BIRDSALL ENGINEERING, INC.
CONSULTING & ENVIRONMENTAL ENGINEERS

A BIRDSALL SERVICES GROUP COMPANY

MUNICIPAL STORMWATER MANAGEMENT PLAN

THE TOWNSHIP OF DELANCO

Submitted To:

THE DELANCO TOWNSHIP JOINT LAND USE BOARD

MARCH 2005

Prepared By:

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STORMWATER MANAGEMENT PLAN
TOWNSHIP OF DELANCO

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1.0 INTRODUCTION

Delanco Township has consulted Birdsall Engineering, Inc. (BEI) to devise a Stormwater Management Plan for the Township. This Municipal Stormwater Management Plan (MSWMP) outlines a strategy for Delanco to alleviate stormwater related impacts imposed on the Township through the incorporation of more stringent policies within their Land Use Regulations. Further, pursuant to N.J.A.C. 7:14 Municipal Stormwater Regulations, the New Jersey Department of Environmental Protection has issued a new set of stormwater management regulations pertaining to "Major Development", which includes development or redevelopment that disturbs one or more acres of land. Also included in the plan are proposed ordinance amendments that would incorporate both the goals of this plan and the new stormwater management standards into the existing municipal regulations. This plan will incorporate all of the required elements described in N.J.A.C. 7:8 Stormwater Management Rules as well as the nine planning goals that should be addressed when devising municipal level stormwater management plans (N.J.A.C. 7:8-2.2). Further, the plan addresses groundwater recharge, stormwater quantity, and stormwater quality impacts by incorporating stormwater design and performance standards for new development proposals. 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 to receiving water bodies.

Also, the proposed amendments and initiatives contained within this plan will incorporate the six control measures proposed to reduce the discharge of pollutants to the maximum extent practicable and protect water quality as outlined within the Phase II New Jersey Pollutant Discharge Elimination System Stormwater Regulation Program Rules (N.J.A.C. 7:14A).

To incorporate more stringent stormwater management techniques, Birdsall Engineering, Inc. has completed a review of Delanco's existing ordinances, its Master Plan, the existing land use regulations, and other planning documents.

2.0 GOALS AND OBJECTIVES

To improve water quality, reduce the risk of flooding, and in turn improve the quality of life for residents of Delanco, the incorporation of more stringent stormwater management techniques has been identified as a priority by both state and local level government agencies. The new stormwater management requirements and best management practices will advance the goals and objectives of both the New Jersey Department of Environmental Protection and the Township of Delanco itself. The New Jersey Department of Environmental Protection (NJDEP) has established a minimum set of goals and objectives that all municipal stormwater management plans should follow, they include to:

- Reduce flood damage, including damage to life and property;
- Minimize, to the extent practical, any increase in stormwater runoff from any new development;
- Reduce soil erosion from any development or construction project;
- Assure the adequacy of existing and proposed culverts and bridges, and other in-stream structures;
- Maintain groundwater recharge;
- Prevent, to the greatest extent feasible, an increase in nonpoint pollution;
- Maintain the integrity of stream channels for their biological functions, as well as for drainage;
- 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
- Protect public safety through the proper design and operation of stormwater basins.

Further, within the Rancocas Creek Watershed Management Plan, the Public Advisory Committee of Watershed Management Area 19 endorsed seven objectives for the Creek's watershed. These items included water quantity and water quality objectives, which are listed below.

Water Quality:

- Maintain and enhance water quality so that all waterways meet surface water quality standards for fishing and swimming.
- Promote Stormwater Management practices that retain stormwater on site.
- Retrofit existing storm systems that discharge to waterways.

Water Quantity:

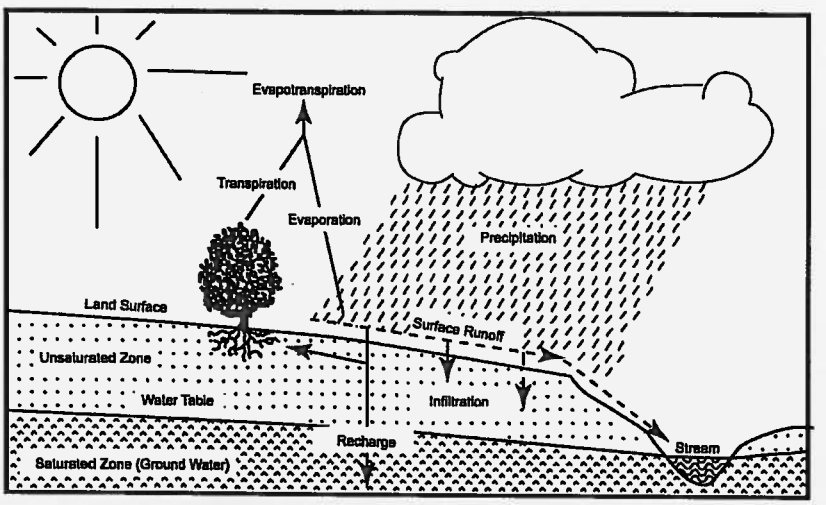
- Promote land use, site design, and stormwater practices to allow stream base flows to approximate pre development conditions.

- Identify methods to equitably distribute water supplies while encouraging water conservation and reuse.
- Develop regional distribution systems for water reuse.

To achieve these goals, this plan examines the most pressing stormwater related issues facing Delanco, and in turn proposes possible amendments to the Township's design and performance standards to incorporate a more comprehensive code for managing stormwater. By examining the Township's history, demographics, and current conditions concerning water quality, water quantity, and flooding issues, a clearer picture can be drawn in regards to what the stormwater management issues are at this time, and what type of policy amendments should be taken to improve them. This plan also calls for additional stormwater management regulations to be adopted by the Township in order to ensure that preventative and corrective maintenance strategies have been formulated to ensure the long-term efficacy of stormwater management facilities.

3.0 EFFECTS OF STORMWATER RUNOFF

The hydrologic cycle is defined as the constant cyclical movement of water from the ground to the atmosphere and back to the ground. As illustrated by the figure below, this process includes evaporation, transpiration, evapotranspiration, condensation, transport, precipitation, infiltration, percolation, surface runoff, interflow, and groundwater flow. Land development has a dramatic effect on the natural function of this process.



Prior to development, native vegetation acts to both intercept falling precipitation, and return water that has infiltrated into the ground through evapotranspiration. By clearing vegetation, compacting soil, and replacing it with impervious cover, lawns, or landscaping, the development process serves to reduce the natural rate of water that may infiltrate into the soil, and in turn evapotranspiration.

In developed areas, following a precipitation event, both the volume and the rate of stormwater runoff will increase in proportion to the amount of additional impervious cover generated through a given development. Often gutters, channels and storm sewers, are the tools with which this additional stormwater is carried to local waterways. These man-made stormwater management tools transport water more quickly which causes the stormwater flows in downstream waterways to peak faster and higher than would be produced in a natural state. The increased peak flow during and shortly after a precipitation event produce greater fluctuations between normal and storm flow rates, which can increase channel erosion.

Table 1: The Effect of Impervious Cover on Runoff

Share of Land With Impervious Cover	Share of Rainwater that Becomes Runoff
0% (natural state)	10 %
10-20%	20%
35-50%	30%
75-100%	55%

Source: NJDEP *Planning for Clean Water: The Municipal Guide* Trenton, NJ 2000.

Not only does the development process increase the peak rate of stormwater flows, the addition of impervious cover also results in water pollution. Pollutants carried within stormwater runoff can take the form of nutrients such as nitrogen and phosphorous which encourage the growth of algae in downstream water ways, or trash and oils that accumulate on sidewalks and roadways between precipitation events. In locations where stormwater sewers discharge runoff directly into a stream, the aggregate accumulation of sediment and pollutants that are carried within it are dumped directly into local waterways. In addition to the chemical and physical contaminants, runoff from impervious systems also requires another form of pollution, heat. When rain falls on pavement that has collected heat through the day, the temperature of runoff can reach as high as 83 degrees Fahrenheit, which is sufficiently warm enough to damage sensitive plant and animal species. Table 2 below, includes a comprehensive list of the possible pollutants contained within untreated stormwater flows.

Table 2: Pollutants Carried in Stormwater
The following pollutants collected and carried in stormwater runoff can seriously degrade water quality in the community:
Nutrients- Include nitrogen and phosphorous, which plants need to grow. However, high levels can cause a health hazard in drinking water and stimulate excessive aquatic plant growth, which can ultimately lower dissolved oxygen levels in the water, causing fish and other aquatic life to smother. Algae blooms are examples of how excess nutrients pollute. Sources of excess nutrients include animal waste, fertilizers, septic systems, road salt applications and auto emissions. About half of the fertilizers applied to lawns in the New Jersey coastal zone enter streams and head to the bay and ocean.
Pathogens- Are disease causing bacteria and viruses associated with the presence of fecal matter. They affect human health directly when people contact contaminated water and consume shellfish. Sources include failing septic systems, animal waste, and boat sanitation facilities.
Sediment- Is fine particles of eroded soil or sand. Common origins are concentrated, excessive stormwater runoff from construction sites. Sediment smothers aquatic habitat, carries pollutants bound to soil particles, makes water cloudy and inhibits the breeding and movement of aquatic species.
Toxic Contaminants- Include pesticides as well as heavy metals such as copper, lead and zinc which are commonly found in old paint, tires, lawn chemicals and preservatives. They attach to sediments, resist breakdown, accumulate in organisms and represent threats to the food chain.
Debris- Consists of various items of trash, such as old tires, shopping carts and plastics. It comes from illegal dumping, street litter, and boating waste. It threatens aquatic life and detracts from recreational and aesthetic values.
Oil- Is one of the worst offenders. One gallon of oil dumped down a storm drain can create a slick up to 8 acres and may pollute up to 1 million gallons of water.
Thermal Stress- From elevated water temperatures reduces survival rates and disease resistance of valued native species and allows the spread of non-native (exotic) species. Water temperature rises because of increased pavement near streams, loss of vegetated stream buffers and stream channelization.
Source: Association of New Jersey Environmental Commissions (1998, Spring). ***ANJEC Report***

4.0 CURRENT CONDITONS

4.1 SETTING

Located in western Burlington County, the Township of Delanco is bordered by Riverside Township, Delran Township, Edgewater Park Township and Beverly City. Home to the Rancocas Creek and right on the Delaware River, Delanco is a lovely waterfront town that started as a summer retreat for people wanting to escape the heat in Philadelphia. Established in 1848, summer visitors would come for the summer by paddle wheel boat. Recently, a 140-acre park was approved on the Rancocas Creek that will include trails, picnic areas, playgrounds and wildlife observation areas. Though it is close to major highways such as Route 130, the Interstate 295 and the New Jersey Turnpike, Delanco is proud to consider itself a small country town, and has lined its streets with mature trees to maintain its cozy, natural feel.

4.2 DEMOGRAPHICS

The Township of Delanco is a small community located on the Delaware River in western Burlington County. Delanco has a land area of 3.37 square miles, and contained 3,237 residents as of the 2000 census.

The population of Delanco has been steadily decreasing since 1970. During the period 1980 to 1990, the Township experienced a growth rate of –11.1%, the lowest it has seen in the last half-century.

Table 3: Delanco Population Characteristics

Year	Population	% Change
1970	4,157	N/A
1980	3,730	-10.3%
1990	3,316	-11.1%
2000	3,237	-2.4%

Source: Burlington County *Burlington County 2002 Databook* accessed on February 25, 2005.
http://www.co.burlington.nj.us/town/documents/Burlington%20County

4.3 WATERWAYS

OVERVIEW

Delanco Township is located at the confluence of Rancocas Creek and the Delaware River. The Delaware River forms the western boundary of the Township. The main branch of the Rancocas Creek, which flows through the southern portion of Delanco is approximately 8 miles long and drains nearly 46 square miles of land. In addition, several small tributaries of the creek also flow through the Township. The Rancocas Watershed has been cited as a priority watershed by the "Draft 1998 Identification and Setting of Priorities for Section 303(d) Water Quality Limited Waters in New Jersey" (NJDEP, 1998). Pollutants have resulted in water quality violations for pH, fecal coliform, lead, mercury, and total phosphorus, leaving the Rancocas moderately to severely impaired. Use impairments include primary contact for recreation, aquatic life support, and fish consumption. The New Jersey Department of Environmental Protection has had in place for some time a system for identifying and monitoring point source pollution discharges in the watershed, and, given the land use development patterns in the watershed, recognized the need to reduce non-point source runoff to enhance and maintain water quality within the watershed.

