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BOROUGH OF CRESSKILL

STORMWATER

MANAGEMENT PLAN

Bergen County, New Jersey

March, 2005

Table of Contents

SECTION NO.	TITLE	Page
I	INTRODUCTION	3
II	GOALS	4
	1. Goal Identification	
	2. Goal Achievement	
III	STORMWATER DISCUSSION	8
IV	BACKGROUND	10
	1. Community Description	
	2. Recent Major Development	
	3. Open Space Acquisition	
	4. Primary Waterways and Bodies of Water	
	5. Brook Improvement Projects	
	6. Principal Flood Problems	
V	WATER QUALITY DISCUSSION	15
VI	GROUNDWATER RECHARGE & WELLHEAD PROTECTION AREAS	18
VII	DESIGN AND PERFORMANCE STANDARDS	18
VIII	PLAN CONSISTENCY	19
IX	NONSTRUCTURAL STORMWATER MANAGEMENT STRATEGIES	21
X	LAND USE/ BUILD-OUT ANALYSIS	24
XI	MITIGATION PLANS	25
XII	BIBLIOGRAPHY AND REFERENCES	28
XIII	ABBREVIATIONS	30

LIST OF FIGURES

Figure 1:	Groundwater Recharge in the Hydrologic Cycle	9
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LIST OF EXHIBITS

Exhibit "A"	Map of Borough of Cresskill, New Jersey Showing Growth in Developed Areas from 1986 to 1995/97
Exhibit "B"	Borough of Cresskill Waterway Map
Exhibit "C"	USGS Quadrangle Map Depicting Borough of Cresskill Corporate Limits
Exhibit "D":	Groundwater Recharge Areas in Borough of Cresskill
Exhibit "E"	Wellhead Protection Areas in Borough of Cresskill
Exhibit "F"	Borough of Cresskill Existing Land Use
Exhibit "G"	Hydrologic Units (HUC14s)
Exhibit "H"	Borough of Cresskill Zoning Map (Scale 1"=250')
Exhibit "I"	Wetlands and Water Land Uses within the Borough of Cresskill – Constrained Land

I. Introduction

This Municipal Stormwater Management Plan (MSWMP) documents the strategy for the Borough of Cresskill (“the Borough”) to address stormwater-related impacts. The creation of this plan is required by N.J.A.C. 7:14A-25 Municipal Stormwater Regulations. This plan contains all of the required elements described in N.J.A.C. 7:8, Stormwater Management Rules. The plan addresses groundwater recharge, stormwater quantity, and stormwater quality impacts by incorporating stormwater design and performance standards for new “Major Development”, defined as projects that disturb one or more acre of land, or increase the impervious surface by one-quarter acre or more. These standards are intended to minimize the adverse impact of stormwater runoff on water quality and water quantity and the loss of groundwater recharge that provides baseflow in receiving water bodies. The plan describes long-term operation and maintenance measures for existing and future stormwater facilities.

The Borough, based upon existing zoning requirements and land available for development contains minimal additional space for new development, therefore a “build-out” analysis is not required in this instance and is not included as part of this Plan.

The plan addresses the review and update of existing ordinances, the Borough Master Plan and other planning documents to allow for project designs that include low impact development techniques.

In December of 2004, the Borough of Cresskill Planning Board completed the necessary re-examination and update of its Municipal Master Plan. A Public Hearing was conducted on this matter on December 21, 2004. The adoption of the Master Plan Revision and Re-examination Report, dated November 2004, as prepared by Hakim Associates in Association with Stuart Turner & Associates, was memorialized in a Resolution of the Board dated January 11, 2005.

The final component of this Plan is a mitigation strategy for when a variance or exemption of the design and performance standards is sought. As part of the mitigation section of the stormwater plan, specific stormwater management measures are identified to lessen the impact of existing development.

II. Goals

1. Goal Identification

The goals of this MSWMP are as follows:

1. reduce flood damage, including damage to life and property;
2. minimize, to the extent practical, any increase in stormwater runoff from any new development;
3. reduce soil erosion from any development or construction project;
4. assure the adequacy of existing and proposed culverts and bridges, and other in-stream structures;
5. maintain groundwater recharge;
6. prevent, to the greatest extent feasible, an increase in nonpoint pollution;
7. maintain the integrity of stream channels for their biological functions, as well as for drainage;
8. minimize pollutants in stormwater runoff from new and existing development to restore, enhance, and maintain the chemical, physical, and biological integrity of the waters of the state, to protect public health, to safeguard fish and aquatic life and scenic and ecological values, and to enhance the domestic, municipal, recreational, industrial, and other uses of water; and
9. protect public safety through the proper design and operation of stormwater basins.

2. Goal Achievement

In order to achieve these goals, this plan outlines specific stormwater design and performance standards for new development. Additionally, the plan proposes stormwater management controls to address impacts from existing development. Preventative and corrective maintenance strategies are included in the plan to ensure long-term effectiveness of stormwater management facilities. The plan also outlines safety standards for stormwater infrastructure to be implemented to protect public safety.

Specific strategies to be utilized in the effort to accomplish the 9 goals noted above are more fully described throughout this Plan but are in general terms, as follows:

- **Goal No. 1 - Reduce flood damage, including damage to life and property**

Chapter 132 of the Code of the Borough of Cresskill is entitled "Flood Damage Prevention". The purpose of this Chapter is to promote the public health, safety and general welfare and to minimize public and private losses due to flood conditions. The Borough currently utilizes the Flood Insurance Rate Maps as published by FEMA to identify the "areas of special flood hazard". These areas are based on the 100-year design

storm. The Borough shall consider utilizing the more restrictive standards set forth under the "State of New Jersey Flood Hazard Area Control Act Rules". By adopting the NJDEP requirements, the floodplain will cover larger areas, since the NJDEP regulatory flood for *non-delineated* watercourses is based on 100-year storm, assuming that the entire contributory drainage area is fully developed in accordance with the current zoning plan, to the maximum impervious cover allowed thereunder and in accordance with the applicable Stormwater management regulations.

For *delineated* watercourses the regulatory flood is the flood hazard area design flood. This flood represents the 100 year flood flow increased by 25% to allow for the future development in the drainage basin. The NJDEP regulations further require that structures that span the flood plain and/or act as control structures for the watercourse, such as bridges, culverts or low dams, to be designed so that any increase in flood elevations, upstream or downstream, will not subject existing residential or commercial buildings to increased flood damages during floods of lesser frequency than the regulatory flood.

Furthermore, as is noted hereinafter, the waterways within the Borough were recently designated as Category One (C1) waters by the NJDEP. With this designation, a 300 feet wide buffer zone is mandated along each bank of the waterway. This buffer requirement shall have the positive effect of limiting development adjacent to the waterways thereby maintaining the flood storage volume that currently exists in the overbank areas.

- **Goal No. 2 - Minimize, to the extent practical, any increase in stormwater runoff from any new development**

The Borough currently applies the Residential Site Improvement Standards (RSIS) to all subdivision and site plan applications involving residential development. These regulations prohibit any increase in stormwater runoff from a site. Under the subject Stormwater Management Plan, the Borough shall adopt the current NJDEP Stormwater Management Rules. These rules prohibit any increase in stormwater runoff from any (i.e. Residential/Commercial/Institutional) new development or re-development that disturbs one or more acre of land, or increases the impervious surface by one-quarter acre or more. In accordance with these regulations, the applicant shall provide hydrologic and hydraulic calculations demonstrating one of the following:

- Post-construction runoff hydrographs for the two, 10, and 100-year storm events do not exceed, at any point in time, the pre-construction runoff hydrographs for the same storm events
- No increase, as compared to the pre-construction condition, in the peak runoff rates of stormwater leaving the site for the two, 10, and 100-year storm events and that the increased volume or change in timing of stormwater runoff will not increase flood damage at or downstream of the site
- Design stormwater management measures so that the post-construction peak runoff rates for the two, 10 and 100-year storm events are 50, 75 and 80 percent, respectively, of the pre-construction peak runoff rates.

- **Goal No. 3 - Reduce soil erosion from any development or construction project**

This goal shall be achieved by adoption of a Stormwater Management Ordinance which shall stipulate that all plans for any "Major Development" shall reflect strict adherence to the Vegetative, Engineering and Stormwater Runoff Treatment Standards set forth within the current edition of the "Standards for Soil Erosion and Sediment Control in New Jersey" as promulgated by the State Soil Conservation Committee.

- **Goal No. 4 - Assure the adequacy of existing and proposed culverts and bridges, and other in-stream structures**

The adequacy of existing and proposed culverts and bridges, and other in-stream structures is assured by requiring adherence to NJAC 7:13 "Flood Hazard Area Control Act Rules". The NJDEP regulations under this chapter specify all applicable requirements to assure the adequacy of all new structures, without causing any adverse effects upstream or downstream, for the regulatory flood and less frequent storm events. Existing culverts, bridges and other in-stream structures shall be reconstructed in accordance with these standards, subject to the availability of funding on both the Local and County levels.

- **Goal No. 5 - Maintain groundwater recharge**

This goal shall be achieved by adopting the design and performance standards for Stormwater Management Measures as set forth under N.J.A.C. 7:8-5.4, Erosion Control, Groundwater Recharge and Runoff Quantity Standards and 7:8-5.6, Calculation of Stormwater Runoff and Groundwater Recharge. With respect to groundwater recharge, it is noted that the in-situ soils within the Borough are predominantly hydrologic soil group Type B and Type C soils. These soils have sufficient permeability such that surface and subsurface infiltration basins may be constructed to satisfy Groundwater Recharge and Stormwater Quality requirements.

- **Goal No. 6 - Prevent, to the greatest extent feasible, an increase in nonpoint pollution**

Nonpoint pollution is generally attributed to stormwater runoff from agricultural and residential areas. The Borough does not contain any agricultural land but is a mature, residential community with single family homes constructed on properties ranging in size from approximately 0.10 acres to 1 acre. The vast majority of these properties are fully improved with structures, driveways and lawn areas. Through mass-mailings and other public outreach campaigns, residents shall be encouraged to limit fertilizer and pesticide applications to the greatest extent feasible. New development or redevelopment shall be required to provide Stormwater management measures that reduce the post-construction load of total suspended solids (TSS) in Stormwater runoff generated from the water

quality design storm by 80 percent of the anticipated load from the developed site, expressed as an annual average.

