.

E. Regulate the construction of flood barriers which will unnaturally divert floodwaters or which may increase flood hazards to other lands.

§ 93.5 Lands to which this chapter applies.

...all areas of special flood hazards within the jurisdiction of the Town of Coeymans.

§ 93.13 General Standards

C. Utilities.

(4) On site waste disposal systems shall be located to avoid impairment to them or contamination from them during flooding.

D. Subdivision proposals.

(2) All subdivision proposals shall have public utilities and facilities such as sewer, gas, electrical and water systems located and constructed to minimize flood damage.

E. Encroachments.

(2) In all areas of special flood hazard in which base flood elevation data is available...and no floodway has been determined, the cumulative effects of any proposed development, when combined with all other existing and anticipated development, shall not increase the water surface elevation of the base flood more than one foot at any point.

§ 93.15 Floodways.

Located within areas of special flood hazard are areas designated as floodways. The floodway is an extremely hazardous area due to high velocity floodwaters carrying debris and posing additional threats from potential erosion forces. When floodway data is available for a particular site...all encroachments including fill, new construction, substantial improvements and other development are prohibited within the limits of the floodway unless a technical evaluation demonstrates that such encroachments shall not result in any increase in flood levels during the occurrence of the base flood discharge.

§ 93.17 Conditions for variances.

D. Variances shall not be issued within any designated floodway if any increase in flood levels during a base flood discharge would result.

Chapter 96 General Code: Freshwater Wetlands

§ 96.1 Regulatory Authority

...The Town of Coeymans shall fully undertake and exercise its regulatory authority...in freshwater wetlands....and in all areas adjacent to any such freshwater wetland up to 100 feet from the boundary of such wetland.

Chapter 102 General Code: Garbage and Garbage Receptacles.

§ 102.5 Storage of garbage outside buildings.

No person shall place or deposit or permit or cause to be placed or deposited any garbage outside any building within the identified zones within the Town of Coeymans unless the garbage is properly and carefully contained within a covered metal, wooden or molded plastic receptacle or placed in an adequate solid enclosure, which receptacle or enclosure shall be capable of holding the contents thereof within the confines of said receptacle or enclosure so as to prevent the same from falling out, being blown about or in any way removed from said receptacle or enclosure, except for transmittal to a proper place of disposal.

Chapter 105 General Code: Junk, Storage of § 105.6 Location. No junk storage area shall be located within: C. Two hundred fifty feet of any stream, lake, pond, wetland or other body of water.

§ 105.10 Burying.

No junkyard items shall be buried in a junkyard.

§105.22 Locational considerations.

In granting or denying a permit, the Town Planning Board shall take the following locational factors into consideration:

C. The proximity of streams, lakes, wetlands, floodplains, groundwater supplies and public water supplies.

D. Local drainage patterns.

Chapter 109 General Code: Landfills

§ 109.1 Legislative declaration.

...It is recognized that the maintenance of a public dump, dumping ground, refuse disposal area or landfill site owned and operated by the Town of Coeymans is useful and necessary. In addition, it is also deemed necessary that no lands other than lands of a public dump or dumping ground heretofore or hereafter established by this town shall be used as a dump, dumping ground, refuse disposal area or as a landfill site in the said Town of Coeymans. Furthermore, the use of land as a private dump, dumping ground, refuse disposal area or landfill site is prohibited and the use of said land for the deposit, burying or disposal in any manner whatsoever of all offal, garbage, trash, rubbish, debris and other like waste is also hereby prohibited.

§ 109.3 Use of landfill site.

A. The driver of any vehicle engaged in the collection, transportation, disposal of garbage, refuse or waste shall fully cover all garbage, refuse or waste while loaded on such vehicle...and shall not permit and such part of such matter to fall from such vehicle.

Chapter 114 General Code: Mobile Home Parks.

§ 114.6 Sanitation.

D. Sewage disposal. Mobile homes or trailer parks shall be serviced by a public sewage system or by a private disposal system which meets the sewer requirements of the state, county and town.

§ 114.7 Insect, rodent control and brush control.

B. Parks shall be maintained free of accumulations of debris which may provide rodent harborage or breeding places for flies, mosquitoes and other pests.

§ 114.19 Environmental considerations.

B. Whenever possible, trees, shrubs and grass shall be retained and maintained in their natural state.

C. Each mobile home park shall be designed, constructed and maintained to ensure optimal conservation, preservation, development and use of the scenic, aesthetic, wildlife, recreational, historical, ecological, and natural resources of the Town of Coeymans.

Chapter 125 General Code: Road Specifications.

§ 125.8 Street widths.

A. Minimum width of street or highway right-of-way hereinafter laid out shall be as follows:

Street Type	Minimum Right-of-way	Minimum Pavement
Major Commercial	80 feet	24 feet/8 ft shoulders
Collector/Local Residential	60 feet	22 feet/4 ft shoulders

§ 125.19 Specifications prior to being offered for dedication

B (5) Culverts and storm sewers. Generally in heavy residential areas, storm sewers and curbs will be required.

G (2) Where a road or a street is traversed by a watercourse, drainage way, channel or stream beyond the proposed right-of-way, there shall be provided a stormwater easement or drainage right-of-way as required by the Town Engineer, and in no case less than 20 feet in width.

Chapter 131 General Code: Septic Systems

§ 131.7 Septic tank disposal.

All equipment and trucks cleaning and servicing septic tanks shall dispose of all material therefrom at a designated manhole to be designated by the Town Board.

§ 131.8 Other disposal.

Materials from pit privies, privy vaults, unsewered privies, other receptacles except septic tanks and from septic tanks serving a produce house or packing plant shall not be dumped into the manhole designated above, but shall be disposed of by dumping into a hole or trench dug for that purpose and shall be immediately covered with not less than 24 inches of dirt.

Chapter 134 General Code: Sewers.

§ 134.8 Unlawful deposit of waste or garbage.

It shall be unlawful for any person to place, deposit or permit to be deposited in any unsanitary manner upon public or private property within the town, or in any area under the jurisdiction of said town any human or animal excrement, garbage or other objectionable waste.

§134.9 Unlawful discharges into watercourses.

It shall be unlawful to discharge to any watercourse, either directly or through any storm sewer within the town, or in any area under the jurisdiction of the town, any sewage, industrial wastes or other polluted waters. Use of separate storm sewers and sanitary sewers is mandatory for all future construction within the town.

§134.10 New privies, septic tanks and cesspools prohibited.

§134.15 Connection required when public sewer becomes available.

At such a time when a public sewer becomes available to a property served by a private sewage disposal system...a direct connection shall be made to the public sewer...and any septic tanks, cesspools and similar private sewage disposal facilities shall be abandoned and filled with suitable material.

§ 134.38 Stormwater and unpolluted drainage; cooling water.

Stromwater and all other unpolluted drainage shall be discharged to such sewers as are specifically designated as storm sewers or to the watercourse approved by the town. Industrial cooling water or unpolluted process water may be discharged upon approval of the local governing body, to a storm sewer or other natural outlet. Any industrial cooling water discharge is also subject to application for a SPDES permit.

§ 145.2 Objectives of land subdivision.

It is declared to be the policy of the Planning Board to consider land subdivision plats as part of the plan for the orderly, efficient and economic development of the town. This means, among other things...that proper provision shall be made for drainage, water supply, sewerage and other needed improvements.

§ 145.19 Street design.

A. Width of rights-of-way. Streets shall have the following widths:

Туре	Minimum Right-of-way	Minimum Pavement
Major streets	100 feet	30 feet
Collector streets	60 feet	24 feet
Local streets	50 feet	24 feet

B. Improvements. Streets shall be graded and improved with pavements, curbs and gutters, sidewalks, storm drainage facilities, water mains, sewers, street trees and fire hydrants.

J. Watercourses... Where a subdivision is traversed by a watercourse, drainageway, channel or stream, there shall be provided a stormwater easement or drainage right-of-way as required by the Town Engineer but in no case less than 20 feet in width.

§ 145.22 Drainage improvements.

- A. Removal of surface and spring water. The subdivider may be required by the Planning Board to carry away by pipe or open ditch and spring or surface water that may exist either previous to or as a result of the subdivision.
- B. Drainage structure to accommodate potential development upstream. A culvert or other drainage facility shall, in each case, be large enough to accommodate potential run-off from its entire upstream drainage area, whether inside or outside the subdivision. The Town Engineer shall approve the design and size of the facility based on anticipated run-off from a ten-year storm under conditions of total potential development permitted by Chapter 165, Zoning, in the watershed.
- C. Responsibility from drainage downstream. The subdivider's engineer shall also study the effect of each subdivision on the existing downstream drainage facilities outside the area

of the subdivision...Where it is anticipated that the additional run-off incident to the development of the subdivision will overload an existing downstream drainage facility during a five year storm...the Planning Board shall not approve the subdivision until provision has been made for the improvement of said condition.

D. Land subject to flooding. Land subject to flooding or land deemed by the Planning Board to be uninhabitable shall not be platted for residential occupancy, nor for such other uses as may increase danger to health, life or property, or aggravate the flooding hazard.

§ 145.23 Parks, open spaces and natural features.

B....The Board shall require that not less than three acres of recreation space be provided per 100 dwelling units shown on the plat. However, in no case shall the amount be more than 10% of the total area of the subdivision.

F. Preservation of natural features. The Planning Board shall, wherever possible, establish the preservation of all natural features which add value to residential developments and to the community, such as large trees or groves, watercourses and –falls, beaches, historic spots, vistas and similar irreplaceable assets. No tree with a diameter of eight inches or more as measured three feet above the base of the trunk shall be removed unless such tree is within the right-of-way of a street....In no case, however, shall a tree with a diameter of eight inches or more as measured three feet above the base of the trunk be removed without prior approval by the Planning Board.

Chapter 165 General Code: Zoning

§ 165.10 Supplementary regulations.

J. Off-street parking minimum requirements.

(4) In all parking lots for more than 15 cars, landscaped areas, wholly contained within the paved area amounting to 10% of the total paved area of the lot, shall be provided. These shall be distributed throughout the lot and maintained.

R. Excavations.

(2) Any excavation or grading which adversely affects natural drainage, silting of reservoirs or streams or the structural safety of adjoining buildings is prohibited. S. Excavations for construction.

(3) Excavations for quarrying and soil mining.

(b) ... The proposed finished grading plan shall show the land to be smooth graded and respread with topsoil to a depth of four inches, or returned to a visually acceptable state. The slopes shall not exceed the normal angle of repose for the material removed.

U. Standards for activities or conditions of obnoxious or injurious nature, in all districts.

(4) The disposal of materials into present or future disposal systems, causing harm to the system or contamination of groundwater, shall be prohibited.

Town of New Scotland

The Town of New Scotland has a comprehensive plan, zoning and subdivision regulations:

Chapter 164 General Code: Subdivision of Land

§ 164-30 Land requirements.

The following general land requirements, where applicable, shall apply to "all" subdivisions in the Town of New Scotland. Land shall be suited to the purpose for which it is to be subdivided. In general, the Planning Board and for minor subdivisions, the Inspector, shall take the following factors into consideration prior to the approval of any subdivision plat.

