TOWNSHIP OF HANOVER

MUNICIPAL STORMWATER MANAGEMENT PLAN

(In Accordance with N.J.A.C. 7:8-4)

February 2005
adopted March 22, 2005

Gerardo Maceira, P.E.
License No. 39699

Blais L. Brancheau, P.P.
License No. 4272

The original copy of this report was signed and sealed in accordance with N.J.A.C. 13:41.

TOWNSHIP OF HANOVER

MUNICIPAL STORMWATER MANAGEMENT PLAN

EXECUTIVE SUMMARY

The Municipal Stormwater Management Plan was prepared as outlined in N.J.A.C. 7:8-4 "Municipal Stormwater Management Planning" pursuant to the requirement imposed by the State of New Jersey as per N.J.A.C. 7:14A-25 "Municipal Stormwater Regulation Program".

The goals of the Plan are to; reduce flood damage, minimize stormwater runoff from any development, reduce soil erosion, assure the adequacy of existing culverts and bridges, maintain groundwater recharge, prevent an increase in non-point pollution, maintain the integrity of stream channels, and protect public safety through the proper design and operation of stormwater basins.

The Plan describes the affects of development upon water quality and quantity, the physical conditions of the Township, and the various stormwater issues within the Township.

The Plan proposes various strategies, procedures and regulations designed to achieve the goals and objectives of this plan. The most important of these is the adoption of a Stormwater Control Ordinance. The ordinance would require all developments to comply with the standards for stormwater management measures as established by N.J.A.C. 7:8-5 to minimize the adverse impact of stormwater runoff on water quality and water quantity and loss of groundwater recharge. The ordinance would also include standards for requiring long-term preventative and corrective maintenance measures of the stormwater management feature.

The Plan also recommends the following:

- Riparian Buffer regulations that would regulate, protect, and maintain riparian lands adjacent to streams, lakes, or other water bodies.
- Steep Slope regulations that would regulate the intensity of land development in areas of steep slopes.

- Recommendations to amend or supplement current regulations to promote the principle of non-structural stormwater management techniques

The Plan states that it will be updated (if necessary) to be consistent with any future updates to the Residential Site Improvement Standards and with any regional plan. In addition, the goals and objectives of the Plan are consistent with the conclusions drawn from the various water quality assessments of the Whippany River conducted by the Township's Health Department and the Whippany River Watershed Action Committee.

The Plan also includes a land use analysis to determine the amount of remaining developable vacant land within the Township.

The final element of the Plan is the recommendation of a Stormwater Mitigation Plan Ordinance. This ordinance provides a method for a developer and the Township to meet the goals of the Plan when a variance or exemption is required from the design and performance standards of the Stormwater Control Ordinance. The developer is required to build a stormwater mitigation project to offset the exemption. The Township would also have the option to allow the developer to provide funding or partial funding of an environmental enhancement project.

Appendices included within the Plan include:

- Appendix A – Water Quality Assessment - Whippany River
- Appendix B – Water Quality Studies of the Whippany River
- Appendix C – N.J.D.E.P. Listing of known Contaminated Sites
- Appendix D – Land Use Analysis – Development Potential
- Appendix E – Draft – Municipal Stormwater Control Ordinance

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Township of Hanover
Morris County, New Jersey
February, 2005

Introduction

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

A "Land Use Analysis" of vacant land has been included in this plan based upon existing zoning and land available for development. The plan also addresses the review and update of existing ordinances, the Township Master Plan, and other planning documents to allow for project designs that include low impact development techniques.

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

Goals

The goals of this plan are 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 culverts and bridges, and other in-stream structures;
- Maintain groundwater recharge;
- Prevent, to the greatest extent feasible, an increase in non-point pollution;
- Maintain the integrity of steam 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.