- **Goal No. 7 - Maintain the integrity of stream channels for their biological functions, as well as for drainage**

The integrity of stream channels for their biological functions, as well as for drainage shall be accomplished with the adoption and enforcement of the Design and Performance Standards for Stormwater Management Measures as set forth under Subchapter 5 of the Stormwater Management rules at N.J.A.C. 7:8. In accordance with the requirements of N.J.A.C. 7:8-5.5(h), Special Water Resource Protection Areas (SWRPA) shall be established along all waters designated Category One at N.J.A.C. 7:8-5.5(h) and perennial or intermittent streams that drain into or upstream of the Category One waters as shown on the USGS Quadrangle Maps or in the County Soil Surveys, within the associated HUC 14 drainage. The Tenakill Brook, Cresskill Brook and Demarest Brook were recently designated as Category One (C1) waters. The SWRPA consists of the establishment of a 300 feet wide buffer on each side of the waterway, measured perpendicular to the waterway, wherein existing vegetation or vegetation following natural succession is provided. Encroachment within this area may be permitted by the NJDEP if an applicant is able to demonstrate that the functional value and overall condition of the SWRPA shall be maintained to the maximum extent practicable and shall not be reduced to less than 150 feet. As is noted in Borough's Master Plan Revision and Re-examination Report: *"These regulations have had an impact on the proposed Cresskill Community/Recreation Center, and the expansion plans for Cresskill High School."*

- **Goal No. 8 - Minimize pollutants in stormwater runoff from new and existing development to restore, enhance, and maintain the chemical, physical, and biological integrity of the waters of the state, to protect public health, to safeguard fish and aquatic life and scenic and ecological values, and to enhance the domestic, municipal, recreational, industrial, and other uses of water**

For new development/redevelopment, this goal shall be achieved by adopting the design and performance standards for Stormwater Management Measures as set forth under N.J.A.C. 7:8-5.5, Stormwater Runoff Quality Standards. This standard requires that Nonstructural and/or Structural Stormwater Management measures be designed and constructed to reduce the post-construction load of total suspended solids (TSS) in stormwater runoff generated from the water quality design storm by 80 percent of the anticipated load from the developed site, expressed as an annual average. Subject to the availability of funding and acquisition of all necessary Access Easements, the Borough shall seek to retrofit existing stormwater management facilities with the use of both structural and nonstructural stormwater management measures to improve groundwater recharge and correct negative stormwater quantity and quality impacts that may currently exist. . Inasmuch as the primary waterways in the Borough are designated Category One waters, subject to SWRPA requirements as enumerated under N.J.A.C. 7:8-5.5(h), the land area available for development shall be reduced with a commensurate reduction in adverse impacts typically associated with land development.

- **Goal No. 9 - Protect public safety through the proper design and operation of stormwater basins.**

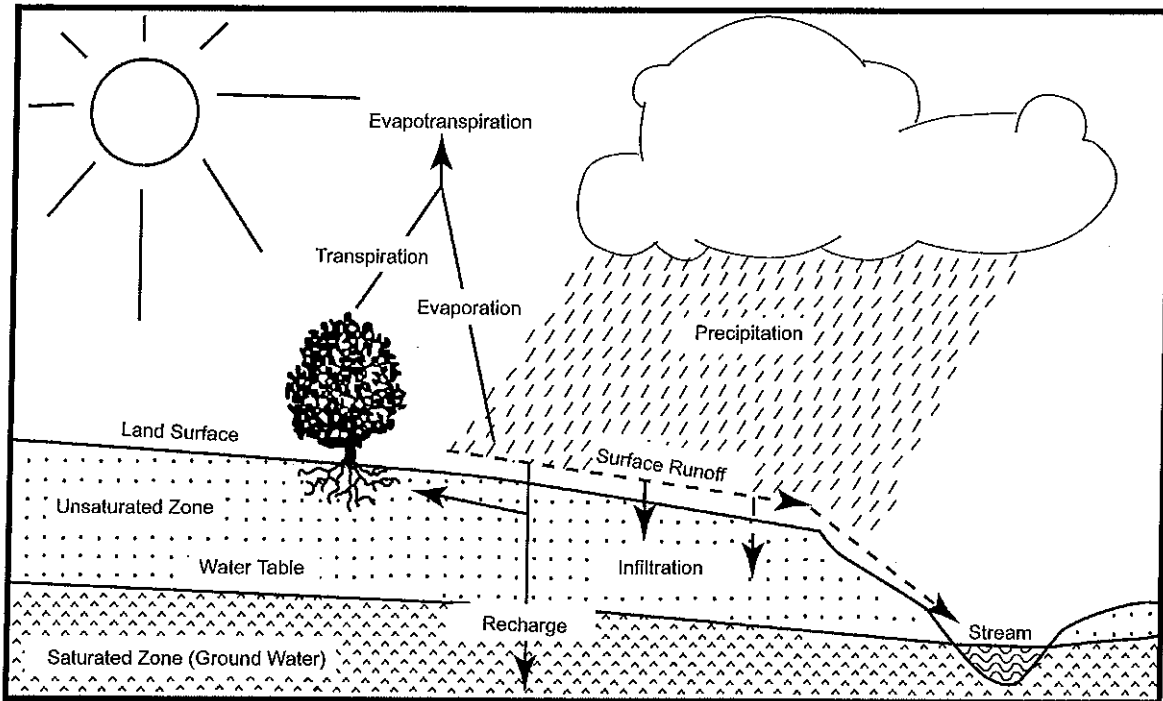
This goal shall be achieved by adoption of a Stormwater Management Ordinance which shall stipulate that all plans for “Major Development” shall reflect strict adherence to the design and performance standards for Stormwater Management Measures set forth under Subchapter 5, Design and Performance Standards for Stormwater Management Measures, Section 8, Maintenance Requirements and Subchapter 6, Safety Standards for Stormwater Management Basins, of the Stormwater Management Rules at N.J.A.C. 7:8. Applicants shall be required to provide a comprehensive Stormwater Management Facility Maintenance Manual as described under Chapter 8 of the “New Jersey Stormwater Best Practices Manual”. Maintenance of any existing stormwater management facilities shall remain the obligation of the parties currently responsible for the same.

III. Stormwater Discussion

Following is a brief description of the hydrologic cycle and how development affects the cycle.

Land development can dramatically alter the hydrologic cycle (See Figure 1) of a site and, ultimately, an entire watershed. Prior to development, native vegetation can either directly intercept precipitation or draw that portion that has infiltrated into the ground and return it to the atmosphere through evapotranspiration. Development can remove this beneficial vegetation and replace it with lawn or impervious cover, reducing the site’s evapotranspiration and infiltration rates. Clearing and grading a site can remove depressions that store rainfall. Construction activities may also compact the soil and diminish its infiltration ability, resulting in increased volumes and rates of stormwater runoff from the site. Impervious areas that are connected to each other through gutters, channels, and storm sewers can transport runoff more quickly than natural areas. This shortening of the transport or travel time quickens the rainfall-runoff response of the drainage area, causing flow in downstream waterways to peak faster and higher than natural conditions. These increases can create new downstream flooding, aggravate existing overflowing, create erosion problems, and increase the quantity of sediment in the channel. Filtration of runoff and removal of pollutants by surface and channel vegetation is eliminated by storm sewers that discharge runoff directly into a stream. Increases in impervious area can also decrease opportunities for infiltration which, in turn, reduces stream base flow and groundwater recharge. Reduced base flows and increased peak flows produce greater fluctuations between normal and storm flow rates, which can increase channel erosion. Reduced base flows can also negatively impact the hydrology of adjacent wetlands and the health of biological communities that depend on base flows. Finally, erosion and sedimentation can destroy habitat to a degree that some species can not adapt to it and result in elimination of those species.

Figure 1: Groundwater Recharge in the Hydrologic Cycle



Source: New Jersey Geological Survey Report GSR-32.

In addition to increases in runoff peaks, volumes, and loss of groundwater recharge, land development often results in the accumulation of pollutants on the land surface that runoff can mobilize and transport to streams. New impervious surfaces and cleared areas created by development can accumulate a variety of pollutants from the atmosphere, fertilizers, animal wastes, and leakage and wear from vehicles. Pollutants can include metals, suspended solids, hydrocarbons, pathogens, and nutrients.

In addition to increased pollutant loading, land development can adversely affect water quality and stream biota in more subtle ways. For example, stormwater falling on impervious surfaces or stored in detention or retention basins can become heated and raise the temperature of the downstream waterway, adversely affecting cold water fish species such as trout. Development can remove trees along stream banks that normally provide shading, stabilization, and leaf litter that falls into streams and becomes food for the aquatic community.

IV. Background

1. Community Description

The Borough of Cresskill is located in Bergen County, New Jersey, in the state's northeast corner. Within Bergen County, the Borough of Cresskill is located near its eastern extremity, in the County's northeast quadrant. The Borough encompasses approximately 2.06 square mile (1,318 acres). Cresskill has been, and remains today, a residential community of pre-dominantly small (1/4 acre) single family lots. A small section of moderately sized (1/3 acre) single family lots are located in the central portion of the Borough. Most of the newer development in the Borough is located east of County Road, and is characterized by larger homes on larger (i.e. approximately 1 acre) lots. These homes are located within the Tammy Brook Hills (100 Lot) residential Subdivision and Tamcrest Estates (34 Lot) residential subdivision.

Commercial development is located primarily in the central area of the Borough. The main retail shopping strip is located along Union Avenue, with some also occurring along County Road in the vicinity of Union Avenue. Upscale retail and other commercial developments are located along Piermont Road in the vicinity of Union Avenue, its minor side streets, and along Broadway in the vicinity of Piermont Road.

Commercial Office development occurs on Cresskill's three corners of Knickerbocker Road and Madison Avenue. Office land uses are also located in the vicinity of Union Avenue and County Road, Spring Street and County Road, along Broadway and Legion Drive.

The few Industrial land uses that remain within the Borough occur south of Broadway, adjacent to the Borough of Cresskill/Borough of Tenafly Municipal Boundary.

The number of Households in the Borough has increased steadily over the last forty years from 1,950 in 1960 to 2,630 in 2000.