Pennington Park, which is being established along the Rancocas Creek, will serve residents of Delanco as a recreation facility and also improve the management of stormwater within the Township. With 3,200 feet of waterfront, construction plans include 3.2 miles of multi-use trails, parking areas and restrooms, drinking fountains, age-appropriate playgrounds, picnic areas with group shelters and wooden wildlife observation blinds. Visitors will also be able to view white-tail deer, wild turkey, waterfowl and other wildlife within the park as reforestation and meadow plantings to be completed as part of the park improvements will establish several new habitat types on the site.

Also, Baggs Creek, a minor tributary of the Delaware River, flows through the northern portions of the Township, before emptying into the Delaware near Larchmont Drive and Second Street.

4.4 WATER QUALITY

Water quality will remain a critical factor to maintain a high quality of life for residents of the Delanco Township community. As illustrated through Appendix A, eleven testing sites along the Rancocas Creek have been listed on the 2002, NJ List of Impaired Water bodies. Further, Appendix A also shows that the State's 2004 Integrated List of Impaired Water Bodies lists thirteen testing sites along the Rancocas Creek. However, none of these testing locations fall within Delanco Township. TDML's are currently in the process of being developed for the non-attaining pollutants found at each testing location. As the TDML's are established, more stringent stormwater management techniques, and public outreach, and public education efforts are all vital components that can combined can realize the goal of improving the water quality within the Dover Township.

4.5 FLOODING AND FLOODPLAINS

To inform both public and private land use decision makers of areas that are subject to flooding, the Federal Emergency Management Agency has completed Flood Insurance Rate Maps (FIRM) for Delanco Township. Wetlands, and low relief areas immediately along the banks of the Delaware River, Rancocas Creek, several unnamed tributaries of the Rancocas, and Baggs Creek have been designated as an "AE Flood Zone" by the FIRM maps. The areas contained within an "AE Flood Zone" designation represents that they have been found to lie within the 100-year floodplain with the base flood elevation determined. Each of these points, along with its corresponding base flood elevation is listed below in Table 5:

Table 5: Elevation Reference Marks Within Delanco Township	
Elevation in Feet	**Location**
7.55	The center of the concrete slab of the gazebo on the south side of Creek Road approximately 1300 feet northeast of its intersection with Pennsylvania Avenue. Established by GEOD Aerial Mapping, Inc.
4.65	An "x" cut in top of bolt at the southwest corner of the bulkhead at the east side of the boat ramp at Eble's Marina located approximately 2400 feet southwest of Creek Road and approximately 4000 feet northwest of U.S. Highway 130. Established by GEOD Aerial Mapping, Inc.
16.24	A standard New Jersey Geodetic Coastal Survey disk stamped monument no. 8874, set in a concrete monument, 47.8 feet southeast of Burlington Avenue and 30.85 feet northeast of Maple Avenue
12.00	A railroad spike in a 20-inch oak tree, 15 feet east of a dirt trail, and approximately 100 feet south of a pond on Hawk Island, approximately 2600 feet southwesterly along the dirt road from the westerly end of Vine Avenue, and approximately 375 feet northwesterly of the edge of Rancocas Creek. Established by GEOD Aerial Mapping, Inc.
12.52	A standard New Jersey Geodetic Coastal Survey monel metal rivet set in the concrete sidewalk at the Northwest corner of the Burlington Avenue bridge over the Rancocas Creek 35.35. feet southwest from a drill hole in the northeast corner of the concrete slab, 7.30 feet northeast from a steamer connection on the east face of the west wingwall.
17.24	The word "TENN" on fire hydrant on the south side at the extreme westerly end of Vine Avenue in front of house no.101. Established by GEOD Aerial Mapping, Inc.
Source: FEMA *Flood Insurance Rate Map (FIRM)—Delanco Township, Ocean County, New Jersey. Effective Date: September 28, 1979*	

4.6 EXISTING AREAS OF FLOODING & PROPOSED SOLUTIONS

As the Township is located at the confluence of the Delaware River and Rancocas Creek, portions of Delanco are subject to flooding. Lands adjacent to the Delaware River and Rancocas Creek are exceptionally vulnerable to flooding, although the 100-year floodplain extends no more than 100 feet into the Township, except for small portions of the northeast and southwestern corners of the Township. Also, freshwater and tidal wetlands exist along both bodies of water, and within flood prone areas in the northeast and southwest portions of the Township.

The Township is continuously monitoring and correcting existing areas of flooding. The Department of Public Works routinely vacuums inlets known prone to flooding and clears away fallen leaves during the autumn months. The Township Engineer will work with the Director of Public Works and the Road Department to develop a list of locations prone to flooding. This list will be prioritized and solutions engineered for each.

The Township actively addresses drainage and flooding issues as they arise and are reported by residents. Each year, the Township includes drainage improvements as part of their Capital Improvement Program. However, as flooding issues and strategies are more thoroughly addressed, the MSWMP will be amended to incorporate a list of areas that experience flooding due to stormwater flows.

5.0 STORMWATER MANAGEMENT

5.1 INFRASTRUCTURE

Delanco Township receives almost 45 inches of rain in an average year. To manage the public risk that flooding imposes on residents, a substantial stormwater management system has been developed. As illustrated earlier through Table 2, the pace, amount, and condition of the water that finds its way into local waterways is in large part determined by the amount of impervious cover the land contains. With less absorption of rainwater into the ground, the increased runoff moves faster and collects more pollutants from the surface, which promotes erosion, damages stream banks, and in turn dumps sediment into streambeds.

N.J.A.C. 7:8 spells out guidelines for how to manage stormwater more effectively and also how to incorporate best management practices into the planning stages of project design. These standards now require stormwater detention capacity to hold and slowly release the runoff from storms that have a likelihood of occurring once every two, ten and one hundred years. Some sites may be able to achieve these standards through vegetative swales, and buffers, and landscaping to control non-point source pollution. Other sites may require the building of a stormwater basin. In these cases, where the development of structural stormwater facilities is necessary, the New Jersey Department of Environmental Protection's BMP guide should be consulted as it outlines alternatives and strategies to incorporate non land-intensive Best Management Practices into a projects site design. The potential alternatives include surface structures such as Infiltration Basins and Sand Filters as well as subsurface measures including Pervious Paving Systems and Vegetative Filters. The incorporation of such designs into the existing stormwater management infrastructure is strongly encouraged to enhance groundwater recharge, and reduce the space and amount of runoff that originates on site; thus improving both the quality and quantity of stormwater that originates within the Township.

Also, Low Impact Development techniques, which coincide with the goals and functions of Stormwater Management BMP's, include additional means to promote the goals stated within this Municipal Stormwater Management Plan. When practicable, incorporating such techniques as maximizing the amount of pervious land to be preserved, utilizing native vegetation for replanting, adding curb cuts to detain and filter stormwater, and using vegetated buffers are also encouraged.

5.2 STORM DRAINS

The Township has an annual Capital Improvement Program through which infrastructure improvements are designed and constructed. The construction or reconstruction of drainage best management practices, and stormwater management improvements, such as the installation of perforated pipe and sump inlets within the Township are included in this program.

5.3 STORMWATER BASINS

Most of the stormwater management system within Delanco Township relies on storm drains. However, there are two types of stormwater basins and both are present in Delanco. First, "detention basins" are built strictly to detain the stormwater for a period of time, while releasing water at a slow and controlled rate. They are designed to be dry between storm events. A second type of basin that is designed to manage stormwater flows is a "retention basin". These basins are designed to stay "wet" by retaining a permanent pool so as to mimic a natural pond or lake. A comprehensive listing and analysis of the stormwater basins operating within Delanco Township is not readily available at this time. However, this information will be added as part of the necessary amendments that will be incorporated into this Municipal Stormwater Management Plan.

5.4 WATERSHED

The Rancocas Creek Watershed, designated as Watershed Management Area (WMA) #19 in the DEP's watershed management initiative, includes the Rancocas Creek, and both its north and south branches. IN all, the watershed encompasses 230,000 acres of land in portions of three counties with a wide range of land uses including forests, agriculture, residential housing, commercial and industrial development and a variety of institutional and public uses. According to NJDEP, in 1997 the watershed was: 34% Forested, 28% Wetlands, 21% Urban, and 12% Agricultural.

6.0 DESIGN AND PERFORMANCE STANDARDS

To minimize the adverse impact of stormwater runoff on water quality, water quantity and the loss of groundwater recharge in receiving water bodies, the Township will adopt design and performance standards that comply with the stormwater management measures as presented in N.J.A.C. 7:8. The design and performance standards include amended language for the inclusion of maintenance requirements, and safety standards consistent with N.J.A.C. 7:8-6. The ordinances will be submitted to the County for review and approval within 24 months of the effective date of permit authorization (EDPA).

Further, by amending their current Land Use Regulations, it is the intention of the Township of Delanco to incorporate both structural and nonstructural stormwater management strategies as presented in N.J.A.C. 7:8-5 to the maximum extent practicable. So as to minimize the adverse impact on water quality which is imposed by stormwater runoff, the proposed amendments to the Township's current development regulations include the incorporation of stricter stormwater management guidelines relating to water quantity, water quality, and groundwater recharge as identified in the design and performance standards as presented in N.J.A.C. 7:8-5. Prior to adoption, these ordinances will all be submitted to the Burlington County Planning Board for review and approval within 24 months of the EDPA.

The second set of rules are the Phase II New Jersey Pollutant Discharge Elimination System Stormwater Regulation Program Rules (N.J.A.C. 7:14A). These Rules are intended to address and reduce pollutants associated with existing stormwater runoff. The Rules establish a regulatory program for existing stormwater discharges as required under the Federal Clean Water Act. These rules govern the issuance of permits to entities that own or operate small municipal separate storm sewer systems, known as MS4s. Under this program permits must be secured by municipalities, certain public complexes such as universities and hospitals, and State, interstate and Federal agencies that operate or maintain highways. The permit program establishes the Statewide Basic Requirements that must be implemented to reduce nonpoint source pollutant loads from these sources. The Statewide Basic Requirements include measures such as: the adoption of ordinances (litter control, pet waste, wildlife feeding, proper waste disposal, etc.); the development of a municipal stormwater management plan and implementing ordinance(s); requiring certain maintenance activities (such as street sweeping and catch basin cleaning); locating discharge points and stenciling catch basins; and a public education component

Owners or operators of small MS4s would be required to develop and implement a storm water management program designed to reduce the discharge of pollutants to the maximum extent practicable and protect water quality. Control measures are expected to include, at a minimum, the following components:

- Public education and outreach
- Public involvement and participation
- Illicit discharge detection and elimination
- Construction site storm water runoff control
- Post-construction storm water management in new development and redevelopment

- Pollution prevention/good housekeeping for municipal operations.

6.1 IMPLEMENTING NON-STRUCTURAL STORMWATER MANAGEMENT STRATEGIES

The implementation of non-structural Best Management Practices are strongly encouraged to be added to the Township's existing development regulations and applied to all new site design proposals. Whenever possible, the following nine strategies should be incorporated into site design:

- Protect areas that provide water quality benefits or areas particularly susceptible to erosion and sediment loss;
- Minimize impervious surfaces and break up or disconnect the flow of runoff over
- impervious surfaces;
- Maximize the protection of natural drainage features and vegetation;
- Minimize the decrease in the "time of concentration" from pre-construction to post construction. "Time of Concentration" is defined as the time it takes for runoff to travel from the hydraulically most distant point of the drainage area to the point of interest within a watershed;
- Minimize land disturbance including clearing and grading;
- Minimize soil compaction;
- Provide low-maintenance landscaping that encourages retention and planting of native vegetation and minimizes the use of lawns, fertilizers and pesticides;
- Provide vegetated open-channel conveyance systems discharging into and through stable vegetated areas; and
- Provide other source controls to prevent or minimize the use or exposure of pollutants at the site in order to prevent or minimize the release of those pollutants into stormwater runoff. These source controls include, but are not limited to:

  i. Site design features that help to prevent accumulation of trash and debris in drainage systems;

  ii. Site design features that help to prevent discharge of trash and debris from drainage systems;

  iii. Site design features that help to prevent and/or contain spills or other harmful accumulations of pollutants at industrial or commercial developments; and

  iv. When establishing vegetation after land disturbance, applying fertilizer in accordance with the requirements established under the Soil Erosion and Sediment Control Act N.J.S.A. 4:24-39 et seq., and implementing rules.