- A. A subdivision laid out on low-lying land that is subject to periodic flooding and/or qualifies as wetland shall not be approved unless it is proven that adequate safeguards against such hazards are provided by the plan and such layout complies with state and federal wetland regulations and federal flood protection regulations.
- B. Areas characterized by steep slopes in excess of 20% grade, rock formations, wetlands and floodplains may be included in area calculations for individual lots identified by the applicant to adequately support structures, water supply and sanitary disposal systems, as required.
- § 164-31 Street or highway system.
 - C. Streets shall be related to topography so as to produce useable lots and grades which do not exceed 10%.
- § 164-33 Street or highway right-of-way widths.
 - A. Minimum street right-of-way widths, measured from lot lines...shall meet the following minimum standards:
 - (1) Primary streets: sixty-six foot right-of-way;
 - (2) Secondary street: sixty-foot right-of-way;
 - (3) Local (minor) street: fifty-foot right-of-way;
 - (4) Marginal access street: fifty-foot right-of-way.
- § 164.34 Pavement widths.
 - A. Minimum pavement widths, measured from edge of pavement to edge of pavement... shall meet the following standards:
 - (1) Primary street: twenty-four-foot pavement width;
 - (2) Secondary (collector) street: twenty-four-foot pavement width;
 - (3) Local (minor) street: twenty-four-foot pavement width;
 - (4) Marginal access street: twenty-four-foot pavement width.
 - B. All streets listed above are to have three-foot-wide shoulders on either side in addition to the minimum pavement widths.
- § 164-39 Easements
 - C. Where a subdivision is traversed by a watercourse, drainage way, channel or stream there shall be provided a drainage easement or right-of-way conforming substantially

with the line of such watercourse and of such further width as will be adequate to preserve natural drainage.

§ 164-41 Stormwater management plan.

A stormwater management plan must be submitted prior to the Planning Board taking any action on any major subdivision and/or development of land specified elsewhere in the regulations and laws of the Town of New Scotland, New York...Said plan must address the following issues:

A. Flood control:

- (1) Peak flow attenuation;
- (2) One-hundred-year flood plans;
- (3) Runoff conveyance systems.
- B. Water quality management:
 - (1) Control of "first flush";
 - (2) Control of thermal discharges;
 - (3) Hierarchy for managing stormwater quality.

Article VI: Cluster Development

§ 164-50 Purpose and authority.

...to promote appropriate use of land, facilitate the adequate and economic use of streets and utilities, encourage the conservation and continued agricultural use of agriculturally valuable land and preserve the natural and scenic qualities of the Town of New Scotland.

Comprehensive Plan – not enforceable.

Section II

Goal: Town character and environment.

To protect and enhance the current Town character and high quality environment while accommodating a mix of residential, commercial, light industrial/manufacturing, agricultural and office uses.

- I. Policies: Natural Environment
 - A. Identify floodplains, floodways, stream corridors, wetlands, water supply resources, steep slopes, vistas, cultural and historic resources, watersheds, parklands, unique geological features and agricultural lands.
 - B. To identify and protect areas of critical environmental importance.
 - C. To monitor, as necessary, the storage, collection and disposal of solid waste, junk and debris and restrict the transportation thereof.
 - D. To provide guidelines for removal of natural cover and mining.
- II. Policies: Open Space
 - A. To maximize buffer areas adjacent to stream corridors, wetlands, steep slopes and vistas.
 - A. To encourage and provide for cluster development to maximize open space.
- IV. Policies: Water and Sewer

B. To outline a plan for protection of existing or potential water sources.

C. To develop independent standards for water and sewer facilities. D. To participate in regional planning endeavors which seek to develop regional water and sewer facilities.

- V. Solid Waste
 - A. To participate in regional planning endeavors which seek to establish long range solid waste management practices.

Section III (D) (4) Onesquethaw Creek Watershed Considerations

Control of surface development need not be as restrictive as that required for watersheds over sand and gravel aquifers, however, precautions should be taken to permit only appropriate development in areas where bedrock wells provide the primary source of water.

The western portion of the Onesquethaw watershed has been diverted to act as a recharge area for the Vly Creek reservoir...As such, and due to the relatively low permeability of the soils in the area, runoff rapidly channels into the reservoir system. Development within this sub-watershed should, therefore, be regulated to minimize potential runoff contamination.

(7) Importance of Watershed Protection

Watersheds, which contain existing or potential municipal water supply wells, should be limited to lower intensity land uses with low pollution potentials. Industrial uses and commercial uses which concentrate vehicular traffic, require import and export of potentially hazardous raw materials and reduce the infiltration of surface water due to pavement of large surface areas should not be allowed in watershed recharge areas. Additionally, the use of pesticides, herbicides and chemical fertilizers for residential and agricultural uses should be strictly limited.

General Code Chapter 190: Zoning

§ 190-22 Cluster Development.

Cluster development serves the purpose of enabling and encouraging the flexible design and development of land in a manner that promotes the appropriate use of land, controlled development, and preservation of the rural character of the Town. Such types of development facilitate the adequate and economic provision of streets and utilities and preserve the natural and scenic qualities of open lands consistent with the goals and objectives of the Comprehensive Land Use Plan.

§ 190-25 Design of off-street parking facilities.

D. Each off-street parking area is to have a landscaped area equivalent to one parking space for every 40 parking spaces which is to be located to allow for no more than 20 cars in a row without a break. Said spaces are to be landscaped with shrubs no higher than three feet over at least half their surface and canopy trees of a minimum of 1 ½ inches caliper....A minimum of one canopy tree per equivalent landscape space is required.

§ 190-28 Pavement requirements.

E. Granite, concrete and/or precast concrete curbing is to be installed, as required, to adequately control stormwater runoff.

§ 190-43 Determination standards

(2) The proposed site possesses adequate soil capacity and natural features to safely support proposed facilities and structures including water and septic services at the site.

(9) The development will reflect the natural capabilities of the site to support such use.Buildings, lots and support facilities will be clustered in those portions of the site that have the most suitable conditions for development. Environmentally sensitive areas, such as wetlands, steep slopes, floodplains, and unique natural features, will be maintained and preserved.(10) The existing landscape will be preserved in its natural state in so far as practical by minimizing tree removal, disturbance and compaction of soil.

(13) The proposed use will comply with the requirements of the State Environmental Quality Review Act.

(14) Proper facilities are to be installed in compliance with any applicable stormwater management plan or stormwater management requirements.

§ 190-52 Site plan review.

The purpose of site plan review is to provide for the review and approval of development plans to ensure that land development occurs in harmony with the surrounding uses, without causing adverse impacts to...the natural environment.

(G) Determination standards. The Planning Board shall review the project to determine the consistency of the following standards:

(1) Site design:

(b) The proposed site possesses adequate soil capacity and natural features to safely support proposed facilities and structures, including water and septic services at the site.

(i) The development will reflect the natural capabilities of the site to support such use. Buildings, lots and support facilities will be clustered in those portions of the site that have the most suitable conditions for development. Environmentally sensitive areas, such as wetlands, steep slopes, floodplains, and unique natural features, will be maintained and preserved.

(j) The existing landscape will be preserved in its natural state insofar as practical by minimizing tree removal, disturbance and compaction of soil.

(n) Proper facilities are to be installed in compliance with any applicable stormwater management plan or stormwater management requirements.

§ 190-53 Planned unit development.

B. The purpose of planned development shall be to encourage development which will result in:
 (3) A pattern of development which preserves unique natural features such as but not limited to outstanding natural topography and geologic features and prevents soil erosion.

D. Planned unit development standards.

(4) At least 10% of the area of the planned unit development shall be retained in usable open space.

§ 190-55 Mobile homes.

A (2) (d) All sewage shall be discharged into a public or private sewer system and/or disposal system approved by the Albany County Health Department.

Article VI: Cluster Development

§ 190-58 Purpose.

B. .. the purposes of cluster development within the Town of New Scotland are to:

(4) Preserve open space and the natural and scenic qualities of open lands including environmentally sensitive features of development sites.

- (5) Preserve significant tracts of forested lands.
- (7) Protect floodplains, wetlands, lakes, ponds, streams, and other natural features.

Village of Ravena

The Village of Ravena has adopted subdivision, flood damage and water quality regulations. The sections of the regulations that impact water quality have been excerpted below:

General Code: Chapter 67: Flood Damage Prevention

§ 67-2 Purpose.

- A. Regulate uses which are dangerous to health, safety and property due to water or erosion hazards or which result in damaging increases in erosion or in flood heights or velocities.
- C. Control the alteration of natural floodplains, stream channels and natural protective barriers which are involved in the accommodation of floodwaters.
- D. Control filling, grading, dredging and other development which may increase erosion or flood damages.
- E. Regulate the construction of flood barriers which will unnaturally divert floodwaters or which may increase flood hazards to other lands.

§ 67-11

...It shall be unlawful to undertake any development in an area of special flood hazard, as shown on the Flood Insurance Rate Map...without a valid floodplain development permit.

§ 67-13 Powers and duties of local administrator

A (3) Determine whether any proposed development in an area of special flood hazard may result in physical damage to any other property (e.g., stream bank erosion and increased flood velocities)...If the proposed development...fails to meet the requirements...The applicant may revise the application to include measures that mitigate or eliminate the adverse effects.

§ 67-14 General standards

A (2) Public utilities and facilities such as sewer, gas, electrical and water systems shall be located and constructed so as to minimize flood damage.

A (3) Adequate drainage shall be provided to reduce exposure to flood damage.

§ 67-15 Standards for all structures

B (3) Enclosed areas.

(a) For enclosed areas below the lowest floor of a structure within Zones A1 through A30, AE or AH, and also Zone A if base flood elevation data are available, new and substantially improved structures shall have fully enclosed areas below the lowest floor that are usable solely for parking of vehicles, building access or storage in an area other than a basement and which are subject to flooding designed to automatically equalize hydrostatic flood forces on exterior walls by allowing for the entry and exit of floodwaters.

§ 67-17 Nonresidential structures

A (2) Be floodproofed so that the structure is watertight below the base flood level with walls substantially impermeable to the passage of water.

§ 67-20 Conditions for Variances

D. Variances shall not be issued within any designated floodway if any increase in flood levels during the base flood discharge would result.

General Code Chapter 102: Subdivision of Land

§ 102-1 Authority of Planning Board; subdivision policy.

...the land to be subdivided shall be of such character that it can be used safely for building purposes without danger to health or peril from fire, flood or other menace; that proper provision shall be made for drainage, water supply, sewerage and other needed improvements.

§ 102-6 Preliminary plat for major Subdivision

D. Study of preliminary plat.

(1) ... Particular attention shall be given to the arrangement, location and width of streets, their relation to the topography of the land, water supply, sewage disposal, drainage.

§ 102-14 Street Design.

A. Width of rights-of-way. Streets shall have the following widths:

Street Classification	Minimum Right of Way	Minimum Pavement
Major Streets	100 feet	30 feet
Collector Streets	60 feet	24 feet
Local Streets	50 feet	24 feet

B Improvements. Streets shall be graded and improved with pavements, curbs and gutters, sidewalks, storm drainage facilities, water mains, sewers, street trees and fire hydrants in such a manner as to meet the minimum requirements.

J. Watercourses.

(2) Where a subdivision is traversed by a watercourse, drainageway, channel or stream, there shall be provided a stormwater easement or drainage right-of-way as required by the Village Engineer, and in no case less than twenty (20) feet in width.

§ 102-17 Drainage improvements.

- A. Removal of springwater and surface water. The subdivider may be required by the Planning Board to carry away by pipe or open ditch any springwater or surface water that may exist either previous to or as a result of the subdivision.
- B. Drainage structure to accommodate potential development upstream. A culvert or other drainage facility shall, in each case, be large enough to accommodate potential runoff from its entire upstream drainage area, whether inside or outside the subdivision...the design and size of the facility based on anticipated runoff from a ten-year storm under conditions of total potential development permitted by the Zoning Ordinance in the watershed.
- C. Responsibility from drainage downstream. The subdivider's engineer shall also study the effect of each subdivision on the existing downstream drainage facilities outside the area of the subdivision...Where it is anticipated that the additional runoff...will overload and existing downstream drainage facility...the Planning Board shall not approve the subdivision.
- D. Land subject to flooding. Land subject to flooding or land deemed by the Planning Board to be uninhabitable shall not be platted for residential occupancy nor for such other uses as may ...aggravate the flood hazard, but such land shall be set aside for such uses as shall not be endangered by periodic or occasional inundation.

§ 102-18 Parks, open spaces and natural features.

B. (2) The Board shall require that not less than three (3) acres of recreation space be provided per one hundred (100) dwelling units shown on the plat. However, in no case shall the amount be more than ten percent (10%) of the total area of the subdivision.