In the last five years, two Major Subdivision projects have been constructed in the Borough. They include the aforementioned Tamcrest Estates Subdivision with approximately 31 Lots located within the Borough of Cresskill the Ridge Road (5 Lot) Subdivision. The 18 acre site located west of the railroad tracks and east of the Tenakill Brook was formerly occupied by the Hoke Corporation and is being redeveloped at this time. The project known as Cresskill Residential Communities is being constructed in three phases. Phase I has been completed and includes a 75 unit apartment complex. Phase II is currently under construction by the Sunrise Assisted Living Corporation and shall include a 160 unit Assisted Living/Congregate Care Facility. An 85 unit Senior Citizens residential condominium complex is to be constructed under Phase III of this project.

Taking into account the number of dwelling units cited above, the current (i.e. 2005) number of Households in the Township is estimated to be approximately 2,901.

2. Recent “Major Development”

As is noted hereinbefore, recent “major development” in the Borough of Cresskill is generally located east of County Road, in the vicinity of the Borough of Cresskill/Borough of Alpine Municipal Boundary, on lands which previously comprised the Tammy Brook Country Club and Golf Course.

Other “major development” in the Borough is actually re-development and includes the aforementioned Cresskill Residential Communities project and the recently approved Site Plan application by Samar a Arain under which application lands and buildings previously owned and occupied by the DiReese Sanitation Company shall be redeveloped to provide for Commercial (Retail, Bank Branch Office and General Office) uses where an Industrial Use once existed.

All residential Subdivision and Site Plan applications filed between January 6, 1997 and February 2, 2004, have been reviewed for consistency with the requirements set forth under Subchapter 7 (Stormwater Management) of the Residential Site Improvement Standards (RSIS). Thus, all Stormwater Management systems proposed during this period, have been sized and designed to incorporate under the developed condition, the mandatory reduction in peak flow rates required pursuant to Section 5:21-7.5 and Water Quality measures required pursuant to Section 5:21-7.6 of the RSIS.

The NJDEP has prepared maps showing the growth in developed use areas for all municipalities. The map showing the Borough’s growth from 1986 to 1995/97 can be accessed at http://www.state.nj.us/dep/gis/images/m4m/berco/creskl_b.html. A copy of this map is attached hereto as **Exhibit “A”**.

3. Open Space Acquisition

The Borough of Cresskill has become increasingly aware and proactive in its quest to preserve the remaining dwindling open spaces within its municipal boundaries and to provide enhanced recreational facilities. The Borough’s request for funding under the “Green Trust Planning Incentive” was recently approved by the NJDEP- Green Acres Program, allowing for the acquisition of the following properties for use as an Open Space and/or Recreational Resource:

- Historic House at 5 Cresskill Avenue, Block Lot
- Old house at 184 Piermont Road Block Lot and
- Old house at 190 Piermont Road, Block Lot

4. Primary Waterways and Bodies of Water

The Borough's primary waterways include the Cresskill Brook, the Demarest Brook and the Tenakill Brook. The Borough contains no major bodies of water but does have several "wet ponds" located throughout the "Rio Vista", "Tammy Brook Hills" and "Tamcrest Estates" subdivisions.

The Demarest Brook and Cresskill Brook originate in the Borough of Alpine. Both Brooks flow westerly across and through the Borough of Demarest, and then enter the northerly limits of the Borough of Cresskill at points located more or less in the center limits of the Borough. These waterways flow in a south and westerly direction through the Borough of Cresskill and ultimately discharge into the Tenakill Brook.

The Tenakill Brook originates in the Borough of Tenafly and flows in a northerly direction. The Tenakill Brook traverses through the central portion of the Borough of Cresskill, flowing in a northerly direction into and through the Borough of Demarest, ultimately discharging to the Dwars Kill in the Borough of Closter, which is part of the Oradell Reservoir System.

The Tenakill Brook is a sub-watershed to the Hackensack River Watershed, in Watershed Management Area (WMA) 5. New Jersey has been divided into 20 Watershed Management Areas. WMA 5, in the northeast region, includes parts of Bergen and Hudson Counties and has a drainage area of 165 square miles and contains the Hudson River Watershed, the Pascack Brook Watershed and the Hackensack River Watershed.

In addition to these principal waterways, there are also unnamed tributaries to the Cresskill Brook located in the northeasterly section of the Borough. These waterways originate at the "wet ponds" located within the "Rio Vista", "Tammy Brook Hills" and "Tamcrest Estates" residential subdivision projects. Each of the "wet pond" systems are hydraulically connected by pipes or open channels. Outflow from the "Rio Vista" system flows in a westerly direction toward Hillside where it is collected and conveyed within a piping network through the Academy of the Holy Angels property, discharging to an existing pond along the Cresskill Brook, located in the rear of the school property. Outflows from the wet pond systems located within the "Tamcrest Estates" and "Tammy Brook Hills" subdivisions also flows within an open channel, in a westerly direction toward Hillside Avenue. This tributary then continues to flow as an open channel passing below Hillside Avenue and Churchill Road in the Borough of Cresskill and then becomes piped just beyond its point of entry at the Borough of Demarest and ultimately discharges to the Cresskill Brook at Spruce Place.

The locations of the primary and secondary waterways within the Borough of Cresskill are as indicated or as schematically superimposed (by this office) on the following Exhibits:

- **Exhibit "B"** – Borough of Cresskill Waterway Map
- **Exhibit "C" 4** - USGS Quadrangle Map Depicting the Borough of Cresskill Corporate Limits, Bergen County, New Jersey.

Aerial topographic drawings entitled "Topographic Mapping in the Northern Valley" dated January 19, 1977, as prepared by the Engineering Division, DPW, Bergen County New Jersey were utilized to locate the unnamed tributaries and to superimpose their approximate locations schematically on the Borough of Cresskill Waterway Map.

5. Brook Improvement Projects

The Tenakill Brook, Cresskill Brook and Demarest Brook were last cleaned and de-snagged in late 1979 and early 1980 pursuant to Permit No. 8873 dated November 19, 1979, as issued by the State of New Jersey Department of Environmental Protection, Division of Water Resources, Bureau of Flood Plain Management Resources.

Channel velocities within the Tenakill Brook, Cresskill Brook and Demarest Brook tend to be relatively low and for this reason bank erosion has not been a major problem in the Borough of Cresskill.

The Delmar Avenue Bridge over the Cresskill Brook was severely damaged by flooding caused by Tropical Storm Floyd. This structure was reconstructed in 2000 to its original cross section and design, pursuant to an emergency permit waiver issued by the NJDEP on February 7, 2000 under Stream Encroachment File No. 0208-99-0001.1 (SE EP) and Freshwater Wetlands File No. 0208-99-0001.2 (FW EP).

As part of the reconstruction effort, approximately 205 LF of gabion wall bank stabilization was installed at the upstream approach to the bridge, while approximately 160 LF of gabion walls were installed along the channels banks at the downstream side of the culvert.

The Borough also recently obtained from the NJDEP, Stream Encroachment Permit No. 0208-04-0001.1 FHA-0400 and Freshwater Wetlands General Permit No. 10A authorizing the construction of an in-kind replacement of the 54 feet long by 14'-9" wide concrete culvert at the Morningside Avenue crossing of the Cresskill Brook. This project will also include the construction of approximately 12 LF of gabion wall stabilization on each side of the channel at the upstream and downstream faces of the culvert structure. It is anticipated that this project shall commence in the summer or early fall months of 2005.

6. Principal Flood Problems

Flooding can occur during any season of the year since New Jersey lies within the major storm tracks of North America. The worst storms, however, have occurred in the summer or early fall when tropical disturbances are most prevalent.

Overflows of Cresskill Brook have affected Delmar Avenue and Morningside Avenue, causing significant long-term damage to the superstructure elements of the existing culvert crossings located along the same. These conditions were exacerbated by flood flows associated with Tropical Storm Floyd, resulting in the need for the short-term replacement of these structures to limit the possibility for the loss of life or damage to real and personal property.

With the exception of the need for the above noted culvert replacements, the Borough has not experienced what would be considered major flood damage. Flooding along the Tenakill Brook has affected residences, the Public High School, the Department of Public Works Garage, the Third Street athletic fields and local roadways, especially the northerly limits of Piermont Road (at or about South Street) which can become impassible during severe rainfall events.

Flooding resulting from Tropical Storm Floyd in September 1999 was a notable exception. The inundation was extensive and covered the area from the Cresskill/Demarest boundary, in a southerly direction to Allen Street (approximately length 1,600 feet) and from the rear yard areas along Pierce Avenue, across the high school property to points located approximately 500 feet east of Piermont Road (approximate width 1,700 feet). The pedestrian bridge at the South Street crossing of the Tenakill Brook was destroyed in this flood has not yet been replaced.

Limited areas adjacent to Cresskill, Demarest and Tenakill Brook are situated within the 100 Year Floodplain and/or Limits of the Flood Hazard Design Flood Area. These floodplains are shown on both the Flood Insurance Rate Maps (FIRM) as published by the Federal Emergency Management Agency (FEMA) and maps published by the State of New Jersey Department of Environmental Protection .

FIRM Panels 203, 204, 210, 211, 212, and 220 of 223, dated September 1995, have been adopted by the Borough as part of its Flood Damage Prevention Code, and are used to identify the flood hazard area within the Borough.

Limited areas adjacent to the Tenakill Brook, Cresskill Brook and Demarest Brook are situated within the 100 Year Flood and Flood Hazard Area, as shown on maps entitled:

- “State of New Jersey, Department of Environmental Protection, Division of Water Resources, Delineation of Floodway & Flood Hazard Area, Borough of Demarest, Borough of Cresskill, N.J., Bergen County, Tenakill Brook”, Plate Nos. 2 and 3 of 3,
- “State of New Jersey, Department of Environmental Protection, Division of Water Resources, Delineation of Floodway & Flood Hazard Area, Borough of Demarest, Borough of Cresskill, N.J., Bergen County, Cresskill Brook”, Plate No 1 of 1 and
- “State of New Jersey, Department of Environmental Protection, Division of Water Resources, Delineation of Floodway & Flood Hazard Area, Borough of Cresskill, Demarest, N.J., Bergen County, Demarest Brook”, Plate No 1 of 1,

all as prepared by Leonard Jackson Engineers of Spring Valley, N.Y., dated August 1980.