Appendix C provides a list of proposed amendments to Delanco's existing Land Use Development Regulations that pertain to stormwater and stormwater management. Upon review and revision, Delanco Township will submit the amended Land Use Regulations to the county

review agency for review and approval within 24 months of the EDPA. A copy will be sent to the Department of Environmental Protection at the time of submission.

6.2 IMPLEMENTING STRUCTURAL STORMWATER MANAGEMENT STRATEGIES

As mentioned earlier, the NJDEP has implemented more rigid regulations regarding the volume, rate, and quality of stormwater originating on a new development site. Some sites may be able to achieve these standards through vegetative swales, and buffers, and landscaping to control non-point source pollution. Other sites may require the building of a stormwater basin. In these cases, where the development of structural stormwater facilities is necessary, the New Jersey Department of Environmental Protection's BMP guide should be consulted. This document includes strategies to incorporate such best management practices as, bioretention systems, Infiltration Basins, Pervious Paving Systems, Rooftop Vegetated Cover, Sand Filters, Vegetative Filters, and Wet Ponds. The incorporation of non-land intensive Best Management Practices that are not into the existing stormwater management infrastructure is strongly encouraged to improve both groundwater recharge and the quality of stormwater runoff that originates in the Township.

6.3 PLAN CONSISTENCY

Currently, land in Delanco is not contained within the bounds of an adopted a Regional Stormwater Management Plan (RSWMP) and no Total Maximum Daily Loads (TMDL's) have been developed for waters within the Township. Therefore, at this time, it is not necessary for the amendments proposed in this plan to adhere to standards developed through the adoption of a Regional Stormwater Management Plan.

Also, this Municipal Stormwater Management Plan is consistent with the Residential Site Improvement Standards (RSIS) N.J.A.C. 5:21, and the Township will utilize the most current update of the RSIS in the stormwater management review of residential areas. The Township's Stormwater Management Ordinance requires all new development and redevelopment plans to comply with New Jersey's Soil Erosion and Sediment Control Standards.

6.4 MITIGATION PLANS

A mitigation plan, which is a mandatory component of municipal stormwater ordinances under the new N.J.A.C. 7:8 Stormwater Management Guidelines, is required to grant a variance or exemption from the design and performance standards of a municipal stormwater management plan.

Under the Township's mitigation plan, developers would be required to contribute to or complete a mitigating alternative to clearly offset the effect on groundwater recharge, stormwater quantity control, and/or stormwater quality control that was created by granting the variance or exemption. The Township is also encouraged to identify and rank possible projects to include within the mitigation project criteria. To devise such a list, it is important for the municipality to have sufficient information on each project, including the project's size, permit requirements, land ownership, and estimated project costs (i.e., permitting fees, engineering costs, construction costs, and maintenance costs).

The Township has begun the process of developing a preliminary list identifying mitigating projects. Through the incorporation of this plan, a prioritized list of mitigating project alternatives. To see these projects through to their fruition, all applicable federal, state, and local funding sources will be pursued. Further, the adoption of a mitigation plan would create yet another potential funding source to advance these projects that the Township has identified to hold the highest potential to alleviate stormwater management problems.

FIGURES

FIGURE 1
SOILS MAP
TOWNSHIP OF DELANCO
BURLINGTON COUNTY, NEW JERSEY

BIRDSALL ENGINEERING, INC.
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Legend: DELANCO TOWNSHIP

DATE	SCALE	JOB NO:	CREATED BY
02/28/05	1" = 1500'	JOB NO:	KBD

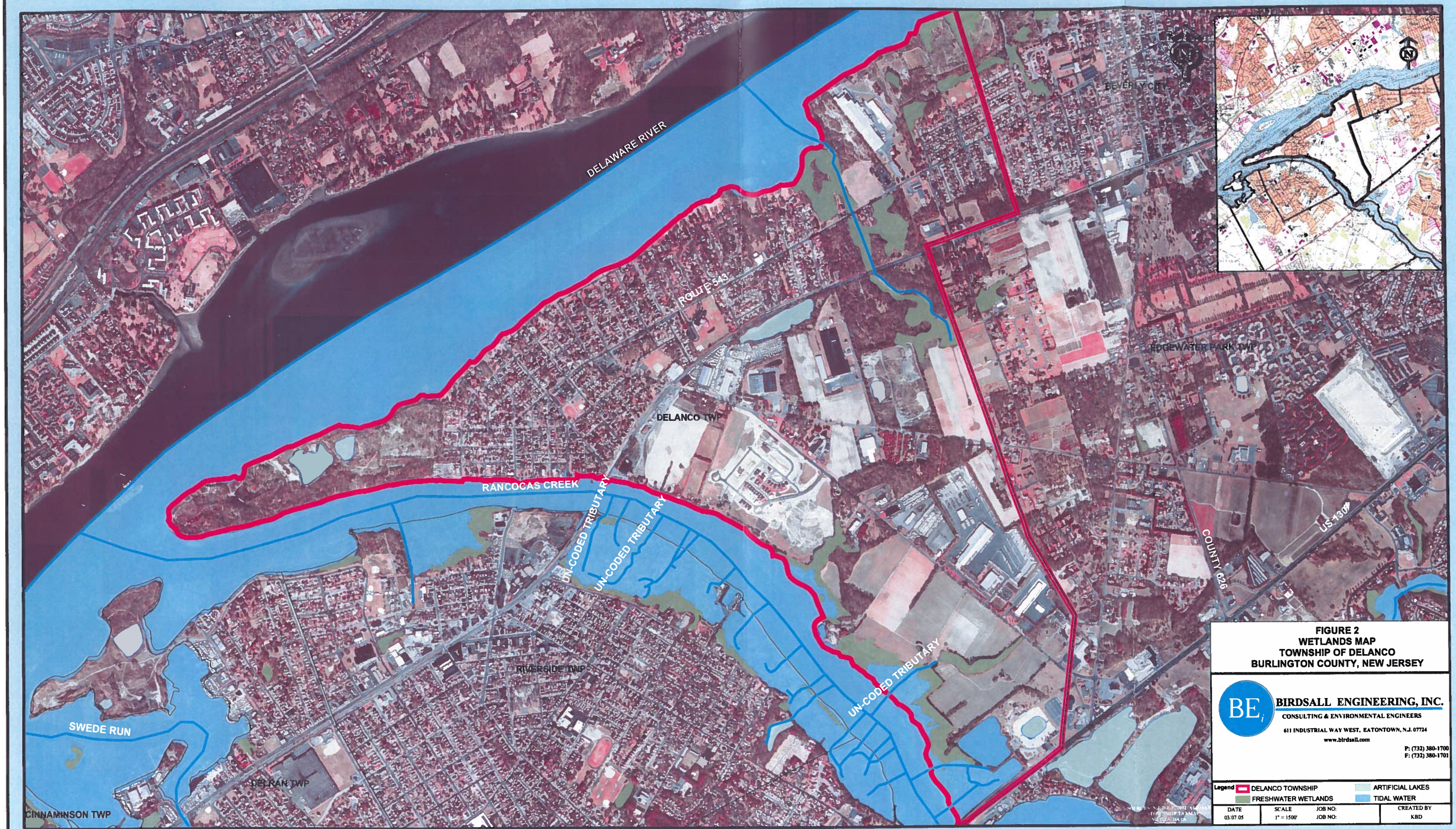

FIGURE 2
WETLANDS MAP
TOWNSHIP OF DELANCO
BURLINGTON COUNTY, NEW JERSEY

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Legend: DELANCO TOWNSHIP; FRESHWATER WETLANDS; ARTIFICIAL LAKES; TIDAL WATER

DATE	SCALE	JOB NO:	JOB NO:	CREATED BY
03/07/05	1" = 1500'			KBD

FIGURE 3
LAND USE MAP
TOWNSHIP OF DELANCO
BURLINGTON COUNTY, NEW JERSEY

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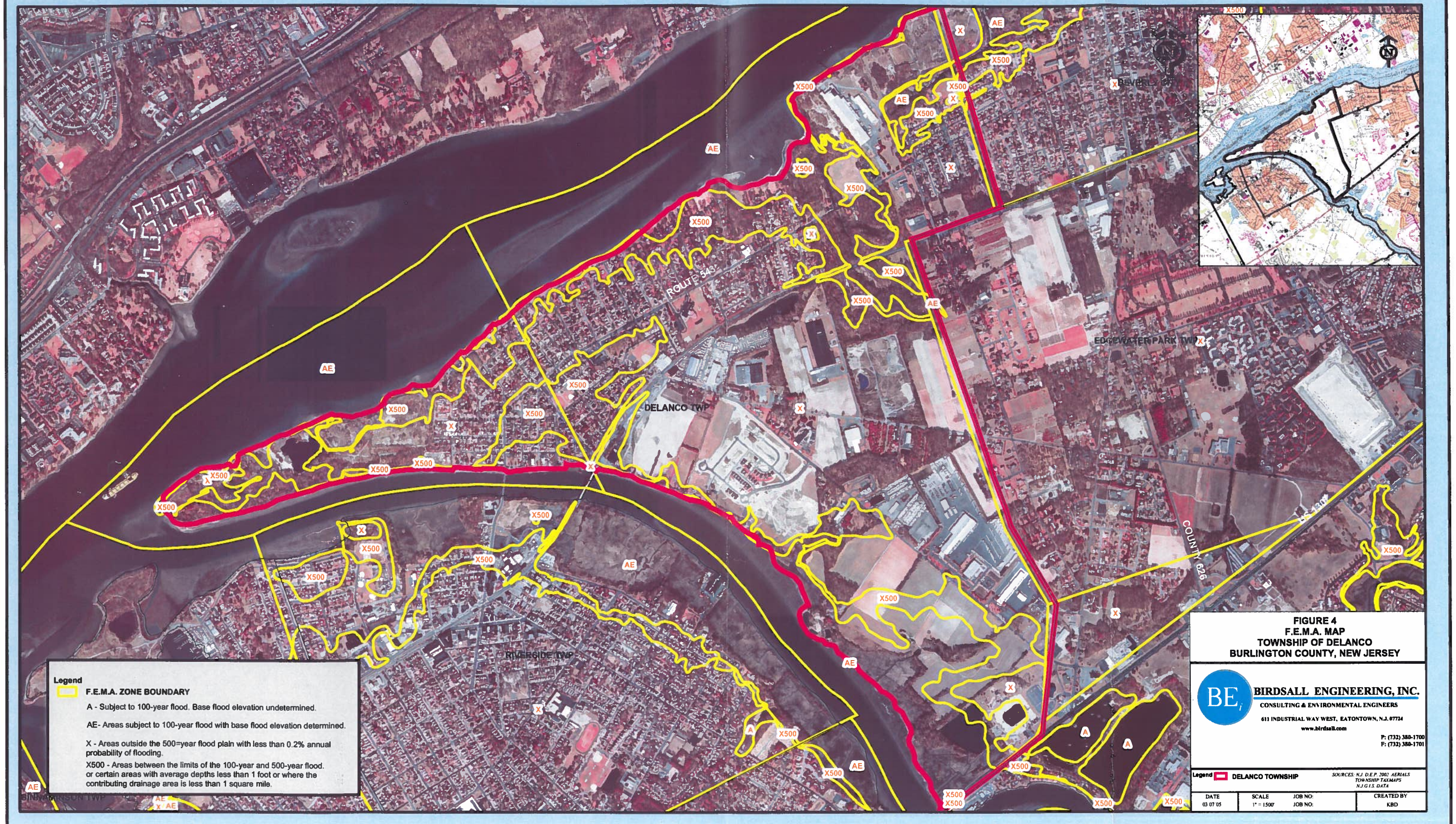