F. Preservation of natural features. The Planning Board shall, wherever possible, establish the preservation of all natural features which add value to residential developments and to the community, such as large trees or groves, watercourses and waterfalls, beaches, historic spots, vistas and similar irreplaceable assets. No tree with a diameter of eight (8) inches or more as measured three (3) feet above the base of the trunk shall be removed unless such tree is within the right-of-way of a street...In no case, however, shall a tree with a diameter of eight (8) inches or more as measured three (3) feet above the base of the trunk be removed unless of the trunk be removed without prior approval of the Planning Board.

General Code Chapter 113: Water

§ 113-4 Permission required for excavations.

No one shall make or cause to be made any holes or excavations for any purpose in or upon any village street or right-of-way, nor fill any ditch or change any watercourse, except upon written

permission obtained from the Village Board of Trustees given over the signature of the Village Clerk.

§ 113-5 Authority to construct drains and culverts.

The Village Board, for the purpose of arresting and preventing damage to property within the village resulting from floods or erosions, may construct drains, culverts, dams and bulkheads and dredge channels and regulate watercourses, ponds and watering places within the village.

General Code Chapter A122: Water Supply Regulations

§ A122-4 Distance from reservoirs or watercourses of temporary receptacles.

No privy, privy vault, pit or receptacle of any kind used for either the temporary storage or the permanent deposit of human excreta shall be constructed, placed, maintained or allowed to remain within one hundred (100) feet of any reservoir or within twenty-five (25) feet of any watercourse tributary to the public water supply of the Village of Ravena.

§ A122-5 Distance from reservoirs or watercourses of permanent receptacles.

No privy, privy vault, pit or other receptacle used for the permanent deposit of human excreta shall be constructed, located, placed, maintained or allowed to remain within two hundred (200) feet of any reservoir or within seventy-five (75) feet of any watercourse tributary to the public water supply of the Village of Ravena.

§ A122-7 Care required.

The excreta collected in the aforesaid removable receptacles permitted under § A122-6 shall be removed and the receptacles cleaned and disinfected as often as necessary...and to effectually prevent any overflow upon the soil or upon the foundation or floor of the privy.

§ A122-8 Disposal of excreta.

Unless otherwise specifically ordered or permitted by the State Commissioner of Health, the excreta collected in the aforesaid removable receptacles...shall, when removed, be disposed of by burying in trenches or pits at a depth of not less than twelve (12) inches below the surface of the ground and in such manner as to effectively prevent its being washed over the surface of the ground by rain or melting snow and at a distance of not less than three hundred (300) feet from any reservoir or watercourse tributary to the public water supply of the Village of Ravena.

§ A122-9 Closing privies or dumps.

Whenever it shall be found that owing to the character of the soil or of the surface of the ground or to the height and flow of subsoil or surface water, or other special local conditions, it is considered by the State Commissioner of Health that the excremental matter from any privy or aforesaid receptacle or from any trench or place of disposal, or the garbage or wastes from any dump, may be washed over the surface or through the soil in an imperfectly purified condition into any reservoir or watercourse tributary to the public water supply of the village, then the said privy or receptacle for excreta or the trench or place of disposal or the said garbage or waste dump shall...be removed.

§ A122-10 Discharge to reservoir or watercourse tributary.
No house slops, bathwater, laundry or garbage wastes, sewage or other excremental matter from any water closet, privy or other source shall be thrown, placed, led, conducted, discharged or allowed to escape or flow in any manner either directly or indirectly into any reservoir or any watercourse tributary to the public water supply of the Village of Ravena, nor shall any such matter be thrown, placed, led, discharged or allowed to escape or flow onto the surface of the ground or into the ground beneath the surface except into watertight receptacles, the contents of which are to be removed...within two hundred (200) feet of any reservoir or within seventy-five (75) feet of any watercourse tributary to the public water supply of the Village of Ravena.

§ A122-11 Discharge to surface of ground.

No garbage, putrescible matter, kitchen or sink wastes, refuse or waste matter from any dairy, cheese factory, nor water in which milk cans, utensils, clothing, bedding, carpets or harness have been washed or rinsed, nor any polluted water or liquid of any kind shall be thrown or discharged directly or indirectly into any reservoir or watercourse tributary to the public water supply, nor shall any liquid or solid matter be thrown or discharged or allowed to escape or remain upon the surface of the ground or to percolate into or through the ground below the surface except into watertight receptacles, the contents of which are to be removed within one hundred (100) feet of any reservoir or within twenty-five (25) feet of any watercourse tributary to the public water supply of the Village of Ravena.

§ A122-12 Discharging pollutants to public water supply.

No clothing, bedding, carpets, harness, vehicle, receptacles, utensils, nor anything that pollutes water shall be washed, rinsed or placed in any reservoir or watercourse tributary to the public water supply of the Village of Ravena.

§ A122-13 Bathing in or polluting public water supply.

No person shall be allowed to bathe in any reservoir or tributary thereof, nor shall any animal or poultry be allowed to stand, wallow, wade or swim in any reservoir nor be washed therein. The watering of animals or poultry in any reservoir of the public water supply of the Village of Ravena is prohibited. No watering place of any kind shall be maintained in such a way as to pollute with muddy leachings or excremental matters any streams tributary to the public water supply of the Village of Ravena.

§ A122-14 Location of stables.

No stable...,barnyard, hogyard, pigpen, poultry house or yard, hitching place or standing place for horses or other animals, manure pile or compost heap shall be constructed, placed, maintained or allowed to remain with its nearest point less than seventy-five (75) feet from any reservoir or within twenty-five (25) feet of any watercourse tributary to the public water supply of the Village of Ravena, and none of the above named objects or sources of pollution shall be so constructed, placed, maintained or allowed to remain where or in such a manner that the drainings, leachings or washings from the same may enter any such reservoir or watercourse without first having passed over or through such an extent of soil as to have been properly purified.

§ A122-15 Placing human excreta, manure or compost on watershed.

No human excreta and no compost or other matter containing human excreta shall be thrown, placed or allowed to escape into any reservoir or watercourse nor be placed, piled or spread upon the surface of the ground at any point on the watershed tributary to the public water supply of the Village of Ravena, nor shall such human excreta or compost or other matter containing human excreta be buried in the soil at a lesser depth than twelve (12) inches below the surface of the ground nor within a distance of two hundred (200) feet of any reservoir nor within seventy-five (75) feet of any watercourse tributary to the public water supply of the Village of Ravena, and no manure or compost of any kind shall be placed, piled or spread upon the ground within a distance of one hundred (100) feet of any reservoir or within twenty-five (25) feet of any watercourse tributary to the Village of Ravena.

§ A122-16 Decayed fruits or vegetables polluting water supply.

No decayed or fermented fruit or vegetables, cider mill wastes, roots, grain or other vegetable refuse or any kind shall be thrown, placed, discharged or allowed to escape or pass into any reservoir or watercourse, nor shall be thrown, placed, piled, maintained or allowed to remain in any such place that the drainings, leachings or washings therefrom may flow by open, blind or covered drains or channels of any kind onto any reservoir or watercourse without first having passed through such an extent of soil as to have been properly purified.

§ A122-17 Manufacturing wastes, dead animals and offal.

No dead animal, bird, fish or any part thereof nor any offal or waste matter of any kind shall be thrown, placed, discharged or allowed to escape or to pass into any reservoir or watercourse tributary to the public water supply of the Village of Ravena, nor shall any such material or refuse be so located, placed, maintained or allowed to remain that the drainings, leachings or washings therefrom may reach any such reservoir or watercourse without having first percolated over or through the soil in a scattered, dissipated form and not concentrated in perceptible lines of drainage for a distance of two hundred (200) feet from any reservoir or seventy-five (75) feet from any watercourse tributary to the public water supply of the Village of Ravena.

§ A122-18 Fishing, boating and ice-cutting.

No boating of any kind or fishing from boats or through the ice shall be allowed in or upon the waters or ice of the reservoir...and strict sanitary supervision shall be maintained by the village over all ice cutting operations on the reservoir in order to prevent pollution.

§ A122-19 Camps.

No temporary camp, tent, building or other structure for housing laborers engaged in construction work or for other purposes shall be located, placed or maintained within a distance of five hundred (500) feet of any reservoir or one hundred (100) feet of any watercourse tributary to the public water supply of the Village of Ravena.

§ A122-20 Cemetaries.

No interment of a human body shall be made within a distance of three hundred (300) feet of any reservoir or one hundred (100) feet of any watercourse tributary to the public water supply of the Village of Ravena.

Appendix 10.4 – Glossary of Non-Point Source Pollution Definitions

Listed below are a sampling of these sources as found in the **Watershed Planning Handbook for the Control of Non-point Source Pollution** prepared by the NYSDEC and the NYS Soil and Water Conservation Committee.

Street Pavement

The components of road surfaces, including breakup and degradation of asphalt, tar, and other oil-based substances are sources of contamination on urban runoff.

Motor Vehicles

Fuels and lubricants spill or leak, particles are worn off from tires or brake linings, exhaust emissions collect on the road surface, and corrosion products or broken parts fall from vehicles. While the quantity of material deposited from individual vehicles may be small, the combined impact from numerous vehicles is significant. Service stations tend to have high concentrations of the above contaminants.

Atmospheric Fallout

Air pollutants include dust, contaminants, and particles from stacks and vents, from automobiles and planes, and from exposed land. The airborne matter will settle on the land surface and wash off as contaminated runoff.

Vegetation

Leaves, grass clippings, and other plant materials that fall or are deposited on urban land may become part of the runoff problem. Quantities depend on the geographic location, season landscaping practices, and disposal methods.

Spills

Producers and manufacturers must store and use large quantities of hazardous substances to supply the goods we demand. Sometimes - through mismanagement, neglect, or accidents - leaks or spills of these substances introduce them into the air, land and water. Consumer products such as paint thinner, lacquers, wax resins, detergents, etc., also find their way into storm drainage systems.

Litter

This consists of various kinds of discarded refuse items, packing materials, and animal droppings. Although the quantities may be small, the pollutant sources can be significant and may be the most visible form of urban runoff.

Anti-skid Components and Chemicals

In the northeast, urban areas employ large amounts of substances designed to melt ice in the winter. Salts, sand, and ash are the most commonly used agents. A variety of other chemicals may be used as fertilizers, pesticides and herbicides. Many of these substances will become part of the urban runoff when improperly stored or applied.

Storm Sewers

These tend to accumulate deposits of materials that will eventually be dislodged and transported by storm flows.

Combined Sewer Overflow

Wet-weather loading from combined storm/sewage overflows may be many times larger than loads discharged from sewage treatment plants during storms, and equal or exceed total annual discharges from sewage treatment plants. (This will only occur in areas of existing development having combined sanitary and storm sewers).

Home Septic Systems

Failing or poorly designed and/or located systems are more likely to overflow during wet weather periods. Sewage may then be carried with runoff into receiving waters.

Agricultural Uses

Land that is used for agricultural purposes such as crop lands and land treaded upon by farm animals is also effected by storm water runoff. Agricultural lands are often cleared of natural vegetation that would ordinarily help to impede the rate of water flow thereby making these lands exposed and more vulnerable to erosion and sedimentation from surface runoff. Land devoted to barnyard activities and animal enclosures is subject to greater soil displacement due to the movement of farm animals. In turn, these lands may also be the sites of accumulated animal wastes. Also, croplands are tilled and cultivated, exposing more surface soil, and allowing for faster water runoff along planting rows. Furthermore, the intensive use of pesticides and fertilizers on these croplands introduce yet additional pollutants that may runoff into water resources. As rainwater impacts and moves across the land at roughly 30 M.P.H., pesticides, fertilizers, animal wastes, and sediments are carried along and deposited into water bodies.