V. Water Quality Discussion

Category One Waters, also known as " C1 waters" are designated in New Jersey's rules for Surface Water Quality Standards (N.J.A.C. 7:9B-1.4) "for protection from measurable changes in water quality characteristics because of their clarity, color, scenic setting, other characteristics of aesthetic value, exceptional ecological significance, exceptional recreational significance, exceptional water supply significance or exceptional fisheries resources". NJDEP has proposed special water resource protection areas to protect Category One Waters in the Stormwater Management Rules, N.J.A.C. 7:8 as published in the January 6, 2003, New Jersey Register. This special water resource protection area requires that a 300 ft buffer zone be established for Category One Waters and perennial or intermittent streams that drain into or upstream of the Category One Waters to the Hydrologic Unit Code (HUC) 14 boundary. Sub-watersheds designated as HUC 14, are the smallest watersheds mapped by the NJDEP and the USGS, with each covering only approximately 3,000 acres. The USGS calls the watersheds Hydrologic Units. Each basic unit is a unique feature, and is given a unique Hydrologic Unit Code (HUC), which is 14 digits long. The HUC is hierarchical. Larger and larger watersheds can be defined using different portions of the 14 digit code to define the watershed boundaries.

On May 19, 2003, the Department adopted amendments to upgrade the antidegradation designations for fifteen waterbodies under Amendment: N.J.A.C. 7:9B-1.15 (R1-C1 Adoption). Of the fifteen, six waterbodies were upgraded to Category 1 based on an integrated ecological assessment conducted by the Department to determine "exceptional ecological significance", while nine water supply reservoirs were designated as Category 1 based on their "exceptional water supply significance". Oradell Reservoir is included among these water supply reservoirs. The USEPA approved these amendments on October 1, 2003. On August 2, 2004, the Department adopted amendments N.J.A.C. 7:9B-1.15 (R3-C1 Adoption), to upgrade the antidegradation designation for seven streams including both

named and unnamed tributaries based upon "exceptional ecological significance". These streams include Tenakill Brook and its tributaries Cresskill and Demarest Brooks. The adopted amendments and maps can be accessed at the following Department's websites:
<http://www.state.nj.us/dep/wmm/sgwqt/amendsummary.html>
<http://www.state.nj.us/dep/wmm/sgwqt/hackpasc.pdf>.

The New Jersey Department of Environmental Protection (NJDEP) has established an Ambient Biomonitoring Network (AMNET) to document the health of the state's waterways. There are about 820 AMNET sites throughout the state of New Jersey. These sites are sampled for benthic macroinvertebrates (bottom dwelling organisms visible to the naked eye) by NJDEP on a five-year cycle. The health of instream benthic macroinvertebrate communities is evaluated using a USEPA-developed statistical methodology referred to as Rapid Bioassessment Protocol (RBP). The results of this new program have been incorporated into the National Environmental Performance Partnership System (NEPPS) as a primary environmental indicator of water quality impairment. Streams are classified as non-impaired, moderately impaired, or severely impaired based on the AMNET data. The data is used to generate a New Jersey Impairment Score (NJIS) which is based on a number of biometrics related to benthic macroinvertebrate community dynamics. AMNET reports of results are published by the bureau annually; copies are available from the NJDEP's web site <http://www.state.nj.us/dep/wmm/bfbm/publications.html>. The chemical and biological data will be available from STORET, <http://www.epa.gov/storet/dbtop.html>, EPA's computerized data system. The AMNET site on Tenakill Brook, study designation AN0209, is located at Cedar Lane at Closter, at 40° 58' 42.631" N, 73° 58' 02.310" W, and was rated as **severely impaired**.

In addition to the AMNET data, the NJDEP and other regulatory agencies collect water quality chemical data on the streams in the state. Data available includes Tenakill Brook at Cedar Lane at Closter, State Site ID 01378387, 5-TEN-2, and Tenakill Brook on Grant Ave, Cresskill, State Site ID 5-TEN-1. These data show that the instream total arsenic and fecal coliform concentrations of Tenakill Brook at Cedar Lane at Closter, frequently exceed the state's criteria. This means that the Brook at this location is considered to be an impaired waterway and the NJDEP is required to develop a Total Maximum Daily Load (TMDL) for these pollutants.

A TMDL is the amount of a pollutant that can be accepted by a waterbody without causing an exceedance of water quality standards or interfering with the ability to use a waterbody for one or more of its designated uses. The allowable load is allocated to the various sources of the pollutant, such as stormwater and wastewater discharges, which require a NJPDES permit to discharge, and nonpoint source, which includes stormwater runoff from agricultural areas and residential areas, along with a margin of safety. Provisions may also be made for future sources in the form of reserve capacity. An implementation plan is developed to identify how the various sources will be reduced to the designated allocations. Implementation strategies may include improved stormwater treatment plants, adoption of ordinances, reforestation of stream corridors, retrofitting stormwater systems, and other Best Management Practices (BMP's).

The New Jersey Integrated Water Quality Monitoring and Assessment Report, is the combination of "Water Quality Inventory Report"[305(b) Report] , and "List of Water Quality Limited Waters" [303(d) List]. The "305(b) Report" contains assessments of water quality of that state's waters as per their support of designated uses and attainment of water quality standards. It also includes the descriptions of water resources management programs. The "303d list," identifies river, lake, and coastal waters that do not achieve the state's surface water quality standards, and the reasons for impairment. The integrated report is required by the federal Clean Water Act to be prepared biennially by each state for the US Environmental Protection Agency (USEPA) and is a valuable source of water quality information. This report presents the extent to which New Jersey waters are attaining water quality standards, and identifies waters that are impaired. Tenakill Brook at Cedar Lane at Closter appears under Sublists 4 and 5 of the 2004 Integrated List of Waterbodies. Under the 2004 Sublist 5, Tenakill Brook at Cedar Lane at Closter is indicated as having Benthic Macroinvertebrates Non-Attainment impairment with a low priority rank at site ID AN0209, and Arsenic as a Non-Attainment parameter with a high ranking priority at Site ID 01378387. A response to TMDL is required. The Sublist 5 in 2002 included also Fecal Coliform. The TMDL for Fecal Coliform has been completed and therefore this parameter was moved to Sublist 4a. Waterways are listed on Sublist 4a once the TMDL has been developed and approved by USEPA that, when implemented, is expected to result in full attainment of the standard.

A study for Tenakill Brook has been initiated by Bergen County. The Advisory Committee, which meets monthly, includes a Technical Advisory Committee, an Open Space Committee and an Education and Outreach Committee. The Tenakill was chosen as the first priority stream segment within WMA 5 because it drains to the Oradell Reservoir. The study will gather and analyze available data on the Tenakill, identify data gaps, collect water samples and based on the results recommend future work and actions needed to ensure the Tenakill's water quality.

There are no other documented water quality or stream health problems specifically known by the Municipality at this time. The Environmental Commission, with the help of volunteers including local high school students, has completed several litter and debris clean-up projects on Borough parkland and other municipally owned properties.

VI. Groundwater Recharge & Wellhead Protection Areas

There is no evidence of decrease either in groundwater recharge or base flows in streams during dry weather periods. Lower base flows can have a negative impact on in-stream habitat during the summer months. Ground-water recharge is estimated using the NJGS methodology from NJ Geological Survey Report GSR-32 "A Method for Evaluation of Ground-Water-Recharge Areas in New Jersey. Land-use/land-cover, soil and municipality-based climatic data were combined and used to produce an estimate of ground-water recharge in inches/year. There is no existing groundwater assessment for the Borough. A map of the groundwater recharge areas is attached hereto as **Exhibit "D"**.

A Well Head Protection Area (WHPA) in New Jersey is a map area calculated around a Public Community Water Supply (PCWS) well in New Jersey that delineates the horizontal extent of ground water captured by a well pumping at a specific rate over a two, five, and twelve-year period of time. The area of capture over two, five, and twelve years is defined using line boundaries and polygon areas generated with Geographic Information System (GIS). WHPA delineations are conducted in response to the Safe Drinking Water Act Amendments of 1986 and 1996 as part of the Source Water Protection Program (SWPP).

Potable water service for the residents of the Borough is provided by United Water New Jersey. As such, there are no Public Community Water Supply wells located within the limits of the Municipality. The adjoining communities of Alpine, Demarest, Tenafly and Dumont are also serviced by this Public Utility Company.

Absent Public Community Water Supply wells in the Borough of Cresskill and the abutting Municipalities, Wellhead Protection Areas are not required in the Borough of Cresskill. A Wellhead Protection Area Map, illustrating the absence of any Public Community Water Supply in the Borough and surround communities is attached hereto as **Exhibit "E"**.

VII. Design and Performance Standards

The Borough of Cresskill will adopt the design and performance standards for stormwater management measures as presented in N.J.A.C. 7:8-5 to minimize the adverse impact of stormwater runoff on water quality and water quantity and loss of groundwater recharge in receiving water bodies. The Borough of Cresskill design and performance standards shall include the appropriate language for maintenance of stormwater management measures consistent with the stormwater management rules at N.J.A.C. 7:8-

5.8: "Maintenance Requirements", and language for safety standards consistent with N.J.A.C. 7:8-6 "Safety Standards for Stormwater Management Basins".

The Borough shall review its Master Plan and Ordinances, and shall modify all references to Stormwater Management in the Borough Land Development and Zoning Ordinances, to incorporate the abovementioned design and performance standards. Once the ordinance texts are completed, they will be submitted to the County review agency for review and approval within 24 months of the effective date of the Stormwater Management Rules. A copy will be sent to the New Jersey Department of Environmental Protection at the time of submission. Portions of Chapter 132 (Flood Damage Prevention), Chapter 201 (Property Maintenance, Nonresidential), Chapter 202 (Property Maintenance, Residential and Nonresidential), Chapter 218 (Site Development Plan), Chapter 234 (Subdivision of Land) and Chapter 275 (Zoning) of the Borough Code, pertaining to Stormwater Management, shall be modified as necessary to ensure strict compliance with the Standards set forth under the Stormwater Management rules at N.J.A.C. 7:8.

Impervious coverage limitations were established in 2002 for the Borough's Residential Zoning Districts. Applications for Development are carefully reviewed to ensure conformance with these regulations. Projects are then carefully monitored during the construction phase to ensure that the impervious coverage is no greater than that which was approved and to ensure that the stormwater management facilities are constructed properly and function as contemplated in the original design.

The Borough shall encourage to the maximum extent practicable, the standards in N.J.A.C. 7:8-5.4 and 5.5 shall be met by incorporating nonstructural stormwater management strategies as enumerated under N.J.A.C. 7:8-5.3 into a Site Plan or Subdivision design.