FIGURE 4
F.E.M.A. MAP
TOWNSHIP OF DELANCO
BURLINGTON COUNTY, NEW JERSEY

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Legend DELANCO TOWNSHIP

SOURCES: N.J. D.E.P. 2002 AERIALS
TOWNSHIP TAXMAPS
N.J.G.I.S. DATA

DATE	SCALE	JOB NO:	CREATED BY
03 07 05	1" = 1500'	JOB NO:	KBD

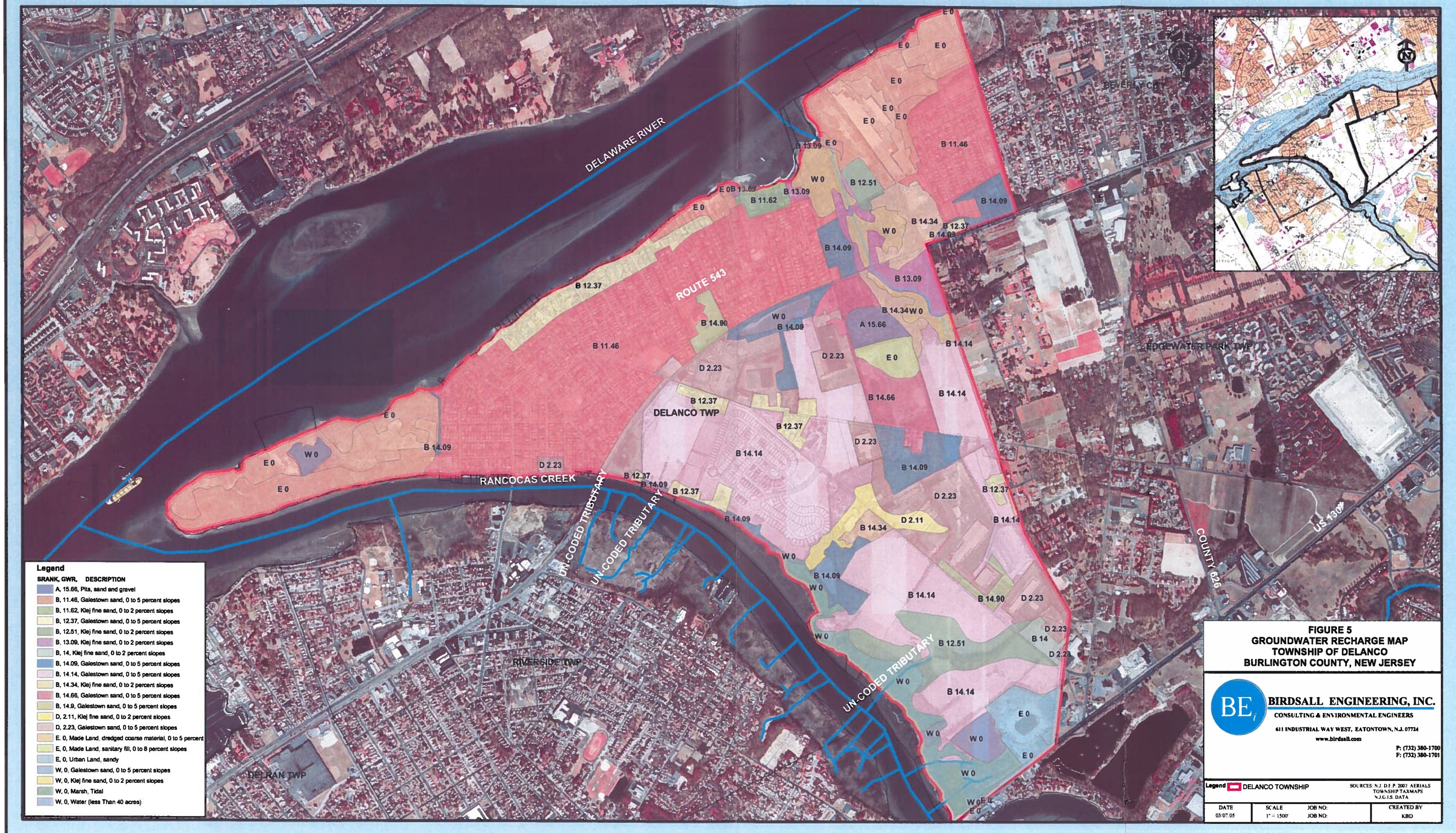


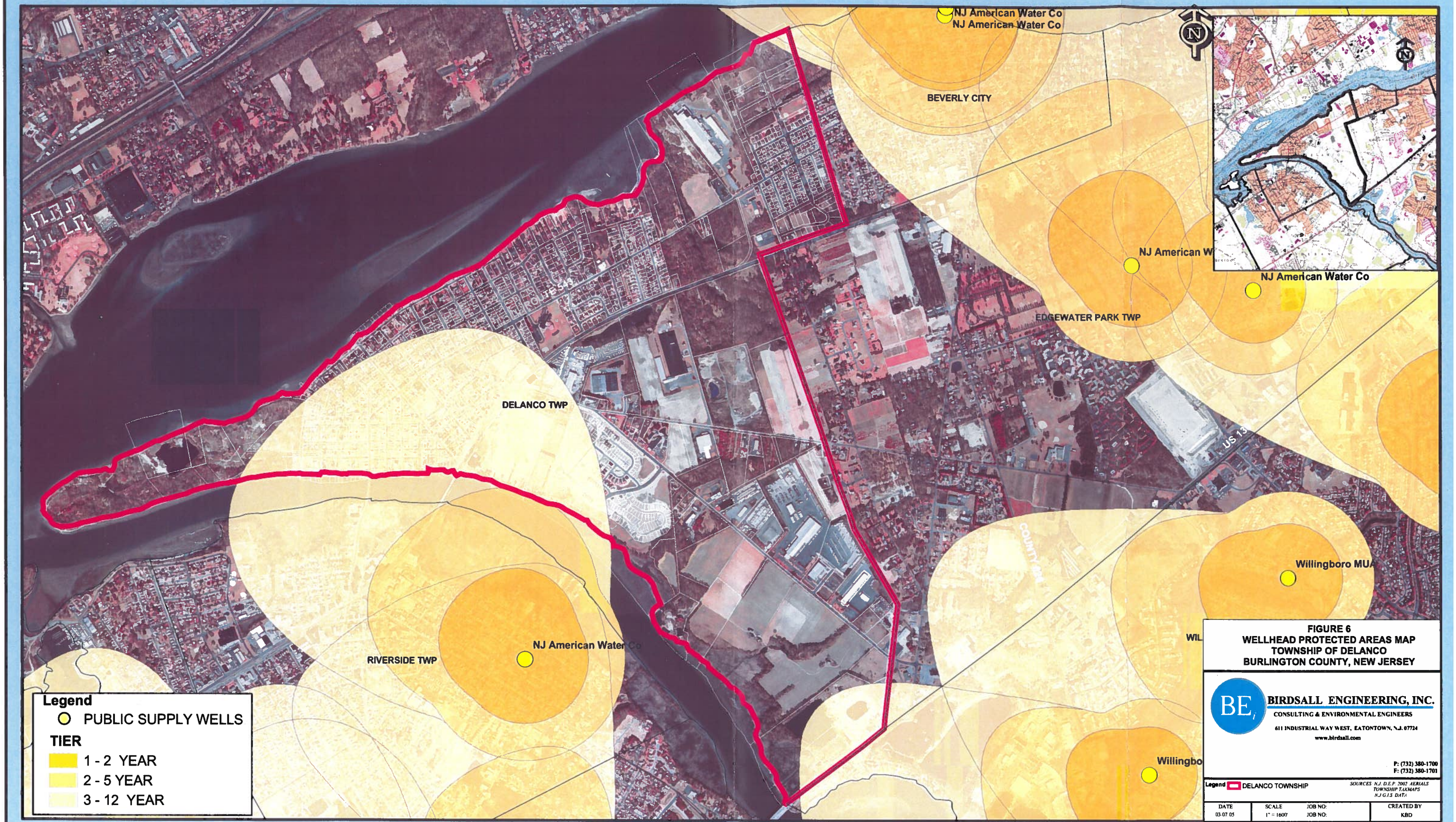
FIGURE 5
GROUNDWATER RECHARGE MAP
TOWNSHIP OF DELANCO
BURLINGTON COUNTY, NEW JERSEY

BIRDSALL ENGINEERING, INC.
CONSULTING & ENVIRONMENTAL ENGINEERS
611 INDUSTRIAL WAY WEST, EATONTOWN, N.J. 07724
www.birdsall.com
P: (732) 380-1700
F: (732) 380-1701

Legend DELANCO TOWNSHIP

SOURCES: N.J. D.E.P. 2002 AERIALS, TOWNSHIP TAXMAPS, N.J.G.I.S. DATA

DATE	SCALE	JOB NO:	CREATED BY
03/07/05	1" = 1500'	JOB NO:	KBD


NJ American Water Co
NJ American Water Co
BEVERLY CITY
NJ American W
NJ American Water Co
EDGEWATER PARK TWP
US 13
DELANCO TWP
RIVERSIDE TWP
NJ American Water Co
Willingboro MUA
Willingbo
Legend
PUBLIC SUPPLY WELLS
TIER
1 - 2 YEAR
2 - 5 YEAR
3 - 12 YEAR
FIGURE 6
WELLHEAD PROTECTED AREAS MAP
TOWNSHIP OF DELANCO
BURLINGTON COUNTY, NEW JERSEY
BIRDSALL ENGINEERING, INC.
CONSULTING & ENVIRONMENTAL ENGINEERS
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Legend DELANCO TOWNSHIP
SOURCES N.J. D.E.P. 2002 AERIALS
TOWNSHIP TAXMAPS
N.J.G.I.S DATA
DATE 03-07-05
SCALE 1" = 1600'
JOB NO:
JOB NO:
CREATED BY KBD

APPENDIX A

NEW JERSEY INTEGRATED LIST OF WATERBODIES 2002 AND 2004

Sublist	Wtrshd Region	WMA	Station Name/Waterbody	Site ID	Parameters
3	Northwest	11	Plum Brook at Rt 579 in Raritan	AN0092	Benthic Macroinvertebrates
3	Northwest	11	Plum Brook near Locktown	01461262	Phosphorus
3	Northwest	01	Pohatcong Creek at Tunnel Hill Rd in Washington	EWQ0055	Dissolved Oxygen
3	Lower Delaware	19	Pole Bridge Branch at blw Country Lk in Pemberton	AN0144, GPOWISSA	Pineland Biological Community
3	Lower Delaware	19	Pole Bridge Branch near Browns Mills	01466200	Phosphorus, Dissolved Solids, Total Suspended Solids
3	Northeast	03	Pompton River at Pompton Plains	01388500, 3-SITE-7	Arsenic, Cadmium, Mercury
3	Northeast	03	Pompton River Trib at Ryerson Rd	01388720	Phosphorus
3	Atlantic Coast	12	Poplar Brook at Almyr Ave in Deal	AN0478	Benthic Macroinvertebrates
3	Atlantic Coast	12	Poplar Brook at Deal	01407630, 59	pH, Total Suspended Solids
3	Atlantic Coast	12	Poricy Brook at Navesink River Rd in Middletown	AN0463	Benthic Macroinvertebrates
3	Northeast	04	Preakness Brook near Little Falls	01389080	Phosphorus, Temperature, pH, Dissolved Oxygen, Nitrate, Dissolved Solids, Total Suspended Solids, Unionized Ammonia
3	Lower Delaware	19	Presidential Lake-19	Presidential Lake, GBIPRESU	Phosphorus, Pineland Biological Community
3	Atlantic Coast	14	Prices Branch at Burnt Mill Rd in Waterford	AN0568, MPRBURNT	Pineland Biological Community
3	Northeast	06	Primrose Brook at Morristown National Park	01378780	Arsenic, Cadmium, Mercury, Silver
3	Lower Delaware	20	Prospertown Lake-20	Prospertown Lake	Phosphorus
3	Atlantic Coast	14	Pump Branch at Old White Horse Pike in Winslow	AN0569, NPUMDIKE	Pineland Biological Community
3	Atlantic Coast	14	Pump Branch impoundment off Cedar Avenue (Lake 1930-14)	NPUIMPNT	Pineland Biological Community
3	Lower Delaware	17	Raccoon Creek at Rt 130 in Bridgeport	01477160	Dissolved Solids
3	Lower Delaware	18	Raccoon Creek near Swedesboro	01477120, 18-RAC-1	Arsenic, Cadmium, Mercury
3	Lower Delaware	18	Raccoon Creek S Br at Swedesboro Rd in South Harrison	AN0681	Benthic Macroinvertebrates
3	Raritan	07	Rahway River at Northfield Ave in West Orange	AN0192	Benthic Macroinvertebrates
3	Raritan	07	Rahway River at Rahway	01395000, 7-RAH-1	Mercury
3	Raritan	07	Rahway River S Br at Colonia	01396030	Dissolved Solids
3	Raritan	07	Rahway River S Br near Maple Ave in Woodbridge	7-SBR-1	Arsenic, Cadmium, Chromium, Copper, Lead, Mercury, Nickel, Selenium, Silver, Thallium, Zinc
3	Raritan	07	Rahway River W Br at Northfield Av at West Orange	01393960	Total Suspended Solids, Arsenic, Cadmium, Chromium, Copper, Lead, Mercury, Nickel, Selenium, Silver, thallium, Zinc
3	Lower Delaware	17	Rainbow Lake-17	Rainbow Lake	Phosphorus
3	Atlantic Coast	12	Ramanessin Brook at Willow Rd in Holmdel	53	pH, Total Suspended Solids
3	Northeast	03	Ramapo River at Dawes Highway	01388100, 01388000	Fecal Coliform
3	Northeast	03	Ramapo River near Mahwah	01387500, 3-SITE-9, 3-RAM-1	Arsenic, Cadmium, Mercury
3	Northeast	04	Ramsey Brook at Allendale	01390900	Phosphorus, Dissolved Solids
3	Lower Delaware	19	Rancocas Creek N Br above New Lisbon-Four Mile Rd	NNONEWLI	Pineland Biological Community
3	Lower Delaware	19	Rancocas Creek N Br at Hanover Furnace	01465950, 19-RA-1N	Total Suspended Solids, Arsenic, Cadmium