Appendix 10.5. – Table of Watershed Animals and Habitat (Biodiversity)

Animal or Habitat	Legal Status	Species of Greatest	For more information	Source	
		Conservation Need?			
American eel (Anguilla rostrata)	game species	yes		NYS DOS Significant Coastal Fish and Wildlife Habitats 1986	
blueback herring (Alosa aestivalis)	game species	yes		NYS DOS Significant Coastal Fish and Wildlife Habitats 1986	
map turtle (Graptemys geographica)	game species	yes	http://www.dec.n y.gov	NY Amphibian and Reptile Atlas	
American shad (Alosa sapidissima)	game species	yes		NYS DOS Significant Coastal Fish and Wildlife Habitats1986	
red cedar rocky summit	none	n/a	http://acris.nynhp .org	NY Natural Heritage Database 2007	
red maple-hardwood swamp	none	n/a	http://acris.nynhp .org	NY Natural Heritage Database 2007	
chestnut oak forest	none	n/a	http://acris.nynhp .org	NY Natural Heritage Database 2007	
Appalachian oak- hickory	none	n/a	http://acris.nynhp .org	NY Natural Heritage Database 2007	
calcareous cliff community	none	n/a	http://acris.nynhp .org	NY Natural Heritage Database 2007	
Eastern small-footed bat (Myotis leibii)	NYS Species of Special Concern	yes	http://acris.nynhp .org	NY Natural Heritage Database 2007	
Shortnose sturgeon (Acipenser brevirostrum)	Federal Endangered Species	yes	http://acris.nynhp .org	NY Natural Heritage Database 2007	
Jefferson • s salamander (Ambystoma jeffersonjanum)	NYS Species of Special Concern	yes	http://www.dec.n y.gov	NY Amphibian and Reptile Atlas	
marbled salamander (Ambystoma opacum)	NYS Species of Special Concern	yes	http://www.dec.n y.gov	NY Amphibian and Reptile Atlas	
spotted salamander (Ambystoma maculatum)		no	http://www.dec.n y.gov	NY Amphibian and Reptile Atlas	
wood frog (Rana sylvatica)		no		NY Amphibian and Reptile Atlas	
wood turtle (Glyptemys insculpta)	NYS Species of Special Concern	yes		NY Amphibian and Reptile Atlas	
smooth green snake (Opheordrys vernalis)		yes		NY Amphibian and Reptile Atlas	
black rat snake (Elaphe obsoleta)		yes		NY Amphibian and Reptile Atlas	

Appendix 10.6 – Stream Flows

USGS FLOW DATA for Site # 01359902, Coeymans Creek near Selkirk, in cubic feet per second (cfs)

01-Jan	17	35	36	18	45	605	89	33	17	10
02-Jan	17	31	36	18	34	257	75	31	19	11
03-Jan	16	26	35	18	41	150	68	28	17	12
04-Jan	16	19	33	17	40	130	61	29	14	13
05-Jan	15	19	32	19	40	100	51	28	11	15
06-Jan	15	20	31	20	40	80	48	28	10	15
07-Jan	14	19	30	21	39	70	46	26	9.6	12
08-Jan	13	16	29	20	37	58	33	27	9.4	11
09-Jan	12	16	28	19	29	56	29	124	9.2	11
10-Jan	12	13	27	18	29	54	30	147	9.2	11
11-Jan	11	13	27	16	51	52	30	396	10	10
12-Jan	11	13	26	14	66	50	33	263	13	10
13-Jan	11	13	26	14	81	45	33	94	18	10
14-Jan	10	12	26	13	130	30	29	90	29	9.4
15-Jan	10	10	25	13	66	20	26	80	61	9
16-Jan	10	12	25	13	60 CE	20	25	64 54	44	9
17-Jan	10	12	24	13	65	21	25	54	26	8.6
18-Jan	10	10	24	12	41	150	32	54 50	1/	8.4
19-Jan 20 Jan	9.0	10	23 22	12	34 22	150	21	52 46	10	0.2
20-Jan 21 Jan	9.0	19	20 00	12	20	400	21	40 50	15	0
21-Jan 22- Ion	9.0	1/	23	11	20	80	20	36	15	78
22-Jan 23-Jan	10	13	23	11	23	110	40 60	34	16	7.0
20 0an 24lan	10	125	22	11	30	130	76	29	17	7.0
25-Jan	10	323	22	11	40	80	66	34	20	7.4
26-Jan	11	66	21	12	42	54	65	70	22	7.4
27-Jan	11	70	21	12	37	52	270	50	380	7.2
28-Jan	12	75	19	12	22	48	261	38	701	7.2
29-Jan	13	65	17	12	25	45	264	46	252	7.2
30-Jan	30	41	19	11	23	43	170	61	135	7.2
31-Jan	45	102	37	11	17	45	134	37	82	7
01-Feb	51	98	21	11	20	47	108	32	66	6.8
02-Feb	90	60	22	11	14	60	68	27	252	6.8
03-Feb	171	51	200	11	13	337	56	26	189	6.8
04-Feb	83	43	160	11	14	150	50	25	99	6.8
05-Feb	56	42	120	10	14	130	46	25	61	6.6
06-Feb	49	37	90	10	15	110	43	30	45	6.6
07-Feb	42	35	70	10	16	94	41	25	45	6.6
08-Feb	38	30	60	10	16	80	40	23	37	6.6
09-Feb	34	25	56	11	17	68	37	23	26	7
10-Feb	30	24	80	12	17	60	34	23	21	8.2
11-Feb	33	23	300	13	18	40	30	23	29	10

12-Feb	34	23	250	15	18	32	28	24	53	13
13-Feb 14 Eob	30	23	165	20	18	26	26	25	40 67	18
14-Feb	20	20	07	30	140	20	20	20	20	
10-Feb	20	20	0/	00 50	140	22	24	27	39	14
16-Feb	17	21	74	50	102	21	23	20	64 454	13
17-Feb		19	60	50	53	21	22	25	454	11
18-Feb	15	18	60	43	40	20	21	23	2/1	10
19-Feb	14	16	57	53	32	19	20	30	463	10
20-Feb	13	16	51	69	38	18	52	38	2//	9.6
21-Feb	13	15	49	127	35	17	52	45	154	9.4
22-Feb	12	16	42	108	32	16	146	53	295	9.4
23-Feb	11	1/	51	118	28	15	321	8/	226	10
24-Feb	11	17	50	128	26	14	116	704	118	16
25-Feb	10	17	46	115	23	13	84	707	104	27
26-Feb	9.8	17	43	120	23	12	62	423	112	35
27-Feb	9.4	15	42	372	23	11	50	335	127	127
28-Feb	9.2	15	31	403	23	11	48	287	110	328
29-Feb	9.2				23				83	
01-Mar	9	15	31	280	37	10	52	261	79	125
02-Mar	8.6	16	31	195	355	14	49	234	63	77
03-Mar	8.6	16	31	132	467	18	44	208	49	70
04-Mar	8.4	14	33	96	138	23	65	185	52	73
05-Mar	8.4	14	46	83	94	29	116	177	287	443
06-Mar	8.4	13	58	87	70	27	93	171	295	226
07-Mar	8.8	12	49	89	75	25	77	169	159	121
08-Mar	9.6	11	53	89	88	40	67	173	113	113
09-Mar	10	10	42	75	65	74	60	169	77	159
10-Mar	15	10	41	66	61	64	55	144	68	271
11-Mar	20	10	35	63	51	58	46	143	63	279
12-Mar	25	10	39	66	41	82	43	143	45	260
13-Mar	22	10	48	73	49	82	36	151	45	851
14-Mar	20	12	38	87	56	69	32	144	43	1330
15-Mar	19	17	34	253	42	69	31	141	38	452
16-Mar	48	24	31	412	44	75	52	141	32	249
17-Mar	371	34	32	273	485	247	234	166	28	168
18-Mar	493	104	35	173	614	220	114	148	32	120
19-Mar	303	218	56	130	237	114	86	181	33	100
20-Mar	184	272	91	114	132	87	62	860	147	85
21-Mar	171	444	156	100	117	69	120	394	196	79
22-Mar	161	337	175	93	285	60	200	183	149	96
23-Mar	224	260	350	94	404	50	136	156	89	172
24-Mar	231	229	224	82	159	45	128	180	74	149

25-Mar	109	585	241	71	100	43	82	212	64	97
26-Mar	88	328	260	68	91	84	67	151	56	93
27-Mar	78	164	745	68	81	81	60	85	47	110
28-Mar	65	116	318	71	75	58	49	68	181	150
29-Mar	62	105	230	79	88	50	41	68	108	530
30-Mar	56	80	154	89	105	47	40	74	80	645
31-Mar	49	80	124	96	96	49	62	63	63	400
01-Apr	54	80	114	104	118	144	114	54	325	209
02-Apr	48	84	900	207	141	848	130	51	299	136
03-Apr	44	100	696	556	105	365	128	911	167	115
04-Apr	42	160	335	338	99	399	156	643	118	94
05-Apr	46	400	260	229	85	696	213	295	86	98
06-Apr	41	330	216	183	78	282	231	204	64	152
07-Apr	36	280	202	193	75	173	142	143	54	98
08-Apr	42	240	222	175	69	133	114	113	51	81
09-Apr	36	200	266	151	66	112	106	92	45	66
10-Apr	32	180	218	288	69	183	112	80	35	59
11-Apr	31	150	153	213	76	147	173	75	32	54
12-Apr	29	140	123	215	90	112	288	68	28	52
13-Apr	28	120	117	253	257	94	291	60	26	48
14-Apr	26	110	110	235	307	82	231	56	22	43
15-Apr	26	90	108	141	185	73	264	54	19	38
16-Apr	24	70	101	111	157	65	160	54	33	32
17-Apr	21	60	93	91	360	58	126	54	31	29
18-Apr	22	78	102	86	252	55	93	49	19	27
19-Apr	20	110	83	94	193	50	77	52	16	26
20-Apr	20	80	92	98	437	44	62	56	14	27
21-Apr	18	110	98	93	315	41	57	40	14	24
22-Apr	17	200	89	79	160	39	52	32	12	22
23-Apr	17	800	74	67	240	37	49	28	13	25
24-Apr	31	450	85	62	150	34	46	31	13	256
25-Apr	361	250	86	57	118	32	42	31	32	324
26-Apr	161	100	71	51	100	29	38	27	323	182
27-Apr	94	82	66	55	85	31	32	24	202	125
28-Apr	72	64	53	53	73	64	29	22	124	86
29-Apr	56	53	50	87	65	81	27	20	79	65
30-Apr	47	48	41	75	58	53	27	18	61	53
01-May	52	43	40	62	53	42	156	18	49	46
02-May	42	38	38	57	60	38	98	19	88	41
03-May	38	36	54	68	72	36	72	20	86	39
04-May	43	32	43	251	320	34	77	20	79	34