VIII. Plan Consistency

The Borough is not within a Regional Stormwater Management Planning Area. Therefore, this plan does not need to be consistent with any regional stormwater management plans (RSWMPs). If any RSWMPs are developed in the future, this Municipal Stormwater Management Plan will be updated to be consistent with any such Plan.

The NJDEP has a TDML in place for Tenakill Brook at Cedar Lane located in Closter. No plans for reduction of Fecal Coliform have been established yet. However, as mentioned under the "Background" section of this Plan, a study for Tenakill Brook has been initiated by the County of Bergen. The study will gather and analyze available data on the Tenakill, identify data gaps, collect water samples and based on the results recommend future work and actions required to enhance the water quality aspect of the

Tenakill Brook. This MSWMP will be updated, as required, to incorporate the Advisory Committee's recommendations for improvement of the water quality at the Tenakill Brook and its two tributaries; the Cresskill Brook and the Demarest Brook.

The New Jersey Department of Environmental Protection recently (i.e. Effective Date August 2, 2004) adopted certain amendments of the Surface Water Quality Standards (SWQS), N.J.A.C. 7:9B. The SWQS govern the protection and enhancement of surface water quality and resources of the State of New Jersey. The rules include stream classifications (comprised of a use classification and an antidegradation designation), policies (including antidegradation policies) and water quality criteria for conventional and toxic pollutants applicable to all of the surface waters of the State. Pursuant to the August 2, 2004 amendment, the antidegradation designation for natural drainage to the Oradell Reservoir was upgraded to Category One (C1) based upon "exceptional water supply significance".

As required pursuant to N.J.A.C. 7:8-5.5(h), Special Water Resource Protection Areas (SWRPA) shall be established along all waters designated Category One at N.J.A.C. 7:9B and perennial or intermittent streams that drain into or upstream of the Category One waters as shown on the USGS Quadrangle Maps or County Soil Surveys, within the associated HUC14 drainage basin.

Given the fact that all "natural drainage" located in the Borough of Cresskill, including but not limited to the Tenakill Brook and its named or un-named tributaries, Cresskill Brook and its named or un-named tributaries and Demarest Brook and its named or un-named tributaries, are tributary to the Oradell Reservoir, the same are classified as a C1 waterways, requiring the establishment of Special Water Resource Protection Areas (SWRPA), along the same.

This Municipal Stormwater Management Plan is consistent with the Residential Site Improvement Standards (RSIS) at N.J.A.C. 5:21. The Borough of Cresskill will utilize the most current edition of the RSIS when reviewing the Stormwater Management Plans for all Applications for Residential Development. This Municipal Stormwater Management Plan will be updated to be consistent with any future updates to the RSIS.

The Borough of Cresskill Stormwater Management Ordinance shall require all new development and redevelopment plans to comply with the State of New Jersey Soil Erosion and Sediment Control Standards. During construction, Members of the Borough Engineers staff will observe the installation and continued maintenance of all required on-site soil erosion and sediment control devices. For projects under the jurisdiction of the Borough Engineer, Developers shall be directed to complete the necessary remedial repairs in a timely manner or be subject to a "Stop Work Order". For those projects under the purview of the Bergen County Soil Conservation District, any irregularities observed by the Borough Engineer's staff shall be reported to said Agency for the necessary enforcement action.

IX. Nonstructural Stormwater Management Strategies

The Borough of Cresskill will adopt Nonstructural Stormwater Management Strategies as promulgated under N.J.A.C. 7:8-5.3(b). To incorporate these strategies the Borough has reviewed its Land Development Ordinances and shall in the future review and amend its Master Plan, as required. Chapter 132, entitled “Flood Damage Prevention”, Chapter 201, entitled “Property Maintenance, Nonresidential”, Chapter 202, entitled “Property Maintenance, Residential and Nonresidential”, Chapter 218, entitled “Site Development Plan”, Chapter 230 entitled “Streets and Sidewalks”, Chapter 234 entitled “Subdivision of Land” and Chapter 275 entitled “Zoning” were reviewed with regard to the incorporation of nonstructural stormwater management strategies. Once the ordinance texts are completed, they will be submitted to the County review agency for review and approval within 24 months of the effective date of the Stormwater Management Rules. A copy will be sent to the Department of Environmental Protection at the time of submission.

Following is a summary of the possible Code revisions:

CHAPTER 132 “Flood Damage Prevention”

The Borough shall consider amending this Chapter of the Borough Code such that reference is made to the more conservative Delineation of Floodway & Flood Hazard Area Maps” as prepared by the State of New Jersey Department of Environmental Protection, as opposed to the FEMA Flood Insurance Rate Maps (FIRM). A new section shall be added establishing the Special Water Resource Protection Area (SWRPA) at Category 1 waterways.

CHAPTERS 201 “Property Maintenance, Nonresidential”

CHAPTERS 202 “Property Maintenance Residential and Nonresidential”

A new Section entitled “Maintenance of Stormwater Management Facilities” may be added to these Chapters. The Borough Code under Chapters 201 and 202 mandates proper maintenance of premises including the exterior. These codes indicate the terms for inspection, detail the procedure to enforce actions, and list the penalties for not meeting the codes. No specific reference to Stormwater Management Facilities is made in either Chapter, although the lack of maintenance of these facilities could be found to be a hazard as identified under Chapter 201 Section 13.E., “Recurring of accumulation of stormwater”, or classified as a “Nuisance” as defined under Chapter 202, if such facilities are not maintained properly. Any additions to the Code shall make reference to the design and performance standards for Stormwater Management Measures set forth under Subchapter 5, Design and Performance Standards for Stormwater Management Measures, Section 8, Maintenance Requirements and Subchapter 6, Safety Standards for Stormwater Management Basins, of the Stormwater Management Rules at N.J.A.C. 7:8.

CHAPTER 218 “Site Development Plan”

Subsection. 218-15. Buffering. Describes the elements that may be used for buffering. The Borough shall consider amending this section to recommend the use of native vegetation at buffer strips. Additionally, language will be included to allow buffer areas to be used for stormwater management by disconnecting impervious surfaces and treating runoff from these impervious surfaces.

Subsection 218-16. Landscaping. Describes the locations and the materials to be used for landscaping. The Borough shall consider amending this section to recommend the use of native vegetation for proposed landscaping.

Subsection 218-19. Environmental considerations. Requires the plan to minimize any adverse impact to environmental elements, including preservation of trees. The Borough shall consider amending this section to expand the definition of trees to include forested/wooded areas, to ensure that leaf litter and other beneficial aspects of the forest are maintained in addition to the trees.

Subsection 218-23.B.(9). Landscaping and Drainage. Describes the essential landscaping and drainage requirements for parking areas. The Borough shall consider amending this section to require the use of nonstructural stormwater management strategies as defined under N.J.A.C. 7:8-5.3, to the maximum extent practicable

Subsection 218-23.F. Paving of Driveways. Describes the requirement for a paved driveway in residential areas. The Borough shall consider amending this section to allow the use of pervious paving materials to minimize stormwater runoff and to promote groundwater recharge.

Subsection 218-26. Landscaping. Indicates the design principles for landscaping. The Borough shall consider amending this section to include recommendation for the use of native vegetation for landscaping, and the use of these areas for stormwater management by disconnecting impervious surfaces and treating runoff from these impervious surfaces.

Subsection 218-28. Environmental Considerations. The second sentence of this Subsection shall be amended to include specific reference to the Design and Performance Standards as set forth under the Stormwater Management Ordinance.

CHAPTER 230 “Streets and Sidewalks”

Section 230-57. Drains. Requires all streets to be provided with inlets and storm sewers and other drainage appurtenances where the same are necessary for proper drainage. The Borough shall consider amending this section to encourage the use of natural vegetated swales in lieu of inlets and pipes. Any additions to the Code shall make reference to Subchapter 5, Design and Performance Standards for Stormwater Management Measures, of the Stormwater Management Rules at N.J.A.C. 7:8.

Section 230-56. Sidewalk materials and width. This section indicates that paved sidewalks shall be constructed of four inch concrete material. The Borough shall consider

amending this section to allow for sidewalks to be constructed with pervious material, where feasible.

CHAPTER 234 "Subdivision of Land"

Subsection 234-38. General Provisions. Describes the general requirements of design standards for subdivision of land. Language will be added to this section to require that stormwater management facilities shall conform to Subchapter 5, Design and Performance Standards for Stormwater Management Measures, of the Stormwater Management Rules at N.J.A.C. 7:8.

Subsection 234-40. Streets. M. This section requires that cul-de-sacs have a minimum radius of 50 feet. The Borough, where feasible, will consider allowing cul-de-sacs of reduced radii and/or encourage the landscaping of the center section of the same.

CHAPTER 275 "Zoning"

Subsection 275-66 Landscaping-General Provisions, Item B and Item C. These paragraphs set forth the requirements for buffer zones/areas, adjacent to different zoning districts. The Borough shall consider amending these paragraphs to recommend the use of native vegetation. Additionally, the Borough shall consider adding language to allow buffer areas to be utilized for stormwater management purposes by disconnecting impervious surfaces and treating runoff from the impervious surfaces within the confines of the buffer area. This same language shall apply to other Zoning Districts in the Borough and shall therefore be added to the following sections of the Code 275-81.D, 275-85.C, and 275-108.C, encouraging the placement of nonstructural stormwater management measures in buffer zone areas.

Subsection 275-69.F. Drainage and surfacing. This paragraph describes the requirements for drainage of parking areas and surface course requirements. This Section may be modified to encourage the use of pervious surfaces within proposed parking areas.

Subsection 275-81.H. Landscaping (Townhouse Residential Zone) This paragraph describes the landscaping regulations in Townhouse Residential Zone. The Borough shall consider amending this section to recommend the use of native vegetation and to retain the existing vegetation to the maximum extent practicable.

Sub-section 275-85.C. Buffer areas. (Affordable Housing Contributing Zone) This paragraph describes the manner in which buffer areas shall be landscaped. The Borough shall consider amending this section to recommend the use of native vegetation and to retain the existing vegetation to the maximum extent practicable.

Subsection 275-108. Design Standards. C.-This paragraph requires a landscaped buffer in the Planned Unit Residential Development (PURD). The Borough shall consider amending this paragraph to recommend the use of native vegetation within the buffer area.