Wtrshd Region	WMA	Station Name/Waterbody	Site ID	Parameters (Insufficient Data)	Data Source
Lower Delaware	19	Pole Bridge Br at blw Country Lk in Pemberton Twp	AN0144	Aquatic Life	NJDEP AMNET
Lower Delaware	19	Pole Bridge Br near Browns Mills	01466200	Phosphorus, Dissolved Solids, TSS	NJDEP/USGS Data
Lower Delaware	19	Presidential Lake-19	Presidential Lake	Nutrients/Sedimentation (Eutrophic)	NJDEP Clean Lakes Program
Lower Delaware	19	Rancocas Creek N Br at Hanover Furnace	01465950, 19-RA-1N	TSS, Arsenic, Cadmium, Chromium, Nickel, Selenium, Zinc	NJDEP/USGS Data, Metal Recon
Lower Delaware	19	Rancocas Creek N Br at Main St in Pemberton	AN0149	Aquatic Life	NJDEP AMNET
Lower Delaware	19	Rancocas Creek N Br at Pemberton	01467000, 19-RA-3N	Arsenic, Cadmium, Mercury	NJDEP/USGS Data, Metal Recon
Lower Delaware	19	Rancocas Creek N Br at Pine St at Mt Holly	01467006, 19-RA-4N	Arsenic, Cadmium, Mercury	NJDEP/USGS Data, Metal Recon
Lower Delaware	19	Rancocas Creek N Br blw Hanover Lk in Pemberton Twp	AN0143	Aquatic Life	NJDEP AMNET
Lower Delaware	19	Rancocas Creek S Br at Rt 38 at Hainsport	19-RA-1S	Arsenic, Cadmium, Chromium, Copper, Mercury, Nickel, Selenium, Zinc	NJDEP Metal Recon
Lower Delaware	19	Rancocas Creek S Br at Buddtown - Beaverville Rd in Southampton Twp	AN0156	Aquatic Life	NJDEP AMNET
Lower Delaware	19	Rancocas Creek S Br at Vincentown	01465850, 19-RA-3S	Arsenic, Cadmium, Mercury	NJDEP/USGS Data, Metal Recon
Lower Delaware	19	Rancocas Creek SW Br at Elmwood Rd in Evesham Twp	AN0162	Aquatic Life	NJDEP AMNET
Lower Delaware	19	Rancocas Creek SW Br at Rt 70 in Medford Twp	AN0169	Aquatic Life	NJDEP AMNET
Lower Delaware	19	Rancocas Creek SW Br at Rte 70 in Medford	19-RA-2S	Arsenic, Cadmium, Chromium, Lead, Copper, Mercury, Nickel, Selenium, Zinc	NJDEP Metal Recon
Lower Delaware	19	Sharps Run at Rt 541 in Medford Twp	AN0170	Aquatic Life	NJDEP AMNET
Lower Delaware	19	Smithville Lake-19	Smithville Lake	Nutrients/Sedimentation (Eutrophic)	NJDEP Clean Lakes Program
Lower Delaware	19	Wood Lake-19	Woodlake	Fecal Coliform	County Health Department
Lower Delaware	20	Annaricken Brook at Island Rd in Springfield Twp	AN0139	Aquatic Life	NJDEP AMNET
Lower Delaware	20	Annaricken Brook near Jobstown	01464578	pH, TSS	NJDEP/USGS Data
Lower Delaware	20	Assiscunk Creek at Cedar Lane at Springfield	20-AS-1	Copper, Nickel, Selenium, Zinc	NJDEP/USGS Metal Recon
Lower Delaware	20	Assiscunk Creek at Columbus - Georgetown Rd in Springfield Twp	AN0138	Aquatic Life	NJDEP AMNET
Lower Delaware	20	Assiscunk Creek UNK Trib at Oxmead Rd in Burlington Twp	AN0142C	Aquatic Life	NJDEP AMNET
Lower Delaware	20	Bacon Run at White Pine Rd in Mansfield Twp	AN0133	Aquatic Life	NJDEP AMNET

Sublist	Wtrshd Region	WMA	Station Name/Waterbody	Site ID	Parameters
3	Lower Delaware	19	Rancocas Creek N Br at Iron Works Park at Mt Holly	01467005, 01467006, 01467003, 19-RA-4N	Cadmium, Mercury
3	Lower Delaware	19	Rancocas Creek N Br at Main St in Pemberton	AN0149, NNORT816	Pineland Biological Community
3	Lower Delaware	19	Rancocas Creek N Br at Pemberton	01467000, 19-RA-3N	Arsenic, Cadmium, Mercury
3	Lower Delaware	19	Rancocas Creek N Br blw Hanover Lk in Pemberton	AN0143, NNOMILIT	Pineland Biological Community
3	Lower Delaware	19	Rancocas Creek S Br at Buddtown - Beaverville Rd in Southampton	AN0156, SSORIDGE	Pineland Biological Community
3	Lower Delaware	19	Rancocas Creek S Br at Burr's Mill Rd	SSOBURRS	Pineland Biological Community
3	Lower Delaware	19	Rancocas Creek S Br at Hainsport	Rancocas, EWQ0176S, 19-RA-1S	pH, Cadmium, Mercury
3	Lower Delaware	19	Rancocas Creek S Br at Ridge Rd in Southampton	EWQ0156	Phosphorus
3	Lower Delaware	19	Rancocas Creek S Br at Vincentown	01465850, 19-RA-3S	Arsenic, Cadmium, Mercury
3	Lower Delaware	19	Rancocas Creek SW Br at Elmwood Rd in Evesham	AN0162	Benthic Macroinvertebrates
3	Lower Delaware	19	Rancocas Creek SW Br at Rt 70 in Medford	EWQ0169, 19-RA-2S	Cadmium, Mercury
3	Raritan	09	Raritan River at Landing Lane in Johnson Pk, Piscatawa	01404170	pH
3	Raritan	09	Raritan River at Queens Bridge	01403300	Cadmium, Mercury
3	Raritan	08	Raritan River N Br at Burnt Mills	01399120, 8-NB-2	Arsenic, Cadmium, Chromium, Lead, Mercury, Nickel, Selenium, Zinc
3	Raritan	08	Raritan River N Br at Rt 202 in Far Hills	EWQ0351	pH
3	Raritan	08	Raritan River S Br Arch St at High Bridge	01396535, 8-SB-2	Arsenic, Cadmium, Mercury
3	Raritan	08	Raritan River S Br at Middle Valley	01396280, EWQ0316, 8-SB-1	Arsenic, Cadmium, Mercury
3	Raritan	08	Raritan River S Br at Smithtown Rd in Mount Olive	AN0310	Benthic Macroinvertebrates
3	Raritan	08	Raritan River S Br at South Branch	01398102, 8-SB-6	Cadmium, Mercury, Silver
3	Raritan	08	Raritan River S Br at Stanton Station	01397000, 8-SB-3	Cadmium, Mercury
3	Raritan	08	Raritan River S Br at Three Bridges	01397400, 8-SB-4	Arsenic, Cadmium, Mercury
3	Raritan	09	Raritan River trib at Rt 527 in Franklin	AN0427	Benthic Macroinvertebrates
3	Lower Delaware	18	Rattling Run at Tomlin Rd in East Greenwich	AN0676	Benthic Macroinvertebrates
3	Lower Delaware	17	Reed Branch at Royal Ave in Franklin	AN0731	Benthic Macroinvertebrates
3	Atlantic Coast	13	Ridgeway Branch at Rt 571 in Jackson	AN0527	Benthic Macroinvertebrates
3	Atlantic Coast	13	Ridgeway Branch UNK Trib at Colliers Mill WMA (outlet of Turn Mill in Jackson	AN0525A	Benthic Macroinvertebrates
3	Northwest	11	Rising Sun Lake-11	Rising Sun Lake	Phosphorus
3	Atlantic Coast	14	Roberts Branch at Carranza Rd in Shamong	AN0580, BTOMCARR	Pineland Biological Community
3	Raritan	07	Robinson Branch at Scotch Plains	01395200	pH, Total Suspended Solids
3	Raritan	07	Robinson Branch at St Georges Av at Rahway	01396003, 7-ROB-1	Total Suspended Solids, Arsenic, Cadmium, Chromium, Copper, Lead, Mercury, Nickel, Selenium, Silver, thallium, Zinc
3	Raritan	07	Robinsons Branch trib at Lamberts Mill Rd in Westfield	AN0198	Benthic Macroinvertebrates
3	Raritan	07	Robinsons Branch trib at Raritan (Terrell) Rd in Scotch Plains	AN0197	Benthic Macroinvertebrates
3	Raritan	10	Rock Brook at Long Hill Rd in Montgomery	AN0399	Benthic Macroinvertebrates
3	Raritan	10	Rock Brook on Burnt Hill Rd in Montgomery.	10-RO-1	Arsenic, Cadmium, Chromium, Copper, Lead, Mercury, Nickel, Selenium, Zinc

APPENDIX B
EXISTING STORMWATER REGULATIONS

§100-37. Storm water management

A. General.

(1) Design of the storm water management system shall be consistent with general and specific concerns, values and standards of the municipal Master Plan and applicable county, regional and state storm drainage control programs, including Mosquito Commission control standards, if applicable. Design shall be based on environmentally sound site planning and engineering techniques.

(2) The best available technology shall be used to minimize off-site storm water runoff, increase on-site infiltration, encourage natural filtration functions, simulate natural drainage systems and minimize off-site discharge of pollutants to groundwater and surface water. Best available technology may include measures such as retention basins, recharge trenches, porous paving and piping, contour terraces and swales.

B. System demand.

(1) Watershed storm water management requires the determination of two runoff parameters: runoff peak rate of discharge and runoff volume. Both parameters shall be used in the comparison of predevelopment and post-development conditions.

(2) Peak rate of discharge calculations shall be used to determine the configurations and sizes of pipes, channels and other routing or flow control structures. Runoff volume calculations shall be used to determine the necessity for, and sizing of, detention and retention facilities.

(3) Runoff peak rate of discharge calculation. The peak rate of runoff for areas of up to 1/2 of a square mile shall be calculated by the Rational Method or derivatives.