05-May	36	30	39	111	260	33	56	45	52	40
06-May	29	27	39	89	127	30	49	37	40	43
07-May	25	24	36	70	97	26	65	62	37	35
08-May	24	24	31	66	111	25	51	59	38	30
09-May	22	67	39	117	470	28	45	56	31	109
10-May	24	62	39	112	235	30	42	35	26	365
11-May	21	45	35	82	135	120	43	33	22	264
12-May	42	38	29	70	106	96	39	52	127	163
13-May	85	36	26	265	87	75	258	101	57	96
14-May	52	32	25	235	72	57	195	58	38	74
15-May	43	30	20	114	73	50	112	44	32	62
16-May	36	26	18	89	81	91	80	52	26	51
17-May	45	25	20	76	170	64	64	40	23	46
18-May	43	23	26	62	102	590	86	32	41	43
19-May	60	22	20	59	81	262	60	27	326	54
20-May	69	68	16	48	82	160	51	24	378	55
21-May	58	54	14	57	100	416	45	21	244	46
22-May	64	38	14	63	75	290	41	20	143	39
23-May	54	31	13	45	61	150	38	25	95	34
24-May	58	27	13	36	52	114	39	20	64	31
25-May	54	26	13	34	45	90	46	14	46	28
26-May	45	23	15	35	40	72	46	13	38	27
27-May	35	21	20	34	38	69	37	12	37	25
28-May	27	19	12	33	34	64	39	12	27	22
29-May	456	20	10	28	32	67	30	12	20	20
30-May	314	81	8	25	30	53	29	10	16	18
31-May	173	42	7.8	25	45	47	29	12	15	17
01-Jun	126	33	7.2	22	88	41	27	11	14	17
02-Jun	102	27	6.7	20	57	35	25	11	26	16
03-Jun	95	57	6.5	18	42	31	24	11	14	15
04-Jun	81	43	6.2	17	41	28	22	20	11	14
05-Jun	62	33	6.5	15	40	29	22	14	8.5	13
06-Jun	51	39	6.5	14	34	25	22	56	7.1	12
07-Jun	42	79	6	14	50	26	20	59	14	13
08-Jun	39	43	5.6	16	35	23	18	32	8.8	11
09-Jun	37	36	6	17	79	20	17	25	5.9	11
10-Jun	62	29	6.2	13	65	18	15	18	5	26
11-Jun	51	24	6	11	44	16	14	14	4.1	32
12-Jun	53	21	6	10	35	15	13	57	6.2	26
13-Jun	52	18	5.5	14	32	19	14	72	3.8	20
14-Jun	43	17	5.8	13	27	20	12	62	3	17
15-Jun	39	22	5.5	10	24	16	12	33	5	14

16-Jun	44	34	5.6	9.4	31	14	12	26	5	13
17-Jun	49	24	5.8	8.3	34	14	16	32	3.6	12
18-Jun	43	18	5.8	7.6	22	14	19	26	3.1	12
19-Jun	39	17	6.2	7.6	20	13	14	21	2.3	18
20-Jun	50	16	6	7.3	20	12	14	18	2	17
21-Jun	35	20	6	5.9	20	11	22	17	5.9	15
22-Jun	30	16	6.5	5.9	60	11	18	14	5	13
23-Jun	25	14	6	5.3	370	11	14	12	3.6	12
24-Jun	26	15	5.5	5.3	700	13	12	10	3	9.6
25-Jun	27	12	5.1	5.1	500	13	14	9.2	2.6	9.2
26-Jun	189	9	5.5	6.2	370	9.5	18	8.5	2.1	9.2
27-Jun	310	8	6	5.5	250	9.1	16	7.3	1.6	8.9
28-Jun	221	7.6	5.6	4.4	180	14	15	7.9	1.4	8.2
29-Jun	153	7	4.7	4.4	120	181	13	7.9	1.2	8.2
30-Jun	100	6.8	4.7	4	370	1490	12	7.3	25	8.5
01-Jul	74	6.4	4.4	5.9	250	740	12	6.8	108	8.2
02-Jul	57	6.2	4.2	9	170	228	12	6.2	17	7.9
03-Jul	45	6	4.5	8	130	152	570	5.7	8.5	7.6
04-Jul	39	5.8	6	5.1	100	122	208	5.2	7.8	7.3
05-Jul	35	5.8	6.7	4.6	82	154	91	4.8	5	7
06-Jul	31	5.8	4.7	4.7	64	110	62	4.5	3.3	6.8
07-Jul	25	5.6	4	4.7	54	82	43	7.9	3.3	6.8
08-Jul	23	5.6	3.8	4	46	64	34	7.6	5.7	6.8
09-Jul	19	5.4	3.2	4.9	43	52	28	6.2	8.1	7
10-Jul	24	5.2	4.7	3.6	35	40	24	5.7	3.4	6.8
11-Jul	27	4.9	5.3	4.6	27	37	22	11	2.8	6.8
12-Jul	19	5.8	4.1	3.8	26	31	14	14	2.4	7
13-Jul	15	5.6	3.1	5.1	24	26	6.3	16	2.2	7.3
14-Jul	14	4.4	3	4.4	22	24	5.7	10	2	6.5
15-Jul	12	4.7	2.7	3.5	20	23	7.4	6.8	2	6.3
16-Jul	12	4	2.9	3	81	22	6.4	6.2	1.4	6.1
17-Jul	11	4	3.3	2.9	102	20	5.5	6.2	1.1	7.9
18-Jul	11	3.9	2.6	2.8	37	16	5.5	13	0.82	6.8
19-Jul	13	3.6	2.6	6.6	30	15	5.2	28	0.87	6.3
20-Jul	13	4	2.5	5.5	24	14	4.9	24	0.69	6.1
21-Jul	8.7	5.1	2.3	3.5	35	14	5.4	50	0.82	5.7
22-Jul	7.1	6.2	2.4	3	24	14	5	20	0.73	6.1
23-Jul	5.9	5.3	2.2	2.9	18	12	5	13	0.73	5.7
24-Jul	6.2	3.8	2.2	2.8	15	11	5.4	8.5	0.87	5.2
25-Jul	6.2	4	2.2	3	14	9.4	5.2	34	0.77	5.3
26-Jul	5.6	3.5	2.2	2.5	14	9.4	5.5	13	0.61	7.9

27-Jul		4.7	3.4	2.2	2.5	12	13	5.4	9.2	0.58	6.3
28-Jul		4.5	43	2.2	2	10	11	5	7	0.61	5.5
29-Jul		3.8	50	2.7	2.8	10	9	4.9	6.2	0.58	5
30-Jul		3.6	25	2.3	4.9	8.8	8.7	12	5.5	0.77	5
31-Jul		3.2	40	2.2	4.4	8.4	8.4	6.4	5	0.77	4.6
01-Aug		3.2	15	3.3	4.4	8.1	7.4	4.9	4.5	1.5	4.8
02-Aug		3.4	15	3.4	4	7	96	3.8	4.5	1.6	6.3
03-Aug		3.1	16	2.5	9	10	180	4.3	4.1	1	6.1
04-Aug		2.7	15	2.4	8.3	11	53	3.5	4.3	0.65	5.7
05-Aug		2.9	28	2.3	5.3	9.5	30	3.3	6.5	0.65	5.3
06-Aug		3.4	15	2.3	4.7	8.1	18	3	6	0.58	5
07-Aug		3.6	12	2.2	2.9	6.7	14	3.5	20	3.4	5.2
08-Aug		2.8	11	2.2	2.9	15	11	3	154	4.7	16
09-Aug		3	12	2.2	2.8	11	9.4	2.8	58	2.2	7
10-Aug		3.2	14	2.1	2.3	8.1	9	2.6	21	314	5.7
11-Aug		2.5	15	2.1	2.8	6.7	10	2.4	77	108	16
12-Aug		2.5	11	2.1	2.8	5.9	11	2.2	97	40	7.9
13-Aug		2.4	9.5	2.2	2.9	5.6	8.4	4.6	22	29	6.3
14-Aug		2.1	8.3	2	2.8	9.5	8.1	7.4	14	20	5.7
15-Aug		2.3	8	2.1	2.2	12	13	5.4	10	18	5.7
16-Aug		2.1	92	2.2	2.2	7.7	27	3.3	8.9	15	4.8
17-Aug		2.5	90	2.1	3.2	6.7	16	2.2	8.5	10	5.3
18-Aug		2.1	31	2	2.6	6.7	13	2	7.3	7.8	5.3
19-Aug		2.1	17	1.9	3	5.6	9.7	2.5	7	6.8	4.3
20-Aug		2.2	12	2.2	2.6	5.9	11	1.8	6.5	6.2	4.8
21-Aug		2.3	9.9	2.1	2.9	5.3	7.4	2.2	6	5.4	4.3
22-Aug		2.5	9.2	2	3.6	4.7	7.8	1.9	5.7	4.1	6.1
23-Aug		2.5	8	2	1.7	9.5	8.1	1.8	5.2	3.9	5
24-Aug		2.1	7.5	1.9	2.6	9.8	7.4	2.3	5.5	3.4	5.2
25-Aug		2.1	7.5	1.9	2.5	16	8.1	2.7	5.7	3.4	4.6
26-Aug		1.8	7.2	1.9	2.6	28	7.8	2.3	5.5	3.8	4.5
27-Aug		1.7	6.5	1.8	13	14	6.8	4	4.8	3.9	4.2
28-Aug		1.2	5.6	1.6	227	7.7	5.1	7	5	4.3	4
29-Aug	2.8	1.4	5.3	1.5	76	5.3	4.6	4.5	4.3	31	3.9
30-Aug	1.9	1.4	5.3	1.5	28	5.6	4.3	4	68	14	4.2
31-Aug	2.8	1.5	4.9	1.8	17	4.4	13	3.6	26	8.1	3.9
01-Sep	2.5	1.6	4.7	1.6	11	4.4	14	3.1	13	5.4	4.2
02-Sep	1.9	1.8	5.3	1.8	9	4.2	5.7	4	9.2	5	4.2
03-Sep	1.9	1.6	5.6	1.9	7.6	3.7	3.9	5	7.9	4.3	4.6
04-Sep	1.7	1.5	5.6	1.8	6.6	3.8	3.2	20	6.8	3.4	3.9
05-Sep	1.6	1.6	5.5	1.9	5.5	3.8	2.9	14	6.2	3.3	4.2

06-Sep	1.6	1.9	5.1	1.9	4.9	3.5	2.7	11	5.5	2.8	4.2
07-Sep	1.6	2.4	5.8	1.9	5.1	3.5	2.8	9.6	5.5	2.6	3.5
08-Sep	1.6	1.8	11	2.1	4.6	3.5	2.5	8.6	4.8	2.3	3.6
09-Sep	1.7	1.8	11	2.2	4.2	3.5	2.4	7.8	4.3	2.2	3.6
10-Sep	3.8	1.8	7.2	2.3	4.2	3.3	2.3	7.2	4.5	3.3	3.6
11-Sep	2.5	7.7	5.8	2.2	3.8	2.8	2.4	6.8	4.3	6.2	3.9
12-Sep	1.8	5.3	5.3	2.2	4.4	3.2	2.2	6.4	5	3.8	3.8
13-Sep	1.9	2.2	4.7	2.4	4.7	3.5	2.2	6.4	7.3	2.3	3.9
14-Sep	1.8	2.3	4.5	2.5	63	4.7	2.3	11	5.2	2.3	5.3
15-Sep	1.9	1.8	4.4	3.8	48	4.4	2.4	9.4	4.1	2.2	4.2
16-Sep	1.8	1.8	4.4	3	24	3.3	2.3	8	4.3	2	4.8
17-Sep	1.8	2	4.5	4	22	4	2.3	9	3.7	4.5	10
18-Sep	1.8	1.6	4.4	4.1	19	3	3.3	8.7	3.9	6.8	6.8
19-Sep	1.8	1.6	4.4	3.6	15	2.8	2.8	8.4	3.7	6.8	13
20-Sep	1.8	1.8	4.1	2.6	13	3.2	2.5	9	5	3	79
21-Sep	1.9	1.8	3.8	2.3	24	3	2.4	16	4.3	3.1	53
22-Sep	1.9	1.8	4.9	2.2	18	3.5	2.4	27	4.8	1.8	23
23-Sep	2.5	1.5	3.8	2.4	14	3.2	2.7	14	7.9	1.9	13
24-Sep	1.8	1.5	3.9	2.1	12	3.7	2.4	11	12	1.6	18
25-Sep	1.9	1.8	3.8	2.2	11	3	2.7	11	315	2.1	70
26-Sep	3.8	1.8	3.4	2.2	9.4	3.3	2.4	9.8	214	2.7	156
27-Sep	3.1	1.9	3.4	4	8.7	3.2	2.5	9.4	287	5.4	116
28-Sep	3.4	1.9	3.2	4	9	3	2.2	14	101	3.9	46
29-Sep	5.4	1.6	3.3	3.4	6.9	3	2.5	53	57	2.8	33
30-Sep	3.4	1.6	3.3	3.2	7.3	3.3	2.7	31	39	2.4	25
01-Oct	2.5	1.7	3.4	2.7	7.7	2.8	2.4	18	30	3.3	
02-Oct	2.2	1.5	3.8	2.7	7	3	2.5	22	25	3	
03-Oct	1.9	1.6	7	3.6	11	2.8	2.9	19	20	3.4	
04-Oct	1.6	1.4	4.5	4.1	11	2.8	2.3	16	17	2.4	
05-Oct	1.6	1.8	4.1	3.6	11	2.7	2.4	13	13	3	
06-Oct	1.9	1.8	3.5	3.5	7.7	2.7	2.7	12	12	2.7	
07-Oct	1.8	2.2	3	4	5.9	57	2.4	11	10	2.8	
08-Oct	1.9	2.4	3.4	3.6	6.1	64	2.7	11	9.6	2.3	
09-Oct	1.9	1.8	3.4	3.9	4.2	27	2.5	10	9.2	277	
10-Oct	3.4	1.9	3.2	4.4	27	16	2.1	9.7	8.2	127	
11-Oct	5.8	1.8	3.2	4.1	36	10	2.8	9	12	54	
12-Oct	2.5	1.8	2.8	4	17	8.1	2.7	9	22	29	
13-Oct	1.9	1.8	3.3	4.9	14	8.4	2.5	7.8	17	20	
14-Oct	1.9	1.8	3.1	4.9	10	6.4	2.7	8.1	49	24	
15-Oct	1.7	1.8	3	8.8	8.4	6.1	2.2	13	29	20	
16-Oct	1.8	1.8	3.2	14	7.4	5.9	2.9	14	20	15	