Possible Code Additions

The Borough may consider amending its Code to include new Chapters for the following items:

1. **Stream Corridor Protection** - The Borough shall consider the adoption of an Ordinance creating a Green Corridor along the Tenakill Brook, as recommended under the Land Use Plan Element of the Master Plan Revision and Reexamination Report prepared for the Borough of Cresskill by Hakim Associates.
2. **Tree Preservation and Removal.** - The Borough shall consider the adoption of an Ordinance regulating the removal of the existing tree stock on both public and privately-owned lands. The ordinance may consider the preservation of forested areas and mandate that replacement trees be planted on-site or elsewhere within the Borough, at a specified ratio commensurate with the number of trees removed from a site.

X. Land Use/Build-Out Analysis

The NJDEP has prepared a detailed land use mapping for the Borough of Cresskill. This mapping is based on 1995/97 GIS information and is attached hereto as **Exhibit "F"**. As indicated therein, there is no land area within the Borough of Cresskill currently utilized for agricultural purposes or recognized as "Barren Land".

A more detailed land use analysis for the Borough was conducted in conjunction with the preparation of the Master Plan Revision And Reexamination Report wherein it is stated that the Borough has no lands used for agricultural purposes and that there is approximately ten (10) acres of undeveloped land remaining within the Borough.

The new regulations specify that if a municipality has a combined total of less than one square mile (i.e. 640 acres) of vacant or agriculture lands, the municipality is not required to provide a build-out analysis.

Given this limited area, the Borough of Cresskill does not require a Land Use/Build-Out Analysis in connection with the preparation of this Plan.

Exhibit "G", depicts the HUC14's within the Borough of Cresskill. The Borough of Cresskill Zoning Map is attached hereto as **Exhibit "H"**. **Exhibit "I"** depicts the Wetlands and Water Land Uses (i.e. constrained land uses), located within the Borough.

XI. Mitigation Plans

Criteria for possible mitigative action are contemplated herein for a proposed development that is granted a variance or exemption from the Stormwater Management design and performance standards.

Mitigation Project Criteria

1. Any proposed mitigation project shall be implemented in the same drainage area as the proposed development. The project must provide additional groundwater recharge benefits, or protection from stormwater runoff quality and quantity from previously developed property that does not currently satisfy the design and performance standards outlined in the Municipal Stormwater Management Plan. The developer must ensure the long-term maintenance of the project, including the maintenance requirements under Chapters 8 and 9 of the NJDEP Stormwater Best Management Practices Manual.
 - a. At the discretion of the Governing Body, the following locations may be considered as possible sites for the implementation of a proposed Mitigation Plan. More detailed information on the projects can be obtained from the Borough Engineer. Listed below are specific sites that can be used to address the mitigation requirement.

Groundwater Recharge

The open space in the following listed sites may be used for installation of seepage pits to provide additional annual groundwater recharge from the roof areas of the following buildings:

- The Public Library
- Municipal Building
- Senior Citizen Center
- Ambulance Corp. Building,
- DPW Garage
- Fire Station
- Third Street Recreation Area

Water Quality

The parking areas in the following listed sites may be retrofitted to provide the removal of 80 percent of total suspended solids. Due to site constraints, the retrofit BMP has to be installed underground in order to maintain the existing number of parking spaces. The type of manufactured treatment device utilized will be selected based on a comparison of past performance,

effectiveness, cost of device, and maintenance costs associated with the same.

- Municipal Building
- Senior Citizen Center
- Ambulance Corp. Building,
- DPW Garage
- Fire Station
- Third Street Recreation Area

Debris Filters such as Containment Booms or Filter Bags may be installed at existing piped outfalls along the Tenakill Brook, Cresskill Brook and Demarest Brook to prevent solids and/or “floatables” from entering these waterways.

Geese Management Measures may be implemented at the Third Street Park, Bryan School Fields, Margie Avenue Playfields and Ackerman Place Field.

Water Quantity

A Stormwater Management system consisting of a subsurface retention/detention system may be installed in the parking area of the following sites to reduce the peak flow from the upstream development on the receiving stream for the 2, 10, and 100 years storms as required:

- Municipal Building
- Senior Citizen Center
- DPW Garage
- Fire Station
- Ambulance Corp. Building

2. The sites listed above may be used also if they are not located in the same drainage area as the proposed development, as discussed in Option 1. Under this scenario, the mitigation project may provide mitigation that is not equivalent to the impacts for which the variance or exemption is sought, but that addresses the same issue. For example, if a variance is given because the 80 percent TSS requirement is not met, the selected project may address water quality impacts due to a fecal impairment.

The Borough may allow a developer to provide funding or partial funding to the municipality for an environmental enhancement project that has been identified in a Municipal Stormwater Management Plan, or towards the development of a Regional Stormwater Management Plan. The funding must be equal to or greater than the cost to implement the mitigation outlined above, including costs associated with purchasing the property or easement rights for mitigation, and the cost associated with the long-term maintenance requirements of the mitigation measure.

XII. Bibliography and References

Data sources reviewed in connection with the preparation of this Stormwater Management Report are as follows:

1. The Bergen County GIS, <http://gis.co.bergen.nj.us/website/viewer1/viewer.htm> as to Exhibit "B".
2. NJDEP site <http://www.state.nj.us/dep/gis/newmapping.htm> as to Exhibits "A", "D", "E", "F", "G", and "I".
3. New Jersey 3-D TopoQuads, as published by DeLorme, as to Exhibit "C".
4. "Zoning Map, Borough of Cresskill, Bergen County, New Jersey" (Exhibit "H"), as prepared by Azzolina Engineering Company of Paramus.
5. 1"=100' Scale Aerial Topographic Maps entitled "Topographical Mapping in the Northern Valley.", dated January 19, 1977, consisting of 17 Sheets, as jointly prepared by Aerial Data Reduction Associates, of Pennsauken, New Jersey and the Engineering Division, D.P.W., Bergen County, New Jersey.
6. Tax Assessment Map, Borough of Cresskill, Sheet Nos. 1 thru 16.
7. "State of New Jersey, Department of Environmental Protection, Division of Water Resources, Delineation of Floodway & Flood Hazard Area, Borough of Cresskill, New Jersey, Bergen County, Tenakill Brook", Plate Nos. 2 and 3 of 3, dated August 1980, as prepared by Leonard Jackson Associates, of Spring Valley, N.Y.
8. "State of New Jersey, Department of Environmental Protection, Division of Water Resources, Delineation of Floodway & Flood Hazard Area, Borough of Cresskill, Borough of Demarest, N.J., Bergen County, Demarest Brook", Plate Nos. 1 of 1, dated August 1980, as prepared by Leonard Jackson Associates, of Spring Valley, N.Y.
9. "State of New Jersey, Department of Environmental Protection, Division of Water Resources, Delineation of Floodway & Flood Hazard Area, Borough of Cresskill, Borough of Demarest, N.J., Bergen County, Cresskill Brook", Plate Nos. 1 of 1, dated August 1980, as prepared by Leonard Jackson Associates, of Spring Valley, N.Y.
10. Flood Insurance Study (FIS) and Flood Insurance Rate Maps (FIRM): Nos. 34003C0203, 34003C0204, 34003C0210, 34003C0211 34003C0212 and 34003C0220, dated September 1995 as published by the Federal Emergency Management Association (FEMA).

11. 2003 Bergen County Data Book, as prepared by the Bergen County Department of Planning And Economic Development, Division pf Data Resources and Technology.
12. Code of the Borough of Cresskill, latest edition.
13. Master Plan Revision and Reexamination Report, dated November 2004, as prepared by Hakim Associates in Association with Stuart Turner & Associates

XIII. Abbreviations

AMNET - Ambient Biomonitoring Network

BMP- Best Management Practices

C1 - Category One waters, designated for purposes of implementing the antidegradation policies set forth at N.J.A.C. 7:9B-1.5(d).

FEMA - Federal Emergency Management Agency

FIRM - Federal Insurance Rate Maps

FW1 - Fresh waters as designated in N.J.A.C. 7:9B-1.15h.

FW2 - General surface water classification applied to those fresh waters that are not designated as FW1 or pineland waters.

HUC- Hydrologic Unit Code

GIS - Geographic Information System

MSWMP-Municipal Stormwater Management Plan

NJDEP - The New Jersey Department of Environmental Protection

NJIS - New Jersey Impairment Score

NT- "Nontrout waters" means fresh waters that have not been designated in N.J.A.C. 7:9B-1.15(b) through (h) as trout production or trout maintenance.

RSIS - Residential Site Improvement Standards

RSWMP- Regional Stormwater Management Plan

PCWS - Public Community Water Supply

PURD - Planned Unit Residential Development

SWPP- Source Water Protection Program

SWMP- Stormwater Management Plan

TMDL - Total Maximum Daily Load

USEPA – United States Environmental Protection agency

USGS - United States Geological Survey







WHPA - Well Head Protection Area

EXHIBITS "A" THRU "I"

Cresskill Boro, New Jersey Showing Growth in Developed Use Areas from 1986 to 1995/97



Legend

-  Municipal Boundary
-  Roads
-  Streams
-  Lakes
-  Developed Areas in 1986
-  Developed Area Growth from 1986 to 1995/1997

Maple, developed 1981 © 2005 by DEP, aerial photo by Google Earth, 2005



The yellow outlined areas delineate areas that were developed as of 1986. The solid yellow areas have been developed between 1986 and 1995/97. The total area of impervious surface (buildings, sidewalks, driveways, parking lots, etc.) is about 392 acres. About 4 acres of this total were added since 1986. The total area of impervious surface constitutes 29% of the total (1339) acres in the municipality.