(a) Typical C values for storms of five to 10 years between periods are provided in Exhibit D, Runoff Coefficients, AMC 11.6 Runoff coefficients from the following sources may also be used: U.S. Department of Commerce, Bureau of Public Roads, May 1965, Design of Roadside Channels - Hydraulic Design Series No. 4, as supplemented or amended; and Department of Transportation, Federal Aviation Administration, July 1970, AC 1505320-5B, Airport Drainage, as supplemented or amended.

(b) The time of concentration (tc) shall be estimated from Exhibit E, Normograph for the Determination of Time and Concentration. The analysis shall also consider the procedure outlined in Section 3.12 (c) of Technical Release (TR) No. 55, Urban Hydrology for Small Watersheds, U.S. Department of Agriculture, Soil Conservation Service, as supplemented and amended (SCS method).

(c) Rainfall intensity as a function of duration and storm recurrence frequency shall be based upon geographically appropriate data as depicted in the plates in technical paper No. 25, Rainfall Intensity

Duration - Frequency Curves, U. S. Department of Commerce, Weather Bureau, as supplemented and amended. Rainfall intensity values may also be estimated from Exhibit F, Rainfall Intensity Curves. Intensity curves may be based on local rainfall frequency data, where available. In all instances, a minimum time of concentration of five minutes should be used. For storm sewer design, a ten-year storm frequency should be considered as a minimum unless special circumstances are involved, such as evidence of local flooding, inadequate downstream storm water facilities and technical ambiguities.

(d) The size of the drainage .area shall include on-site and off-site lands contributing to the design point.

(e) Computer software adaptations of the Rational Method calculations are acceptable, provided that their data and graphic printout allow review and evaluation.

(f) The peak rate of runoff for areas greater than 1/2 square mile shall be calculated by the hydro graph analysis method as outlined in TR No. 55 (SCS method), as supplemented- and amended.

(4) Runoff volume calculation.

(a) Runoff volume shall be calculated by the hydro graph analysis method as outlined in TR No. 55 (SCS method). This method shall be used for watersheds with drainage areas of less than five square miles. For drainage areas of less than five acres, the Rational Method triangular hydrography approximation may be used as an alternative.

(b) Runoff volume for drainage areas of greater than five square miles shall be calculated by the Stankowski Method. Computer software adaptions of these runoff value calculations are acceptable, provided that their data and graphic printout allow review and evaluation.

C. System strategy

(1) A system emphasizing a natural as opposed to an engineered drainage strategy shall be encouraged.
(2) The applicability of a natural approach depends on such factors as site storage capacity, open channel hydraulic capacity and maintenance needs and resources.
(3) Hydraulic capacity for open channel or closed conduit flow shall be determined by the Manning Equation. The hydraulic capacity is termed Q and is expressed as discharge in cubic feet per second.
(4) Velocities in open channels at design flow shall not be less than 0.5 foot per second and not greater than that velocity which will begin to cause erosion or scouring of the channel. Permissible velocities for swales, open channels and ditches are shown in Exhibit H.
(5) Velocities in closed conduits at design flow shall be at least two feet per second but not more than the velocity which will cause erosion damage to the conduit.

D. Pipe capacity, materials and placement.

(1) Pipe size shall be dictated by design runoff and hydraulic capacity.
(2) Hydraulic capacity shall be determined by the Manning Equation.
(3) In general, no pipe size in the storm drainage system shall be less than fifteen-inch diameter. A twelve-inch-diameter pipe will be permitted as a cross-drain to a single inlet.
(4) All discharge pipes shall terminate with a precast concrete or corrugated metal end section or a cast-in-place concrete headwall with or without wingwalls as conditions require.
(5) Materials used in the construction of storm sewers shall be constructed of reinforced concrete, ductile iron, corrugated aluminum or corrugated steel. The least expensive materials shall be permitted unless site and other conditions dictate otherwise. Specifications referred to, such as AASHTO, ASTM, AWWA, etc., should be the latest revision.

(a) Reinforced concrete pipe:

[1] Circular reinforced concrete pipe and fittings shall meet the requirements of ASTM C 76.
[2] Elliptical reinforced concrete pipe shall meet the requirements of ASTM C 507.
[3] Joint design and joint material for circular pipe shall conform to ASTM C 443.
[4] Joints for elliptical pipe shall be bell-and-spigot or tongue-and-groove sealed with butyl, rubber tape or external sealing bands conforming to ASTM C 877.
[5] All pipe shall be Class III unless a stronger pipe (i.e., higher class) is indicated to be necessary.
[6] The minimum depth of cover over the concrete pipe shall be as designated by the American Concrete Pipe Association, as follows:

i. Ductile iron pipe shall be centrifugally cast in metal or sand-lined molds to ANSI A21.51-1976 (AWWA C151-76). The joints shall conform to AWWA C111. Pipe shall be furnished with flanges where connections to flange fittings are required. Pipe should be Class 50 (minimum). The outside of the pipe 'should be coated with a uniform thickness of hot applied coal tar coating and the inside lined cement in accordance with AWWA C 104. Ductile iron pipe shall be installed with Class C, Ordinary Bedding.
ii. Corrugated aluminum pipe. Within the public right-of-way and where severe topographic conditions or the desire to minimize the destruction of trees and vegetation exist, corrugated aluminum pipe, pipe arch or helical corrugated pipe may be used. The material used shall comply with the Standard Specifications for Corrugated Aluminum Alloy Culvert and Under Drains AASHTO M 196 or the Standard Specification for Aluminum Alloy Helical Pipe AASHTO designation M-211. The minimum thickness of the aluminum pipe to be used shall be as follows: less than twenty-four-inch diameter or equivalent, 0.75 inch (fourteen-gauge); twenty-four-inch diameter and less than forty-eight-inch diameter or equivalent, 0.105 inch

(twelve-gauge); forty-eight-inch but less than seventy-two-inch diameter or equivalent, 0.135 inch (ten-gauge); and seventy-two-inch diameter or equivalent and. larger, 0.164 inch (eight-gauge).

iii. Corrugated steel pipe may be used in place of corrugated aluminum and shall meet the requirements of AASHTO M-36. Coupling bands and special sections shall also conform to AASHTO M-36. All corrugated steel pipe shall be bituminous coated in accordance with AASHTO M-190, Type A minimum.

(6) Pipe bedding shall be provided as specified in Design and Construction of Sanitary and Storm Sewers, ASCE Manuals and Reports on Engineering Practice No. 37, prepared by a Joint Committee of the Society of Civil Engineers and the Water Pollution Control Federation, New York, 1969.

(7) Maintenance easements shall be provided around storm water facilities where such facilities are located outside of the public right-of-way. The size of the easement shall be dictated by working needs. In general, the easement shall be 20 feet in width for one utility and five additional feet, if practicable, for each additional utility located in the same easement.

E. Inlets, catch basins and manholes.

(1) Inlets, catch basins and manholes shall be designed in accordance with relevant state highway department standard plans and specifications. Frames and grates shall be Campbell Foundry Company Pattern No. 2617 Bicycle Grates with stream-flowing grating, or equal.
(2) Manhole spacing shall be increased with pipe size.
(3) Manholes shall be precast concrete, brick or concrete block coated with two coats of portland cement mortar.
(4) If precast manhole barrels and cones are used, they shall conform to ASTM C 478 with round rubber gasketed joints, conforming to ASTM C 923. Maximum absorption shall be 9%. In accordance with ASTM C 478, Method A.
(5) If precast manholes are utilized, the top riser section shall terminate less than one foot below the finished grade and the manhole cover shall be flush with the finished gra.
(6) Manhole frames and covers shall be of cast iron conforming to specification ASTM A 48 Class 30 and be suitable for H 20 loading capacity. All manhole covers in rights-of-way or in remote areas shall be provided with a locking device. In order to allow the municipality to plan better for system management, the name of the municipality, the year, and the words "STORM SEWER" shall be cast integrally in the cover.

F. Detention facilities.

(1) Development shall use the best available technology to accommodate storm water management by natural drainage strategies as indicated in Article X, Section I 100-34B of this chapter.
(2) Nonstructural management practices, such as cluster land use development, open space acquisition, stream encroachment and flood hazard controls shall be coordinated with detention requirements. Changes in land use can often reduce the scope and cost of detention provisions required by means of appropriate changes in runoff coefficients.

(3) Detention and all other storm water management facilities shall conform to applicable state standards.

(4) Where detention facilities are deemed necessary, they shall accommodate site runoff generated from two-year, ten-year, and one-hundred-year storms considered individually, unless the detention basin is classified as a dam, in which case the facility must also comply with prevailing dam safety standards. These design storms shall be defined as either a twenty-four-hour storm, using the rainfall distribution recommended by the U.S. Soil Conservation Service using U.S. Soil Conservation procedures (such. as U.S. Soil Conservation Service, Urban Hydrology for Small Watersheds, Technical Release No. 55), or as the estimated maximum rainfall for the estimated time of concentration of runoff at the site, using a design method such as the Rational Method. Runoff greater than that occurring from the one-hundred-year, twenty-four-hour storm will be passed over an emergency spillway. Detention will be provided such that after development the peak rate of flow from the site will not exceed the corresponding flow which would have been created by similar storms prior to development. For purposes of computing runoff, lands in the site shall be assumed, prior to development, to be in good condition (if the lands are pastures, lawns or parks), with good cover (if the lands are woods), or with conservation treatment (if the land is cultivated), regardless of conditions existing at the time of computation.

(5) In calculating the site runoff to be accommodated by a detention facility, the method to be used is a tabular hydrograph method as presented in TR No. 55 (SCS method), as supplemented and amended.

(6) Detention facilities shall be located as far horizontally from surface water and as far vertically from groundwater as is practicable.

(7) Detention facilities shall not intercept the post-development groundwater table, where practicable.

(8) The following list of general structural criteria shall be used to design storm water detention basins. Due to the uniqueness of each storm water detention basin and the variability of soil and other . site conditions, these criteria may be modified or appended at the discretion of the reviewing engineer if reasons for the variance are indicated in writing.

(a) Detention components: principal outlets (quantity control).

[1] To minimize the chance of clogging and to facilitate cleaning, outlet pipes shall be at least six inches in diameter. Similarly, riser pipes, if utilized, shall be at least eight inches in diameter, All pipe joints are to be watertight, reinforced concrete pipe. In addition, trash racks and/or anti-vortex devices shall be required where necessary.

[2] Eight-inch-thick anti-seep collars are to be installed along outlet pipes. Reinforcement steel shall be No. 5 bars at 12 inches both ways with two inches of cover on both faces (minimum).

[3] Where necessary, a concrete cradle shall be provided for outlet pipes.

[4] All principal outlet structures shall be concrete block or reinforced concrete. All construction joints are to be watertight.

[5] Suitable lining shall be placed upstream and downstream of principal outlets as necessary to prevent scour and erosion. Such lining shall conform to the criteria contained in Hydraulic Engineering Circular No. 15, Design of Stable Channels with Flexible Linings, published by the Federal Highway Administration of the U.S. Department of Transportation, or National Handbook of Conservation Practices

published by the U.S. Department of Agriculture/Soil Conservation Service.

(b) Detention components: principal outlets (quality control).

[1] Based upon the requirement limiting the size of the outlet to a minimum of six inches in diameter, water quality control shall be maintained by providing an amount of storage equal to the total amount of runoff which will be produced by the one-year-frequency SCS Type III twenty-four-hour storm, or a one-and-twenty-five-hundredths-inch, two-hour rainfall at the bottom of the proposed detention basin along with a minimum three-inch-diameter outlet.

[2] The invert(s) of the principal outlet(s) used to control the larger storms for flood control purposes would then be located at the resultant water surface elevation required to produce this storage volume. Therefore, the principal outlets would be utilized for storms only in excess of the one-and-twenty-five-hundredths-inch, two-hour event which, in turn, would be completely controlled by the lower, three-inch outlet. If the above requirements would result in a pipe smaller than three inches in diameter, the period of retention shall be waived so that three inches will be the minimum pipe size used. It should be remembered that, in all cases, the basin should be considered initially empty (i.e., the storage provided for the quality requirements and the discharge capacity of its outlet should be utilized during the routing of the larger flood control storms).