17-Oct	1.7	1.8	3.1	10	6.7	5.3	2.5	20	16	12
18-Oct	1.7	2.1	3	9.9	6.7	5.3	2.9	15	717	10
19-Oct	3.8	2.8	2.9	8.8	6.1	4.4	2.9	13	908	9.6
20-Oct	1.8	2.3	2.9	9.2	5.9	4.4	2.4	12	657	15
21-Oct	1.6	2.1	4	9.2	6.1	4	2.9	11	254	472
22-Oct	1.6	2	3.4	15	5.9	4	2.8	9.7	149	143
23-Oct	1.6	2	3	39	5.3	4.2	2.5	9.7	102	77
24-Oct	1.7	2	2.8	20	5.9	3.7	2.8	9	73	54
25-Oct	3.8	6.1	2.7	14	9.1	3.8	2.7	9.3	63	54
26-Oct	48	3.6	3.1	12	9.5	3.7	2.7	9.7	98	115
27-Oct	18	2.3	2.8	12	8.8	5.3	2.5	9.7	58	79
28-Oct	10	3.4	2.8	9.5	9.1	8.8	2.7	9	44	57
29-Oct	8.8	3.1	2.8	9.2	7.7	13	2.8	8.4	37	45
30-Oct	6.5	2.6	2.8	8.8	7.4	19	47	7.6	34	36
31-Oct	5.8	2.7	2.7	8	6.7	14	25	8.7	30	45
01-Nov	5.4	2.2	2.8	8	6.1	11	13	8.1	27	45
02-Nov	5	2.3	3.1	7.8	6.7	15	8.4	8.4	23	36
03-Nov	29	2.2	6	7.2	7	27	6.8	8.1	22	31
04-Nov	21	2	4.7	7.8	7.4	22	5.7	8.4	20	51
05-Nov	20	2.3	11	7.5	6.7	33	5.7	17	18	57
06-Nov	15	1.9	60	7.8	6.1	32	4.8	31	15	99
07-Nov	12	7.5	35	7	6.4	23	4	22	14	70
08-Nov	11	26	488	6.7	6.4	121	6	18	13	57
09-Nov	9.6	12	163	7.2	6.4	653	4	16	14	48
10-Nov	9.6	14	89	6.7	6.4	147	3.9	15	13	38
11-Nov	8.8	14	61	7.5	6.1	94	3.8	15	19	34
12-Nov	9.2	11	53	7.8	5.9	76	3.7	14	20	31
13-Nov	10	10	56	7.8	6.1	61	3.8	145	133	26
14-Nov	9.2	10	46	8	5.6	93	3.3	53	156	25
15-Nov	9.2	11	46	17	5.9	114	3.6	51	125	22
16-Nov	6.5	20	37	38	6.1	99	3.6	38	98	20
17-Nov	7.3	23	33	30	5.9	87	3.6	32	85	18
18-Nov	8	42	30	23	6.1	75	3.7	28	71	17
19-Nov	8.4	136	32	22	5.6	69	3.4	26	59	17
20-Nov	9.6	62	294	23	5.6	210	3.6	33	50	16
21-Nov	8	40	114	29	6.1	157	3.6	109	108	15
22-Nov	8.4	36	74	25	7	105	3.3	68	154	14
23-Nov	14	38	60	23	7.7	81	3.6	45	88	12
24-Nov	24	37	66	22	7.7	72	3.4	39	64	12
25-Nov	30	44	58	18	7.7	69	4	36	51	11
26-Nov	31	36	61	16	7.7	736	4.8	31	42	10

27-Nov	31	31	54	16	9.1	377	5.1	24	63	10
28-Nov	28	35	49	16	15	197	6.2	22	101	10
29-Nov	22	71	44	17	28	188	6.8	22	71	11
30-Nov	20	48	38	16	85	135	6.2	20	56	12
01-Dec	16	37	40	17	70	123	5.9	17	101	12
02-Dec	16	35	36	16	52	106	4.8	19	99	11
03-Dec	18	31	35	16	42	97	4.8	21	73	11
04-Dec	33	82	30	20	38	90	4.5	18	52	10
05-Dec	28	162	26	21	30	85	5.6	22	39	10
06-Dec	23	81	24	20	31	449	22	15	38	10
07-Dec	22	58	22	19	99	396	14	14	38	100
08-Dec	25	53	26	20	114	154	10	337	31	80
09-Dec	29	41	34	20	114	150	48	371	27	60
10-Dec	24	44	46	22	173	159	183	130	207	45
11-Dec	22	37	864	22	590	141	73	86	171	31
12-Dec	280	22	320	25	255	106	50	71	104	28
13-Dec	232	22	162	24	130	114	41	64	76	27
14-Dec	96	46	109	26	97	106	113	62	62	30
15-Dec	67	46	91	26	103	90	90	58	54	22
16-Dec	54	46	68	25	130	85	55	55	49	18
17-Dec	47	35	54	24	106	79	45	96	37	17
18-Dec	45	28	57	24	85	70	55	83	31	16
19-Dec	45	24	49	23	64	62	46	61	29	16
20-Dec	40	24	43	23	60	58	38	53	22	15
21-Dec	34	23	39	24	57	55	971	48	20	14
22-Dec	34	22	39	26	49	120	372	44	19	14
23-Dec	31	25	37	26	38	141	188	41	18	13
24-Dec	26	28	36	25	41	123	120	39	18	13
25-Dec	24	26	35	23	45	118	82	37	19	12
26-Dec	24	22	35	22	39	120	110	36	22	11
27-Dec	23	25	35	21	41	120	490	34	18	11
28-Dec	21	29	36	21	42	100	288	33	22	11
29-Dec	20	60	37	20	42	76	193	32	31	10
30-Dec	19	102	37	19	39	69	146	32	38	9.6
31-Dec	18	74	36	19	39	197	104	32	25	10

Appendix 10.7 – Codes and Ordinances Worksheet

1. Street Width

a. What is the minimum pavement width allowed for streets in low density residential developments that have less than 500 average daily trips (ADT)?
If the answer is between 18-22 feet, award 4 points
b. At higher densities are parking lanes allowed to also serve as traffic lanes (i.e., queuing streets)?
If the answer is YES, award 3 points

2. Street Length

a. Do street standards promote the most efficient street layouts that reduce overall street length? *If the answer is YES, award 1 point*

3. Right-of-Way Width

a. What is the minimum right-of-way (ROW) width for a residential street?
If the answer is less than 45 feet, award 3 points
b. Does the code allow utilities to be placed under the paved section of the ROW?
If the answer is YES, award 1 point

4. Cul-de-Sacs

a. What is the minimum radius allowed for cul-de-sacs?
If the answer is less than 35 feet, award 3 points
If the answer is 36 feet to 45 feet, award 1 point
b. Can a landscaped island be created within the cul-de-sac?
If the answer is YES, award 1 point
c. Are alternative turn arounds such as "hammerheads" allowed on short streets in low density residential developments?
If the answer is YES, award 1 point

5. Vegetated Open Channels

a. Are curb and gutters required for most residential street sections?
If the answer is NO, award 2 points
b. Are there established design criteria for swales that can provide stormwater quality treatment (i.e., dry swales, biofilters, or grass swales)?
If the answer is YES, award 2 points

6. Parking Ratios

a. What is the minimum parking ratio for a professional office building (per 1000 ft2 of gross floor area)?

If the answer is less than 3.0 spaces, award 1 point

b. What is the minimum required parking ratio for shopping centers (per 1,000 ft2 gross floor area)?

If the answer is 4.5 spaces or less, award 1 point

c. What is the minimum required parking ratio for single family homes (per home)? *If the answer is less than or equal to 2.0 spaces, award 1 point*

d. Are the parking requirements set as maximum or median (rather than minimum) requirements?

If the answer is **YES**, award **2** points

7. Parking Codes

a. Is the use of shared parking arrangements promoted?
If the answer is YES, award 1 point
b. Are model shared parking agreements provided?
If the answer is YES, award 1 point
c. Are parking ratios reduced if shared parking arrangements are in place?
If the answer is YES, award 1 point
d. If mass transit is provided nearby, is the parking ratio reduced?
If the answer is YES, award 1 point
d. If mass transit is provided nearby, is the parking ratio reduced?
If the answer is YES, award 1 point
8 Parking Lots

8. Parking Lots

a. What is the minimum stall width for a standard parking space?
If the answer is 9 feet or less, award 1 point
b. What is the minimum stall length for a standard parking space?
If the answer is 18 feet or less, award 1 point
c. Are at least 30% of the spaces at larger commercial parking lots required to have smaller dimensions for compact cars?
If the answer is YES, award 1 point
d. Can pervious materials be used for spillover parking areas?
If the answer is YES, award 2 points

9. Structured Parking

a. Are there any incentives to developers to provide parking within garages rather than surface parking lots? *If the answer is YES, award 1 point*

10. Parking Lot Runoff

a. Is a minimum percentage of a parking lot required to be landscaped?
If the answer is YES, award 2 points
b. Is the use of bioretention islands and other stormwater practices within landscaped areas or setbacks allowed?
If the answer is YES, award 2 points

11. Open Space Design

a. Are open space or cluster development designs allowed in the community? *If the answer is YES, award 3 points If the answer is NO, skip to question No. 12*b. Is land conservation or impervious cover reduction a major goal or objective of the open space design ordinance? *If the answer is YES, award 1 point*c. Are the submittal or review requirements for open space design greater than those for conventional development? *If the answer is NO, award 1 point*d. Is open space or cluster design a by-right form of development? *If the answer is YES, award 1 point*e. Are flexible site design criteria available for developers that utilize open space or cluster design options (e.g, setbacks, road widths, lot sizes) *If the answer is YES, award 2 points*

12. Setbacks and Frontages

a. Are irregular lot shapes (e.g., pie-shaped, flag lots) allowed in the community?
If the answer is YES, award 1 point
b. What is the minimum requirement for front setbacks for a one half (1/2) acre residential lot?

If the answer is **20 feet or less**, award **1** point

c. What is the minimum requirement for rear setbacks for a **one half (1/2) acre** residential lot?

If the answer is **25 feet or less**, award **1** point

d. What is the minimum requirement for side setbacks for a **one half (1/2) acre** residential lot?

If the answer is 8 feet or less, award 1 points

e. What is the minimum frontage distance for a **one half (1/2) acre** residential lot? *If the answer is less than 80 feet, award 2 <i>points*

13. Sidewalks

a. What is the minimum sidewalk width allowed in the community? *If the answer is 4 feet or less, award 2 points*

b. Are sidewalks always required on both sides of residential streets?