Exhibit "B": Waterways in Borough of Cresskill
 Source: <http://gis.co.bergen.nj.us/website/viewer1/viewer.htm>, March 2005



Exhibit "C": Borough of Cresskill Boundary on USGS

Source: USGS Detail: 13-0 Datum NAD27

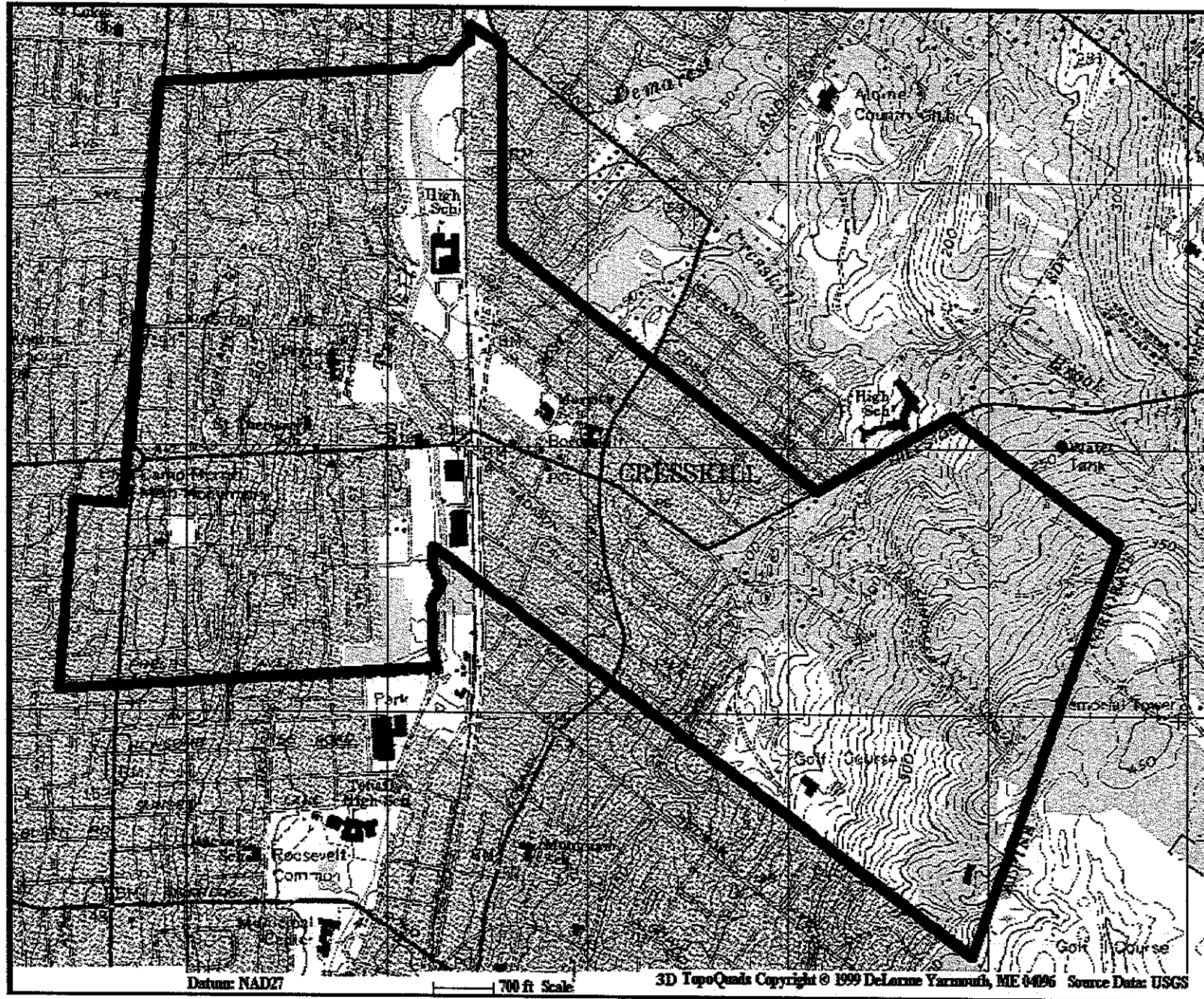
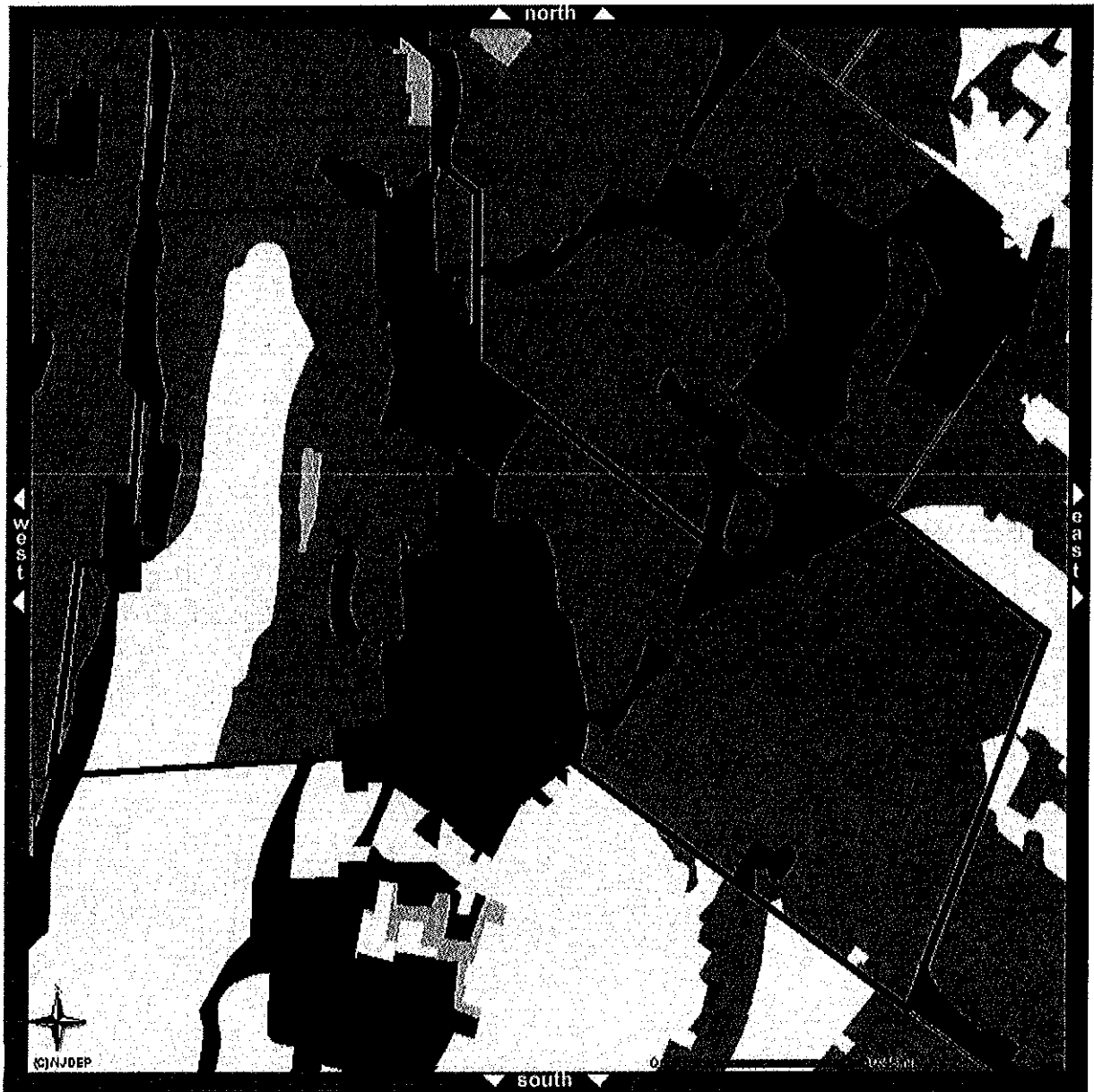


Exhibit "D": Groundwater Recharge Areas in Borough of Cresskill
Source: <http://www.state.nj.us/dep/gis/newmapping.htm>, March 2005













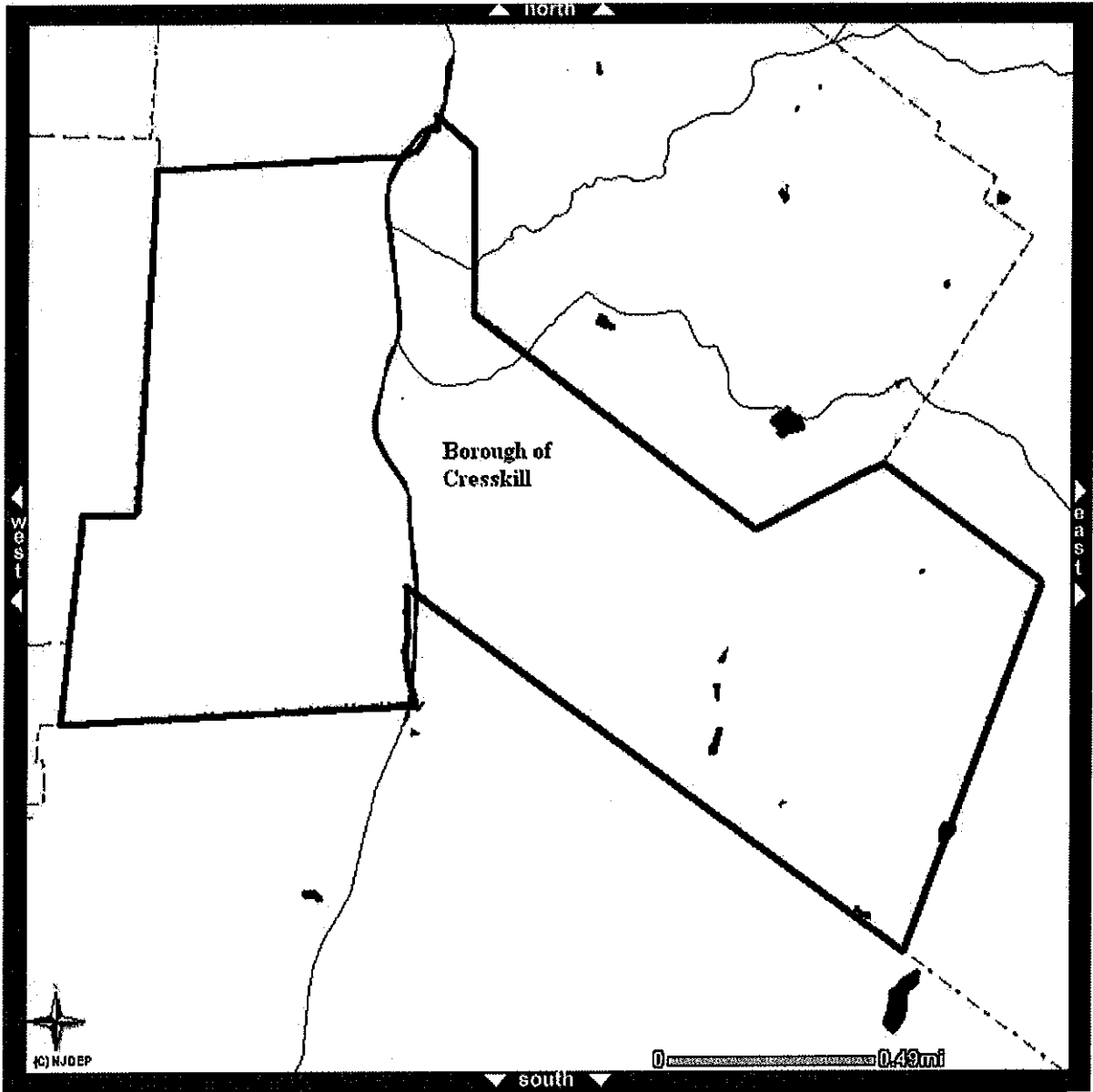
-  Municipalities
-  Groundwater Recharge
-  16 to 23 in/yr
-  11 to 15 in/yr
-  8 to 10 in/yr
-  1 to 7 in/yr
-  0 in/yr
-  Hydric Soils
-  Wetland & open water
-  No Recharge Calculated