(c) Detention components: emergency spillways.

[1] Vegetated emergency spillways shall have side slopes not exceeding three horizontal to one vertical.

[2] Emergency spillways not excavated from noncompacted soil shall be suitably lined and shall comply with criteria contained in Hydraulic Circular No. 15 or National Handbook of Conservation Practices.

[3] Maximum velocities in emergency spillways shall be checked based on the velocity of the peak flow in the spillway resulting from the routed Emergency Spillway Hydrography. Where maximum velocities exceed those contained Exhibit H, suitable lining shall be provided.

(d) Detention components: dams and embankments

[1] The minimum top widths of all dams and embankments are listed below. These values have been adopted from the National Handbook of Conservation Practices.

[2] The design top elevation of all dams and embankments after all settlement has taken place shall be equal to, or greater than, the maximum water surface elevation in the basin resulting from the routed Freeboard Hydrograph. Therefore, the design height of the dam or embankment, defined as the vertical distance from the top down to the bottom of the deepest cut, shall be increased by the amount needed to ensure that the design top elevation will be maintained following all settlement. This increase shall not be less than 5%. Where necessary, the Engineer. shall require consolidation tests of the undisturbed foundation soil to more accurately determine the necessary increase.

[3] Maximum side slopes for all dams and embankments are three horizontal to one vertical.
[4] All earth fill shall be free from brush, roots and other organic material subject to decomposition.
[5] Cutoff trenches are to be excavated along the dam or embankment center line to impervious subsoil. or bedrock.
[6] Safety ledges shall be constructed on the side slopes of all detention basins having a permanent pool of water. The ledges shall be four feet to six feet in width and located approximately 2 1/2 feet to three feet o six below and one foot to 1 1/2 feet above the permanent water surface.
[7] The fill material in all earth dams and embankments shall be compacted to at least 95% of the maximum density obtained from compaction tests performed by the appropriate method in ASTM D 698.

(e) Detention facilities in flood hazard areas.

[1] There will be no detention basins in the flood way except for those on-stream.
[2] Whenever practicable, developments and their storm water detention facilities should be beyond the extent of the flood hazard area of a stream. When that is not feasible and detention facilities are proposed to be located partially or wholly within the flood hazard area or other areas which are frequently flooded, some storm conditions will make the facility ineffective at providing retention of site runoff. This will happen if the stream is already overflowing its banks and the detention basin, causing the basin to be filled prior to the time it is needed. In such cases, the standards established in these regulations will be modified in order to give only partial credit to detention capacities located within a flood hazard area. The credit will vary in a ratio intended to reflect the probability that storage in a detention basin will be available at the time a storm occurs at the site.
[3] In addition, detention facilities must be in compliance with all applicable regulations.
[4] Detention storage provided below the elevation of the edge of the flood hazard area will be credited as effective storage at a reduced proportion. *Area contributing flood waters to the flood hazard area at the site in question. This effective detention storage will be required to provide for drainage of the developed land in accordance with the criteria already established in these regulations. However, the gross storage considered for crediting will not exceed that which would be filled. by runoff of a one-hundred-year storm from the site.
[5] As an alternative to the approach outlined in Subsection F(8)(b) above, if the developer can demonstrate that the detention provided would be effective during runoff from the one-hundred-year, twenty-four-hour Type II storm, peaking simultaneously at the site and on the flood hazard area, the developer's plan will be accepted as complying with the provisions of Subsection F(8)(b) above.
[6] In making computations under Subsection F(8)(b) or (e) above, the volume of net fill added to the flood hazard area portion of the project's site will. be subtracted from the capacity of effective detention storage provided. Net fill is defined as the total amount of fill created by the project less the amount of material excavated during the construction of

the project, both measured below the elevation of the one-hundred-year flood but above the elevation of low water in the stream.
[7] Where detention basins are proposed to be located in areas which are frequently flooded but have not been mapped as flood hazard areas, the provisions of either Subsections F(8)(b) or (e) will be applied substituting the elevation of a computed one-hundred-year flood for the elevation of the flood hazard area in Subsection F(8)(b).

(f) Detention facilities: maintenance and repair.
[1] Responsibility for operation and maintenance of detention facilities, including periodic removal and disposal of accumulated particulate material and debris, shall remain with the owner or owners of the property with permanent arrangements that such responsibility shall pass to any successive owner, unless assumed by a government agency. If portions of the land are to be sold, legally binding arrangements shall be made to pass the. basic responsibility to successors in title.
[2] Prior to granting approval to any project subject to review under 'this chapter, the applicant shall enter into an agreement with the municipality to ensure the continued operation and maintenance of the detention facility. This agreement shall be in a form satisfactory to the Municipal Attorney and may include but may not necessarily be limited to personal guaranties, deed restrictions, covenants and bonds. In cases where property is subdivided and sold separately, a homeowner's association or similar permanent entity should be established as the responsible entity, absent an agreement by a governmental agency to assume responsibility.
[3] In the event that the detention facility becomes a danger to public safety or public health, or if it is in need of maintenance, the municipality shall so notify, in writing, the responsible person. From that notice, the responsible person shall have 14 days to effect such maintenance and repair of the facility in a manner that is approved by the Municipal Engineer or his or her designee. If the responsible person fails or refuses to perform such maintenance and repair, the municipality may immediately proceed to do so and shall bill the cost thereof to the responsible person.

G. Protecting water quality.
(1) In addition to addressing water quantity generated by development, a storm water management system shall also enhance the water quality of storm water runoff.
(2) In order to enhance water quality of storm water runoff, storm water management shall provide for the control of a water quality design storm. The water quality design storm shall be defined as the one-year-frequency SCS Type III twenty-four-hour storm or a one-and-twenty-five-hundredths-inch two-hour rainfall.
(3) The water quality design storm shall be controlled by best management practices. These include but are not limited to the following:
(a) In "dry" detention basins, provisions shall be made to ensure that the runoff from the water quality design storm is retained such that not more than 90% will be evacuated prior to 36 hours for all nonresidential projects. The retention time shall be considered a brim drawdown time, and therefore shall begin at the time of peak

storage. The retention time shall be reduced in any case which would require an outlet size diameter of three inches or less. Therefore, three-inch-diameter orifices shall be the minimum allowed.

(b) In permanent ponds or "wet" basins, the water quality requirements of this chapter shall be satisfied where the volume of permanent water is at least three times the volume of runoff produced by the water quality design storm.

(c) Infiltration practices such as dry wells, infiltration basins, infiltration trenches, buffer strips, etc., may be used to satisfy this requirement, provided that they produce zero runoff from the water quality design storm and allow for complete infiltration within 72 hours.

(d) Other suitable best management practices shall be strictly. applied and adhered to as provided in other relevant state and county regulatory criteria, including; but not limited to, the following:

[1] All storm water management: water quality requirements in N.J.A.C. 5:21-7.6.

[2] Storm water and Nonpoint Source Pollution Control,. Best Management Practices, Manual, State of New Jersey, Department of Environmental Protection, Office of Land and Water Planning.

[3] Technical Manual for Land Use Regulation Program, Bureaus of Inland and Coastal Regulations, Stream Encroachment Permits, revised September 1995. State of New Jersey, Department of Environmental Protection.

[4] Ocean County Demonstration Study Storm water Management Facilities Maintenance Manual, June 1989, State of New Jersey, Department of Environmental Protection, Office of Land and Water Planning.

[5] Any Phase II Regional Storm water Management Plan.

APPENDIX C

PROPOSED AMENDMENTS TO STORMWATER REGULATIONS

Regulations and Standards Proposed to be Added to the Delanco Township Land Development Regulations

General Requirements

Flood control, groundwater recharge, and pollutant reduction through nonstructural or low impact techniques shall be explored before relying on structural BMPs. Structural BMPs should be integrated with nonstructural stormwater management measures and proper maintenance plans. Nonstructural measures include both environmentally sensitive site design and source controls that prevent pollutants from being placed on the site. Source control plans should be developed based upon physical site conditions and the origin, nature, and the anticipated loading of potential pollutants. Multiple stormwater management BMPs may be necessary to achieve the established performance standards for water quality, quantity, and groundwater recharge.

a. This ordinance shall apply to any site plan that requires preliminary or final site plan review.

b. This ordinance is not intended to interfere with, abrogate, or annul any other ordinances, rule or regulation, statute, or other provision of law except that, where any provision of this ordinance imposes restrictions different from those imposed by any other ordinance, rule or regulation, or other provision of law, the more restrictive provisions or higher standards shall control.

General Standards

A. Design and Performance Standards for Stormwater Management Measures

1. Stormwater management measures for major development shall be developed to meet the erosion control, groundwater recharge, stormwater runoff quantity, and stormwater runoff quality standards in this section. To the maximum extent feasible, these standards shall be met by incorporating nonstructural stormwater management strategies into the design. If these strategies alone are not sufficient to meet these standards, structural stormwater management measures necessary to meet these standards shall be incorporated into the design.

2. The standards in this ordinance apply only to new major development and are intended to minimize the impact of stormwater runoff on water quality and water quantity in receiving water bodies and maintain groundwater recharge. The standards do not apply to new major development to the extent that alternative design and performance standards are applicable under a regional stormwater management plan or Water Quality Management Plan adopted in accordance with Department rules. Such alternative standards shall provide at least as much protection from stormwater-related loss of

groundwater recharge, stormwater quantity and water quality impacts of major development projects as would be provided under the standards in this subchapter.

Stormwater Management Measures for Major Development

(a) Stormwater management measures for major development shall be developed to meet the erosion control, groundwater recharge, stormwater runoff quantity, and stormwater runoff quality standards at N.J.A.C. 7:8-5.4 and 5.5. To the maximum extent practicable, these standards shall be met by incorporating nonstructural stormwater management strategies at N.J.A.C. 7:8-5.3 into the design. If these measures alone are not sufficient to meet these standards, structural stormwater management measures at N.J.A.C. 7:8-5.7 necessary to meet these standards shall be incorporated into the design.

Erosion Control, Groundwater Recharge and Runoff Quantity Standards

a. The minimum design and performance standards for erosion control are those established under the Soil Erosion and Sediment Control Act, N.J.S.A. 4:24-39 et seq. and implementing rules.

b. The minimum design and performance standards for groundwater recharge are as follows:

(1) The design engineer shall, using the assumptions and factors for stormwater runoff and groundwater recharge calculations provided, either:

(a) Demonstrate through hydrologic and hydraulic analysis that the site and its stormwater management measures maintain 100 percent of the average annual pre-construction groundwater recharge volume for the site; or

(b) Demonstrate through hydrologic and hydraulic analysis that the increase of stormwater runoff volume from pre-construction to post-construction for the 2-year storm is infiltrated.

(2) This groundwater recharge requirement does not apply to the following projects:

(a) projects within an "urban redevelopment area"
(b) areas of steep slopes within the Township as defined in section 7.33.A.
(c) projects subject to (3) below.

(3) The following types of stormwater shall not be recharged:

(a) Stormwater from areas of high pollutant loading. High pollutant loading areas are areas in

a)industrial and commercial developments where solvents and/or petroleum products are loaded/unloaded, stored, or applied, areas where pesticides are

loaded/unloaded or stored; areas where hazardous materials are expected to be present in greater than "reportable quantities" as defined by the United States Environmental Protection Agency (EPA) at 40 CFR 302.4; areas where recharge would be inconsistent with Department approved remedial action work plan or landfill closure plan and areas with high risks for spills of toxic materials, such as gas stations and vehicle maintenance facilities; and

(b) Industrial stormwater exposed to "source material." "Source material" means any material(s) or machinery, located at an industrial facility, that is directly or indirectly related to process, manufacturing or other industrial activities, which could be a source of pollutants in any industrial stormwater discharge to groundwater. Source materials include, but are not limited to, raw materials; intermediate products; final products; waste materials; by-products; industrial machinery and fuels, and lubricants, solvents, and detergents that are related to process, manufacturing, or other industrial activities that are exposed to stormwater.