If the answer is **NO**, award **2** points

c. Are sidewalks generally sloped so they drain to the front yard rather than the street?

If the answer is **YES**, award **1** point

d. Can alternate pedestrian networks be substituted for sidewalks (e.g., trails through common areas)?

If the answer is **YES**, award **1** point

14. Driveways

a. What is the minimum driveway width specified in the community? If the answer is 9 feet or less (one lane) or 18 feet (two lanes), award 2 points
b. Can pervious materials be used for single family home driveways (e.g., grass, gravel, porous pavers, etc)? If the answer is YES, award 2 points
c. Can a "two track" design be used at single family driveways? If the answer is YES, award 1 point
d. Are shared driveways permitted in residential developments? If the answer is YES, award 1 point

15. Open Space Management

a. Does the community have enforceable requirements to establish associations that can effectively manage open space? *If the answer is YES, award 2 points*

b. Are open space areas required to be consolidated into larger units?

If the answer is **YES**, award **1** point

c. Does a minimum percentage of open space have to be managed in a natural condition?

If the answer is **YES**, award **1** point

d. Are allowable and unallowable uses for open space in residential developments defined?

If the answer is **YES**, award **1** point

e. Can open space be managed by a third party using land trusts or conservation easements?

If the answer is **YES**, award **1** point

16. Rooftop Runoff

a. Can rooftop runoff be discharged to yard areas? *If the answer is YES, award 2 points*

b. Do current grading or drainage requirements allow for temporary ponding of stormwater on front yards or rooftops? *If the answer is YES, award 2 points*

17. Buffer Systems

a. Is there a stream buffer ordinance in the community?
If the answer is YES, award 2 points
b. If so, what is the minimum buffer width?
If the answer is 75 feet or more, award 1 point
c. Is expansion of the buffer to include freshwater wetlands, steep slopes or the 100-year floodplain required?
If the answer is YES, award 1 point

18. Buffer Maintenance

a. Does the stream buffer ordinance specify that at least part of the stream buffer be maintained with native vegetation?
If the answer is YES, award 2 points
b. Does the stream buffer ordinance outline allowable uses?
If the answer is YES, award 1 point
c. Does the ordinance specify enforcement and education mechanisms?
If the answer is YES, award 1 point

19. Clearing and Grading

a. Is there any ordinance that requires or encourages the preservation of natural vegetation at residential development sites?
If the answer is **YES**, award **2** points
b. Do reserve septic field areas need to be cleared of trees at the time of

development? If the answer is **NO**, award **1** point

20. Tree Conservation

a. If forests or specimen trees are present at residential development sites, does some of the stand have to be preserved?
If the answer is YES, award 2 points
b. Are the limits of disturbance shown on construction plans adequate for preventing clearing of natural vegetative cover during construction?
If the answer is YES, award 1 point

21. Land Conservation Incentives

a. Are there any incentives to developers or landowners to conserve non-regulated land (open space design, density bonuses, stormwater credits or lower property tax rates)?

If the answer is **YES**, award **2** points

b. Is flexibility to meet regulatory or conservation restrictions (density compensation, buffer averaging, transferable development rights, off-site mitigation) offered to developers?

If the answer is **YES**, award **2** points

22. Stormwater Outfalls

a. Is stormwater required to be treated for quality before it is discharged? *If the answer is YES, award 2 points*

b. Are there effective design criteria for stormwater best management practices

(BMPs)?

If the answer is **YES***, award* **1** *point* c. Can stormwater be directly discharged into a jurisdictional wetland without pretreatment?

If the answer is **NO**, award **1** point

d. Does a floodplain management ordinance that restricts or prohibits development within the 100 year floodplain exist?

If the answer is **YES**, award **2** points

TOTAL

Scoring

90 - 100

Community has above-average provisions that promote the protection of streams, lakes and estuaries.

80 - 89

Local development rules are good, but could use minor adjustments or revisions in some areas.

70 - 79

Opportunities exist to improve development rules. Consider creating a site planning roundtable.

60 - 69

Development rules are likely inadequate to protect local aquatic resources. A site planning roundtable would be very useful.

less than 60

Development rules are definitely not environmentally friendly. Serious reform is needed.

Appendix 10.8 – Agricultural Programs

The USDA provides a variety of programs to landowners and farmers to improve water quality enhance wildlife habitat and control soil erosion. These programs provide financial incentives to participants through conservation cost sharing for the installation of practices and annual payments for acreage enrolled in enduring practices such as stream corridor buffers.

Conservation Reserve Program

USDA Farm Service Agency's (FSA) Conservation Reserve Program (CRP) is a voluntary program available to agricultural producers to help them safeguard environmentally sensitive land. Producers enrolled in CRP plant long-term, resource-conserving covers to improve the quality of water, control soil erosion, and enhance wildlife habitat. In return, FSA provides participants with rental payments and cost-share assistance. Contract duration is between 10 and 15 years.

The Food Security Act of 1985, as amended, authorized CRP. The program is also governed by regulations published in 7 CFR, part 1410. The program is implemented by FSA on behalf of USDA's Commodity Credit Corporation.

Benefits

CRP protects millions of acres of American topsoil from erosion and is designed to safeguard the Nation's natural resources. By reducing water runoff and sedimentation, CRP protects groundwater and helps improve the condition of lakes, rivers, ponds, and streams. Acreage enrolled in the CRP is planted to resource-conserving vegetative covers, making the program a major contributor to increased wildlife populations in many parts of the country.

Conservation Reserve Enhancement Program

The Conservation Reserve Enhancement Program (CREP) is a voluntary land retirement program that helps agricultural producers protect environmentally sensitive land, decrease erosion, restore wildlife habitat, and safeguard ground and surface water.

The program is a partnership among producers; tribal, state, and federal governments; and, in some cases, private groups. CREP is an offshoot of the country's largest private-lands environmental improvement program -- the Conservation Reserve Program (CRP).

Like CRP, CREP is administered by USDA's Farm Service Agency (FSA). By combining CRP resources with state, tribal, and private programs, CREP provides farmers and ranchers with a sound financial package for conserving and enhancing the natural resources of farms.

CREP addresses high-priority conservation issues of both local and national significance, such as impacts to water supplies, loss of critical habitat for threatened and endangered wildlife species, soil erosion, and reduced habitat for fish populations such as salmon. CREP is a community-based, results-oriented effort centered around local participation and leadership.

Conservation Security Program

CSP is a voluntary program that provides financial and technical assistance to promote the conservation and improvement of soil, water, air, energy, plant and animal life, and other conservation purposes on Tribal and private working lands. Working lands include cropland, grassland, prairie land, improved pasture, and range land, as well as forested land that is an incidental part of an agriculture operation. The program is available in all 50 States, the Caribbean Area and the Pacific Basin area. The program provides equitable access to benefits to all producers, regardless of size of operation, crops produced, or geographic location.

Debt for Nature Program

The Debt for Nature Program (DFN), also known as the Debt Cancellation Conservation Contract Program, is a unique program for eligible landowners that protects important natural resources and other sensitive areas while providing a debt management tool.

DFN is available to persons with Farm Service Agency (FSA) loans secured by real estate. These individuals may qualify for cancellation of a portion of their FSA indebtedness in exchange for a conservation contract with a term of 50, 30, or 10 years. The conservation contract is a voluntary legal agreement that restricts the type and amount of development that may take place on portions of the landowner's property. Contracts may be established on marginal cropland and other environmentally sensitive lands for conservation, recreation, and wildlife purposes.

165

Emergency Conservation Program (ECP)

The 2007 Act provided \$16 million in funds for ECP. ECP provides emergency funding and technical assistance for farmers and ranchers to rehabilitate farmland damaged by natural disasters and for carrying out emergency water conservation measures in periods of severe drought. FSA county committees determine land eligibility based on on-site inspections of damage, taking into account the type and extent of damage.

For land to be eligible, the natural disaster must create new conservation problems that, if untreated, would:

* impair or endanger the land;

* materially affect the land's productive capacity;

* represent unusual damage which, except for wind erosion, is not the type likely to recur frequently in the same area; and

* be so costly to repair that federal assistance is or will be required to return the land to productive agricultural use.

Environmental Quality Incentives Program

The Environmental Quality Incentives Program (EQIP) was reauthorized in the Farm Security and Rural Investment Act of 2002 (Farm Bill) to provide a voluntary conservation program for farmers and ranchers that promotes agricultural production and environmental quality as compatible national goals. EQIP offers financial and technical help to assist eligible participants install or implement structural and management practices on eligible agricultural land. EQIP offers contracts with a minimum term that ends one year after the implementation of the last scheduled practices and a maximum term of ten years. These contracts provide incentive payments and cost-shares to implement conservation practices. Persons who are engaged in livestock or agricultural production on eligible land may participate in the EQIP program. EQIP activities are carried out according to an environmental quality incentives program plan of operations developed in conjunction with the producer that identifies the appropriate conservation practice or practices to address the resource concerns. The practices are subject to NRCS technical standards adapted for local conditions. EQIP may cost-share up to 75 percent of the costs of certain conservation practices. Incentive payments may be provided for up to three years to encourage producers to carry out management practices they may not otherwise use without the incentive. However, limited resource producers and beginning farmers and ranchers may be eligible for cost-shares up to 90 percent. Farmers and ranchers may elect to use a certified third-party provider for technical assistance. An individual or entity may not receive, directly or indirectly, cost-share or incentive payments that, in the aggregate, exceed \$450,000 for all EQIP contracts entered during the term of the Farm Bill. Farm and Ranch Lands Protection Program The Farm and Ranch Land Protection Program (FRPP) provides matching funds to help purchase development rights to keep productive farm and ranchland in agricultural uses. Working through existing programs, USDA partners with State, tribal, or local governments and non-governmental organizations to acquire conservation easements or other interests in land from landowners. USDA provides up to 50 percent of the fair market easement value of the conservation easement. To qualify, farmland must: be part of a pending offer from a State, tribe, or local farmland protection program; be privately owned; have a conservation plan for highly erodible land; be large enough to sustain agricultural production; be accessible to markets for what the land produces; have adequate infrastructure and agricultural support services; and have surrounding parcels of land that can support long-term agricultural production. Depending on funding availability, proposals must be submitted by the eligible entities to the appropriate NRCS State Office during the application window.

Grassland Reserve Program

The Grassland Reserve Program (GRP) is a voluntary program offering landowners the opportunity to protect, restore, and enhance grasslands on their property. Section 2401 of the Farm Security and Rural Investment Act of 2002 (Pub. L. 107-171) amended the Food Security Act of 1985 to authorize this program. The Natural Resources Conservation Service, Farm Service Agency and Forest Service are coordinating implementation of GRP, which helps landowners restore and protect grassland, rangeland, pastureland, shrubland and certain other lands and provides assistance for rehabilitating grasslands. The program will conserve vulnerable grasslands from conversion to cropland or other uses and conserve valuable grasslands by helping maintain viable ranching operations. Grasslands make up the largest land cover on America's private lands. Privately-owned grasslands and shrublands cover more than 525 million acres in the United States. For the first time, the U.S. Department of Agriculture will direct financial resources and technical expertise to help landowners protect and restore these lands.

Wetlands Reserve Program

The Wetlands Reserve Program is a voluntary program offering landowners the opportunity to protect, restore, and enhance wetlands on their property. The USDA Natural Resources Conservation Service (NRCS) provides technical and financial support to help landowners with their wetland restoration efforts. The NRCS goal is to achieve the greatest wetland functions and values, along with optimum wildlife habitat, on every acre enrolled in the program. This program offers landowners an opportunity to establish long-term conservation and wildlife practices and protection.