Exhibit "E": Wellhead Protection Areas in Borough of Cresskill
Source: <http://www.state.nj.us/dep/gis/newmapping.htm>, March 2005



Legend

- ★ Public Community Water Supply Wells
- - - Municipalities
- Well Head Protection Area
 - Tier 1: 2-Year
 - Tier 2: 6-Year
 - Tier 3: 12-Year

Notes: No Wellhead Protection Areas are identified within the Borough of Cresskill.
Private wellhead location is not available.

Exhibit "F": Borough of Cresskill's Existing Land Use
Source: <http://www.state.nj.us/dep/gis/newmapping.htm>, March, 2005

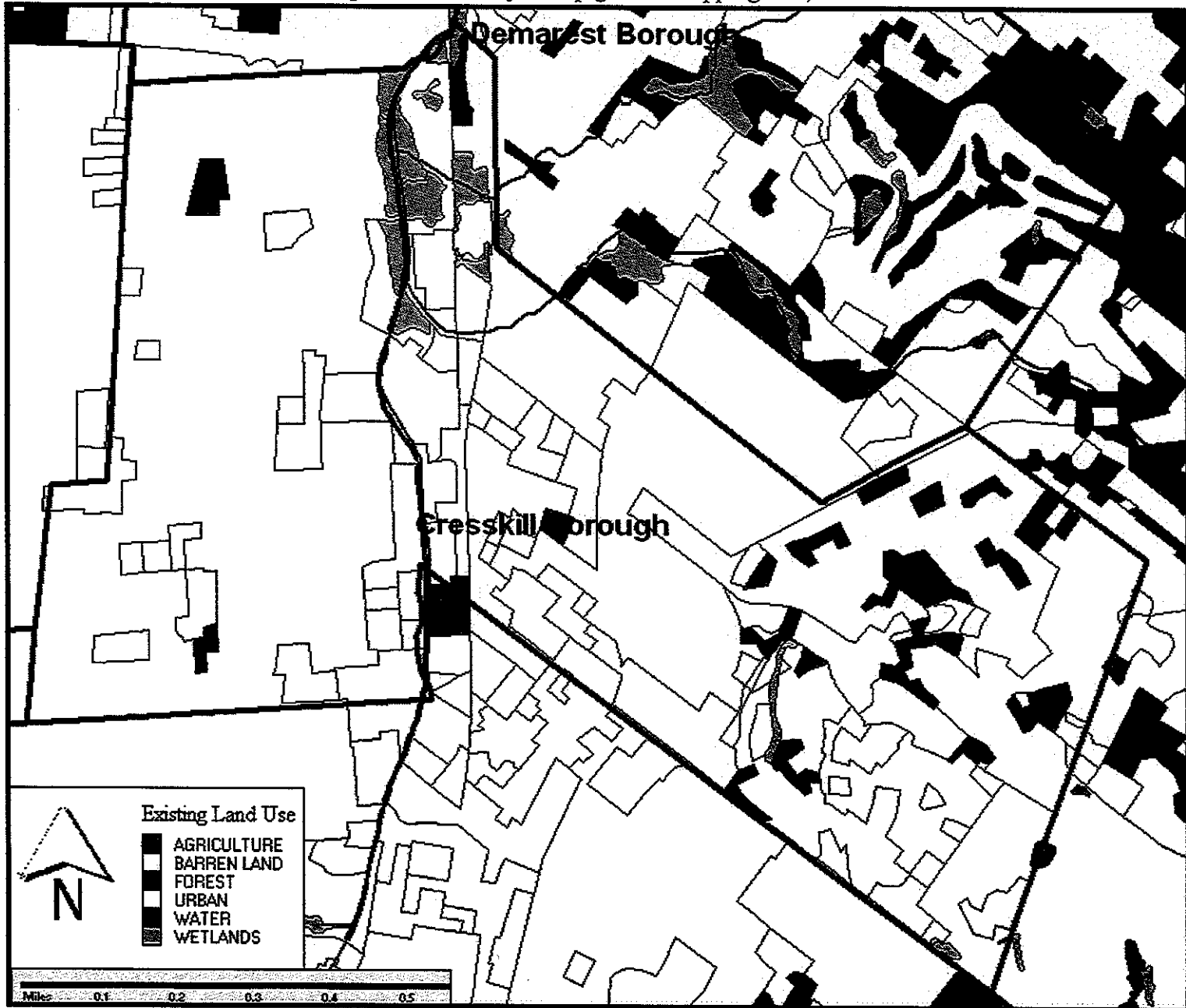
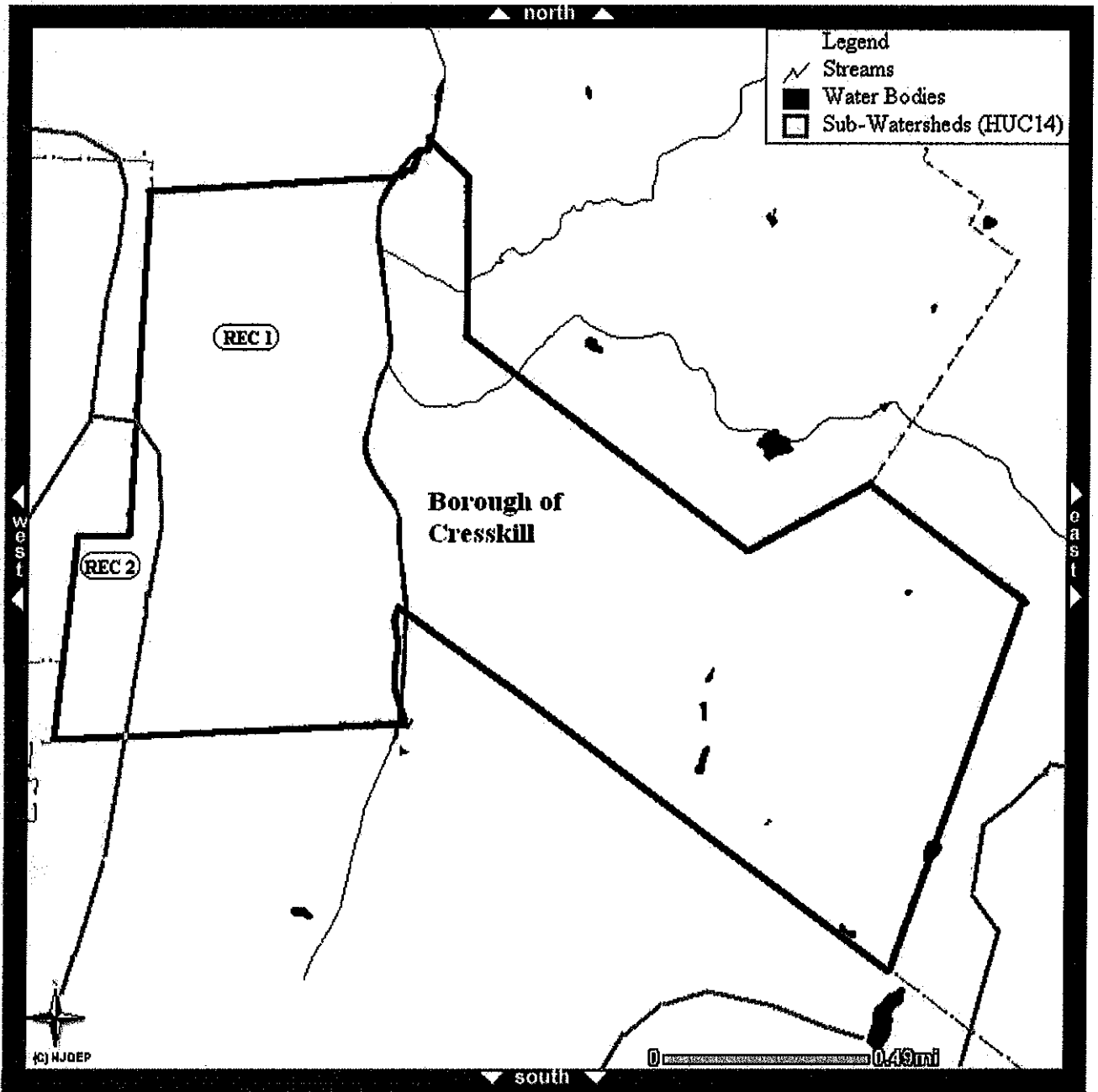


Exhibit "G": Hydrologic Units (HUC14s) Within Borough of Cresskill
 Source: <http://www.state.nj.us/dep/gis/newmapping.htm>, March 2005



Sub-Watersheds (HUC14)

Rec	Sub-Watershed Name	Sub-Watershed ID	Hydrologic Unit Code (14 digit)	Watershed Name	Watershed ID	Watershed Management Area	Management Area ID	Water Region	Water Region ID
1	Tenakill Brook	05BA04	02030103170040	Hackensack R (above Hirshfeld Brook)	05BA	Hackensack and Pascack	05	Northeast	1
2	Overpeck Creek	05BB04	02030103180040	Hackensack R (below Hirshfeld Brook)	05BB	Hackensack and Pascack	05	Northeast	1

Exhibit "T": Wetlands and Water Land Uses Within the Borough – Land Constrained
Source: <http://www.state.nj.us/dep/gis/newmapping.htm>, March 2005