(4) The design engineer shall assess the hydraulic impact on the groundwater table and design the site so as to avoid adverse hydraulic impacts. Potential adverse hydraulic impacts include, but are not limited to, exacerbating a naturally or seasonally high water table so as to cause surficial ponding, flooding of basements, or interference with the proper operation of subsurface sewage disposal systems and other subsurface structures in the vicinity or downgradient of the groundwater recharge area.

c. In order to control stormwater runoff quantity impacts, the design engineer shall, using the assumptions and factors for stormwater runoff calculations complete one of the following:

(1) Demonstrate through hydrologic and hydraulic analysis that for stormwater leaving the site, 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;

(2) Demonstrate through hydrologic and hydraulic analysis that there is 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. This analysis shall include the analysis of impacts of existing land uses and projected land uses assuming full development under existing zoning and land use ordinances in the drainage area;

(3) Design stormwater management measures so that the post-construction peak runoff rates for the 2, 10 and 100 year storm events are 50, 75 and 80 percent, respectively, of the preconstruction peak runoff rates. The percentages apply only to the post-construction stormwater runoff that is

attributable to the portion of the site on which the proposed development or project is to be constructed. The percentages shall not be applied to post-construction stormwater runoff into tidal flood hazard areas if the increased volume of stormwater runoff will not increase flood damages below the point of discharge; or

(4) In tidal flood hazard areas, stormwater runoff quantity analysis in accordance with (1), (2)and (3) above shall only be applied if the increased volume of stormwater runoff could increase flood damages below the point of discharge.

2. Any application for a new agricultural development that meets the definition of major development at Section 2 shall be submitted to the appropriate Soil Conservation District for review and approval in accordance with the requirements of this section and any applicable Soil Conservation District guidelines for stormwater runoff quantity and erosion control. For the purposes of this section, "agricultural development" means land uses normally associated with the production of food, fiber and livestock for sale. Such uses do not include the development of land for the processing or sale of food and the manufacturing of agriculturally related products.

Stormwater Runoff Quality Standards

1. Stormwater management measures shall be designed to reduce the post-construction load of total suspended solids (TSS) in stormwater runoff by 80 percent of the anticipated load from the developed site, expressed as an annual average. Stormwater management measures shall only be required for water quality control if an additional 1/4 acre of impervious surface is being proposed on a development site. The requirement to reduce TSS does not apply to any stormwater runoff in a discharge regulated under a numeric effluent limitation for TSS imposed under the New Jersey Pollution Discharge Elimination System (NJPDES) rules, N.J.A.C. 7:14A, or in a discharge specifically exempt under a NJPDES permit from this requirement. The water quality design storm is 1.25 inches of rainfall in two hours. Water quality calculations shall take into account the distribution of rain from the water quality design storm, as reflected in Table 1. The calculation of the volume of runoff may take into account the implementation of non-structural and structural stormwater management measures.

Safety Standards for Stormwater Management Basins

A. This section sets forth requirements to protect public safety through the proper design and operation of stormwater management basins. This subchapter applies to any new stormwater management basin.
B. The provisions of this section are not intended to preempt municipal or county safety requirements for new or existing stormwater management basins.

Provisions for Trash Racks, Overflow Grates, and Escape

C. Operative date and compliance schedule
1. For purposes of this subchapter, a stormwater management basin is "existing" if construction of such basin commenced prior to (one year from the effective date of this ordinance), or if such basin was identified in a subdivision or site plan application that received final approval pursuant to the Municipal Land Use Law (N.J.S.A. 40:55D-1 et seq.) as of (one year from the effective date of this ordinance). Any other stormwater management basin is a "new" basin.

2. As of (one year from the effective date of this ordinance), the construction, installation, or operation of any new stormwater management basin that does not conform to the requirements of this subchapter is prohibited.

3. If an existing stormwater management basin does not conform to a municipal or county stormwater control ordinance adopted pursuant to N.J.A.C. 7:8-6.1(c), the person responsible for the stormwater management basin under such ordinance shall, within the time period specified in the ordinance, modify the basin to comply with the ordinance.

D. Requirements for trash racks, overflow grates and escape provisions
1. A trash rack is a device designed to catch trash and debris and prevent the clogging of outlet structures. Trash racks shall be installed at the intake to the outlet from the stormwater management basin to ensure proper functioning of the basin outlets in accordance with the following:

a. The trash rack shall have parallel bars, with no greater than six inch spacing between the bars.

b. The trash rack shall be designed so as not to adversely affect the hydraulic performance of the outlet pipe or structure.

c. The average velocity of flow through a clean trash rack is not to exceed 2.5 feet per second under the full range of stage and discharge. Velocity is to be computed on the basis of the net area of opening through the rack.

d. The trash rack shall be constructed and installed to be rigid, durable, and corrosion resistant, and shall be designed to withstand a perpendicular live loading of 300 lbs/ft sq.

2. An overflow grate is designed to prevent obstruction of the overflow structure. If an outlet structure has an overflow grate, such grate shall meet the following requirements:
a. The overflow grate shall be secured to the outlet structure but removable for emergencies and maintenance.

b. The overflow grate spacing shall be no less than two inches across the smallest dimension.

c. The overflow grate shall be constructed and installed to be rigid, durable, and corrosion resistant, and shall be designed to withstand a perpendicular live loading of 300 lbs/ft sq.

3. For purposes of this subsection, escape provisions means the permanent installation of ladders, steps, rungs, or other features that provide easily accessible means of egress from stormwater management basins. Stormwater management basins shall include escape provisions as follows:

a. If a stormwater management basin has an outlet structure, escape provisions shall be incorporated in or on the structure. With the prior approval of the reviewing agency, a free-standing outlet structure may be exempted from this requirement.

b. Safety ledges shall be constructed on the slopes of all new stormwater management basins having a permanent pool of water deeper than two and one-half feet. Such safety ledges shall be comprised of two steps. Each step shall be four to six feet in width. One step shall be located approximately two and one-half feet below the permanent water surface, and the second step shall be located one to one and one-half feet above the permanent water surface.

c. In new stormwater management basins, the maximum interior slope for an earthen dam, embankment, or berm shall not be steeper than 3 horizontal to 1 vertical.

E. Variance or exemption from safety standards
1. A variance or exemption from the safety standards for stormwater management basins may be granted only upon a written finding by the appropriate reviewing agency (municipality, county or Department).

Stormwater Management Facilities, Maintenances, and Repair

(1) Responsibility for operation and maintenance of stormwater management facilities, including periodic removal and disposal of accumulated particulate materials and debris, shall remain with owner or owners of the property with permanent arrangements that it shall pass to any successive owner unless assumed by a government agency. If portions of the land are sold, legally binding arrangements shall be made to pass the basic responsibility to successors in title. These arrangements shall designate for each project the property owner, governmental agency, or other legally established entity to be permanently responsible for maintenance, hereinafter in this section referred to as the responsible person.

(2) The applicant shall enter into an agreement with the township (or county) to ensure the continued operation and maintenance of the facility. This agreement shall be in a form satisfactory to the township attorney, and may include, but may not necessarily be limited to, personal guarantees, deed restrictions, covenants, and bonds. In cases where property is subdivided and sold separately, a homeowners' association or similar

permanent entity shall be established as the responsible entity, absent an agreement by a governmental agency to assume responsibility.

An applicant seeking approval for construction of a stormwater management facility shall provide funds necessary to permanently maintain the facility in accordance with subsection 18-35 8g of this chapter.

(3) In the event that the stormwater management facility becomes a danger to public safety or public health, or if it is in need of maintenance, the township shall so notify in writing the responsible person. From that notice, the responsible person shall have 14 days to effect such maintenance and repair, of the facility in a manner that is approved by the township engineer or his designee. If the responsible person falls or refuses to perform such maintenance and repair, the township may proceed to do so and shall bill the cost thereof to the responsible person.

(4) In the event that stormwater from a Township street or property contributes to a stormwater management facility on private property, the Township shall assume responsibility for the maintenance and ownership of that facility.

5) Dedication of Facilities

Where required, the stormwater management facilities shall be dedicated to the township as a lot. Detention or retention facility dedication shall be 15 feet from the top of bank of facilities in cut and the toe of slope of facilities constructed in fill. Inlet and outlet piping and maintenance access shall be contained within 20 foot wide, minimum, drainage utility easements. No relocation, construction or reconstruction shall take place within the areas of the easement, nor shall any structures be located within such area, nor shall any action be taken which may alter or impair the effectiveness of present or future drainage facilities or cause soil erosion without prior approving authority or township committee approval.

Nonstructural Stormwater Management Strategies

1. Nonstructural stormwater management measures incorporated into site design shall:
   a. Protect areas that provide water quality benefits or areas particularly susceptible to erosion and sediment loss;
   b. Minimize impervious surfaces and break up or disconnect the flow of runoff over impervious surfaces;

   c. Maximize the protection of natural drainage features and vegetation;

   d. Minimize the decrease in the "time of concentration" from pre-construction to post construction. "Time of concentration" is defined as the time it takes for

runoff to travel from the hydraulically most distant point of the watershed to the point of interest within a watershed;
e. Minimize land disturbance including clearing and grading;
f. Minimize soil compaction;
g. Provide low-maintenance landscaping that encourages retention and planting of native vegetation and minimizes the use of lawns, fertilizers and pesticides;
h. Provide vegetated open-channel conveyance systems discharging into and through stable vegetated areas;
i. Provide other source controls to prevent or minimize the use or exposure of pollutants at the site in order to prevent or minimize the release of those pollutants into stormwater runoff. These source controls include, but are not limited to:
(1) Site design features that help to prevent accumulation of trash and debris in drainage systems;
(2) Site design features that help to prevent discharge of trash and debris from drainage systems;
(3) Site design features that help to prevent and/or contain spills or other harmful accumulations of pollutants at industrial or commercial developments; and
(4) When establishing vegetation after land disturbance, applying fertilizer in accordance with the requirements established under the Soil Erosion and Sediment Control Act, N.J.S.A. 4:24-39 et seq., and implementing rules.

2. Any land area used as a nonstructural stormwater management measure to meet the performance standards shall be dedicated to a government agency, subjected to a conservation restriction filed with the appropriate County Clerk's office, or subject to an approved equivalent restriction that ensures that measure or an equivalent stormwater management measure approved by the reviewing agency is maintained in perpetuity.

3. Guidance for nonstructural stormwater management measures is available in the New Jersey Stormwater Best Management Practices Manual. The manual is available on the Department of Environmental Protection's stormwater web page at http://www.njstormwater.org.

Sources for Technical Guidance

A. Technical guidance for stormwater management measures can be found in the documents listed at 1 and 2 below, which are available from Maps and Publications, Department of Environmental Protection, 428 East State Street, P.O. Box 420, Trenton, New Jersey, 08625; telephone (609) 777-1038.

1. Guidelines for stormwater management measures are contained in the New Jersey Stormwater Best Management Practices Manual, as amended. Information is provided on stormwater management measures such as: bioretention systems, constructed stormwater wetlands, dry wells, extended detention basins, infiltration structures, manufactured treatment devices, pervious paving, sand filters, vegetative filter strips, and wet ponds.

APPENDIX D

MITIGATION PLAN CRITERIA

MITIGATION PLAN

This mitigation plan is provided for a proposed development that is granted a variance or exemption from the stormwater management design and performance standards.

Proposed: Mitigation Project Criteria

1. The mitigation project must 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 meet 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 BMP Manual.

a. The applicant can select one of the following projects listed to compensate for the deficit from the performance standards resulting from the proposed project. More detailed information on the projects can be obtained from the Township Engineer. Listed below are specific projects that can be used to address the mitigation requirement.

2. If a suitable site cannot be located in the same drainage area as the proposed development, as discussed in Option 1, 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 fecal impairment. Listed below are specific projects that can be used to address the mitigation option.

At this point the Township may include a list of projects designed to improve water quality, water quantity, or groundwater recharge issues with the Township. Contributing to or completing one of these alternatives would provide the clearly offset the effect on groundwater recharge, stormwater quantity control, and/or stormwater quality control that was created by granting the variance or exemption. The Township is encouraged to identify and rank possible projects to include within the mitigation project criteria.
It is important for the municipality to have sufficient information on each project, including size of the project, permit requirements, land ownership, and estimated project costs (i.e., permitting fees, engineering costs, construction costs, and maintenance costs).