Wildlife Habitat Incentives Program

The Wildlife Habitat Incentives Program (WHIP) is a voluntary program for people who want to develop and improve wildlife habitat primarily on private land. Through WHIP USDA's Natural Resources Conservation Service provides both technical assistance and up to 75 percent cost-share assistance to establish and improve fish and wildlife habitat. WHIP agreements between NRCS and the participant generally last from 5 to 10 years from the date the agreement is signed. WHIP has proven to be a highly effective and widely accepted program across the country. By targeting wildlife habitat projects on all lands and aquatic areas, WHIP provides assistance to conservation minded landowners.

The Farm Security and Rural Investment Act of 2002 reauthorized WHIP as a voluntary approach to improving wildlife habitat in our Nation. Program administration of WHIP is provided under the Natural Resources Conservation Service.

Appendix 10. 9 – Kisby Study – Eroded Sites Table

SITE	РТ	DATE		# LGTH	BANK	L	AT	LON	NOTES
	Start	9/23/2001	2	32.1 Right	-73.87 ⁻	61	42.5398		
site2.doc	End	9/23/2001	2	32.1 Right	-73.87 ⁻	47	42.53961		
site2.doc	Start	9/23/2001	3	47 Right	-73.87 ⁻	41	42.53942		
site3.doc	End	9/23/2001	3	47 Right	-73.87 ⁻	116	42.53905		
site3.doc	Start	9/23/2001	4	10 Right	-73.87 ⁻	114	42.53892		
site4.doc	End	9/23/2001	4	10 Right	-73.87 ⁻	04	42.53878		
site4.doc	Center	9/23/2001	5	6.9 Left	-73.8	709	42.53864		
site5.doc	Start	9/23/2001	6	47.5 Right	-73.87 ⁻	09	42.53857		
site6.doc	End	9/23/2001	6	47.5 Right	-73.87 ⁻	03	42.53823		
site6.doc	Start	9/23/2001	7	100 Right	-73.870)99	42.53815		
site7.doc	End	9/23/2001	7	100 Right	-73.870	031	42.53736		
site7.doc	End	9/23/2001	1	74.8 Left	-73.87 ⁻	154	42.54	Directly b	ehind Audubon Intl office
site1.doc	Start	9/23/2001	1	74.8 Left	-73.872	214	42.53991	Directly b	ehind Audubon Intl office
site1.doc	Start	10/8/2001	8	66.2 Right	-73.870	001	42.53716		
site8.doc	End	10/8/2001	8	66.2 Right	-73.869	932	42.53713		
site8.doc	Start	10/8/2001	9	23.6 Right	-73.869	916	42.5373		
site9.doc	End	10/8/2001	9	23.6 Right	-73.868	399	42.53744		
site9.doc	Start	10/8/2001	10	44.8 R + L	-73.86	763	42.53737	Brdige co	onstruction site
site10.doc	End	10/8/2001	10	44.8 R + L	-73.86	744	42.53712	Bridge co	onstruction site
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site12.doc	End	10/8/2001	12	71.4 Right	-73.864	147	42.53643		
site12.doc	End	10/8/2001	13	25.3 Left	-73.864	154	42.53648		
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site13.doc	Center	10/10/2001	14	8.2 Right	-73.80	642	42.53656		
site14.doc	Start	10/10/2001	15	20.8 Right	-73.863	318	42.53688		
site15.doc	End	10/10/2001	15	20.8 Right	-73.862	291	42.53679		
site15.doc	Start	10/10/2001	16	14.3 Right	-73.862	244	42.53645		
site16.doc	End	10/10/2001	16	14.3 Right	-73.862	223	42.53651		
site16.doc	Start	10/10/2001	17	65.8 Right	-73.862	208	42.5366		
site17.doc	End	10/10/2001	17	65.8 Right	-73.86	29	42.53651		
site17.doc	Start	10/10/2001	18	25 Right	-73.860)82	42.53647		
site18.doc	End	10/10/2001	18	25 Right	-73.860)55	42.53655		
site18.doc	Start	10/21/2001	19	126.7 Right	-73.856	666	42.53822		
site19.doc	End	10/21/2001	19	126.7 Right	-73.85	526	42.53779		
site19.doc	Start	10/21/2001	20	44.1 Left	-73.85	537	42.53805		
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site20.doc	Start	10/21/2001	21	69.4 Right	-73.854	147	42.5373		
site21.doc	End	10/21/2001	21	69.4 Right	-73.853	396	42.53676		
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site22.doc	End	10/21/2001	22	66.4 Left	-73.853	347	42.53595		
site22.doc	Center	10/21/2001	23	10 Right	-73.853	348	42.53567	Undercut	bank baccess bank - GPS point as close
site23.doc	Start	10/21/2001	25	134.7 Left	-73.849	951	42.53565	to b	

				Difficult to access bank - GPS point as close
site25.doc End	10/21/2001	25	134.7 Left	-73.8481 42.53583 to b
site25.doc Start	10/21/2001	26	150.6 Right	-73.84782 42.53484 Some scouring evident
site26.doc End	10/21/2001	26	150.6 Right	-73.84662 42.53455 Some scouring evident
site26.doc Start	10/27/2001	27	30 Left	-73.84647 42.53514
site27.doc End	10/27/2001	27	30 Left	-73.84609 42.53515
site27.doc End	10/27/2001	28	100.4 Right	-73.84507 42.53547 Major alteration of original flow path
site28.doc Start	10/27/2001	29	89.5 Left	-73.84556 42.53556 Path diverted from main flow near site 28
site29.doc End	10/27/2001	29	89.5 Left	-73.84459 42.53551 Path diverted from main flow near site 28
site29.doc Start	10/27/2001	30	84.2 Right	-73.84512 42.53502
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site32.doc End	10/27/2001	32	50 Right	-73.84293 42.53515
site32.doc Start	10/27/2001	33	142.7 Center	-73.84423 42.53582 Path diverted from main flow
site33.doc Center	10/27/2001	33	142.7 Center	-73.8436 42.53556 Path diverted from main flow
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site34.doc End	10/27/2001	34	114 Right	-73.8411 42.53456
site34.doc Start	10/27/2001	35	176 Left	-73.84037 42.53578
site35.doc End	10/27/2001	35	176 Left	-73.83893 42.53695
site35.doc Start	10/27/2001	36	119 Right	-73.83877 42.5368
site36.doc End	10/27/2001	36	119 Right	-73.83775 42.53771
	11/0/0001	07	100 41 -#	Bank difficult to access - GPS point as close
site36.doc Start	11/2/2001	37	120.4 Left	-/3.83803 42.53/// as possible Bank difficult to access - GPS as close as
site37.doc End	11/2/2001	37	120.4 Left	-73.83674 42.53821 possible
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site40.doc End	11/2/2001	40	49 Left	-73.8334 42.53911
site40.doc Start	11/2/2001	41	64 Right	-73.8329 42.53888
site41.doc End	11/2/2001	41	64 Right	-73.83216 42.53883
site41.doc Center	11/2/2001	42	10 Right	-73.8316 42.53898
site42.doc Center	11/2/2001	43	30 Left	-73.83135 42.53928
site43.doc End	11/2/2001	44	37.2 Left	-73.82977 42.53944
site44.doc Center	10/21/2001	24	0 Right	-73.85295 42.53396
site24.doc Start	10/27/2001	28	100.4 Right	-73.84603 42.53498 Major alteration of flow path
site28.doc Start	11/2/2001	44	37.2 Left	-73.83021 42.53937 GIS based point- GPS point not processed
site44.doc				· · ·



APPENDIX 10.10 – Where the Onesquethaw-Coeymans Meets the Hudson River Estuary

The Onesquethaw-Coeymans Creek is one of at least 65 streams and rivers that directly flow into the Hudson River Estuary. Hudson River tributaries vary in size from small streams that may dry-up during summer months, to larger rivers with watersheds that are hundreds of square miles. In general, the Onesquethaw-Coeymans watershed is an average sized tributary compared to all the tributaries, draining approximately 50 square miles of land in Albany County. Tributaries, such as the Onesquethaw-Coeymans, are interwoven components to the Hudson Estuary ecosystem. They contribute freshwater, essential nutrients, possible contaminants, and typically form vital habitats at their confluence with the Hudson Estuary.

Freshwater Flow

At the mouth of Hudson River tributaries, where they meet the tidal Hudson River, are tidal coves and bays, which are mixing zones for water draining from the watershed and water of the Estuary. In the more southerly portions of the Estuary below Poughkeepsie, the water in the Hudson River mainstem can be brackish during certain times of year, while the water discharging from the tributary and its watershed is entirely fresh. Freshwater inflows from tributary streams play an important role in maintaining salinity gradient in the Hudson River Estuary. The figure to the right depicts the saltwater and freshwater gradient in the Hudson River Estuary.

Essential Nutrients

Tributaries also contribute vital nutrients to the Hudson Estuary ecosystem. Carbon, for example, is one such nutrient that originates from vegetation, soils, and forests in the watershed and makes its way to the Hudson Estuary where it is consumed by bacteria and animals, serving as an essential building block for the Hudson River estuary food chain.



Pollutants Inputs

Water quality impacts to the Hudson River Estuary from the Onesquethaw-Coeymans are likely most influenced at the tidal cove/bay, where drainage waters are protected from dilution and dispersion by the overwhelming tidal waters of the Hudson River. Land uses in the Onesquethaw-Coeymans watershed, including agriculture, urban, commercial, and residential development, may have a negative impact on not only the small streams and rivers in the watershed, but also in the tidal area where it meets the Hudson River. For example, excess sediment discharged from the tributary can settle in these coves, where the free flowing meets the slower slack water in the Hudson River. This may lead to shallowing of the cove, smothering of benthic habitat, opportunities for invasive vegetation to establish itself, and stress to native submerged aquatic vegetation. Elevated pathogen and nutrient levels from the watershed may also contribute to water quality problems and threaten swimming and other recreational opportunities. The vulnerability of tributary mouths to watershed impacts far upstream and their ecological connection to the Hudson River Estuary ecosystem and the Atlantic Ocean heightens the level of responsibility and caution for everyone living in the Hudson Valley.

Coastal Habitat

The tidal Coeymans Creek provides unique habitat where freshwater riverine and tidal ecosystems converge. Approximately one-quarter of a mile of Coeymans Creek is tidal between downstream of a large waterfall below Route 144 and the Hudson River mainstem, providing valuable coastal habitat for Hudson River fish and wildlife. Aquatic and terrestrial animal species use the bay for refuge, foraging, over-wintering, and reproduction. Many species of Hudson River fish and wildlife move between and among tributary mouths and coves, such as the Coeymans, to complete required parts of their life history. Coeymans Creek bay, for example, is an important spawning area for anadromous fishes including alewife, blueback herring, white perch, and American shad. Shortnose Sturgeon, an endangered species, also use the Hudson River off the Coeymans Creek mouth as spawning area and may use the tidal portion of the Creek for refuge during high spring flows.

The figure to the right illustrates the movement of river herring along the Atlantic Coast. River Herring, such as Alewife and Blueback Herring use the mouth of the Coeymans Creek for spawning in the spring. Leaving the Hudson River Estuary in late early summer, these fish migrate Northeast to the coast of Maine to spend the summer feeding, and then migrate south to the coast of North and South Carolina. Fish, such as Striped Bass follow the herring along this migratory journey to prey on River Herring.



Limited tidal marshes and flats exist at the mouth of the Coeymans Creek. Although much of the tidal Coeymans Creek shallows naturally along the shoreline, bulkheading exists, which may restrict tidal flow into a small marsh south of the creek.

APPENDIX 10.11 – List of Graphs and Charts

Page	Graph or Chart
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29	Impervious Areas
32	Wetlands
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36	Steep Slopes
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39	Septic Limitations
40	Aquifers & Public Water
41	Karst Terrain; Bedrock Geology
44	Stream Classification
46	Land Cover
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52	Development Activity
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55	Public Water Supplies
56	Public Water Districts
69	USGS Flow Data
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77	Clay Ravines
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87	Town Ordinances & Regulations
99	Public Parks, Preserves & Managment Areas
107-110	Appendix 10.2 - SPDES Permits
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