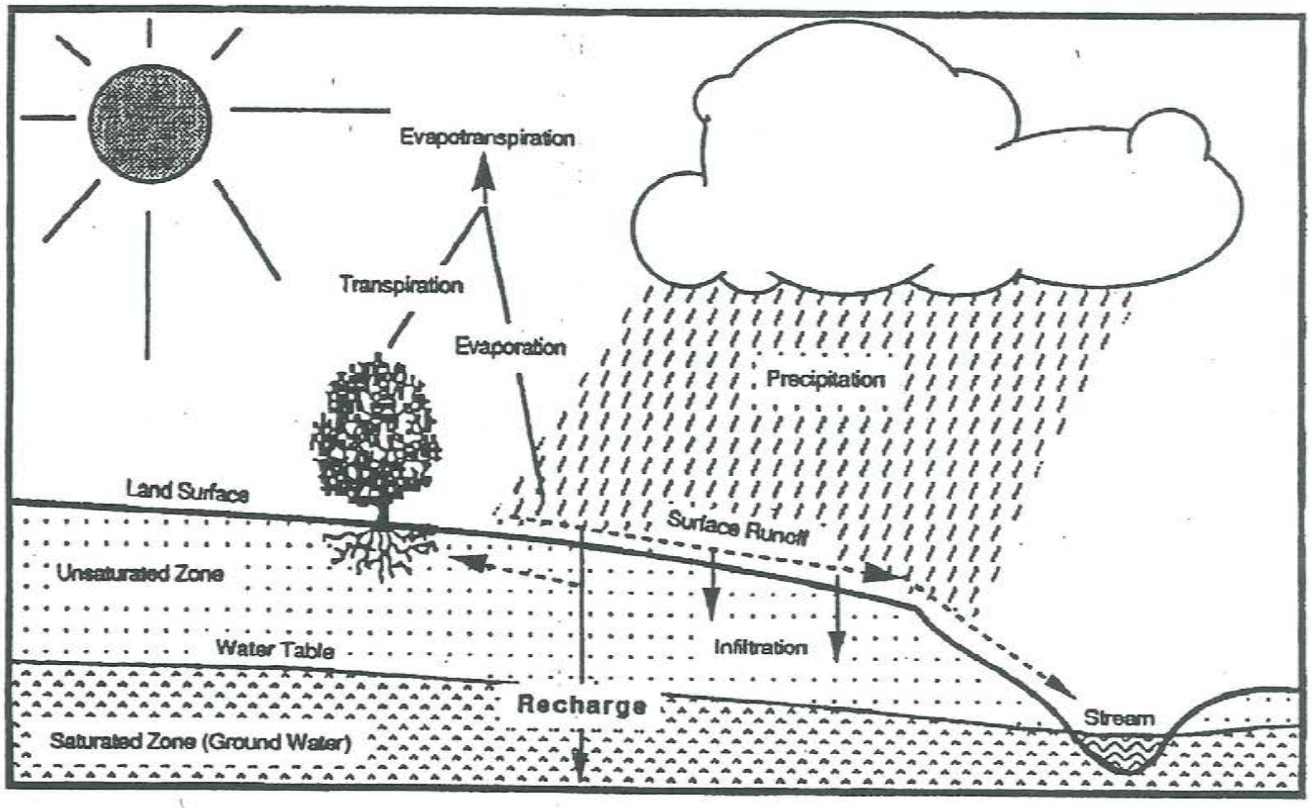
To achieve these goals, this plan outlines specific stormwater design and performance standards for new development. Additionally, the plan proposes stormwater management controls to address impacts from existing development. Preventative and corrective maintenance strategies are included in the plan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

Affects of Development Upon Water Quality and Quantity

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

In addition to increases in runoff peaks, volumes, and loss of groundwater recharge, land development often results in the accumulation of pollutants on the land surface that runoff can mobilize and transport to streams. New impervious surfaces and cleared areas created by development can accumulate a variety of pollutants from the atmosphere, fertilizers, animal wastes, and leakage and wear from vehicles. Pollutants can include metals, suspended solids, hydrocarbons, pathogens, and nutrients. In addition to increased pollutant loading, land development can adversely affect water quality and stream biota in more subtle ways. For example, stormwater falling on impervious surfaces or stored in detention or retention basins can become heated and raise the temperature of the downstream waterway, adversely affecting cold water fish species such as trout. Development can remove trees along stream banks that normally provide shading, stabilization, and leaf litter that falls into streams and becomes food for the aquatic community.

Groundwater Recharge in the Hydrologic Cycle



Source: New Jersey Geological Survey Report GSR-32.

Figure 1

Physical Conditions in the Township of Hanover

The Township encompasses 10.8 square mile area in the eastern portion of Morris County, New Jersey. Figure 2 depicts the Township boundary on the USGS quadrangle maps.

The topography of the Township of Hanover is variable, including hills, gently rolling areas and large expanses of level, low-lying areas. The highest elevation of the Township, in the far western section, is about 500 feet above sea level, and the lowest elevation, in the southeast corner, is approximately 186 feet above sea level. Some areas of steeper slopes exist, notably in four locations:

1) along the both sides of the proposed extension of Route 24 west of Ridgedale Avenue,
2) in the neighborhood of Longview Drive east of Ford Hill Road,
3) Along both sides of Whippany Road near Eden Lane and Parsippany Road, and
4) east of Troy Hills Road and north of the railroad.

Several low, typically wet areas also exist in the Township. The largest of these is Black Meadows, located in the eastern portion of the Township adjacent to East Hanover, and encompassing the Morristown Airport. As described in the Township's Open Space and Recreation Plan, "Black Meadows is part of a complex system of wetlands in the Central Passaic Basin. It is the remains of the Glacial Lake Passaic, which covered the region towards the end of the Pleistocene geological period. The wetlands within Black Meadows have been designated as 'priority wetlands' by the U.S. Environmental Protection Agency due their flood retention, toxin uptake and habitat value for waterfowl and other wildlife. Black Meadows also has a groundwater 1-A classification. This classification stipulates non-degradation and disallows human activities resulting in the degradation of the natural quality. The area is mostly forested wetlands with some emergent wetlands habitat. The area is also considered to be suitable habitat for the endangered bog turtle, bluespotted salamander and Tremblay's salamander. The Meadows is also habitat for other rare reptiles and amphibians and frequented by waterfowl and songbirds." Also as stated in the Open Space Plan, this area is also part of a buried valley aquifer shared with East Hanover, Florham Park and Parsippany-Troy Hills, a source of drinking water for much of Morris County.

Other wet areas include the Passaic Meadows macrosite, also located along the eastern boundary of the Township north of Route 10, and Lee Meadows, located in the northwest corner of the Township, adjacent to Parsippany-Troy Hills and between Routes 10 and 287. Other smaller wet areas exist along the various rivers and brooks, and in other low-lying areas of the Township.

According to the Soil Survey of Morris County, New Jersey (U.S. Dept. of Agriculture), the soils in the Township of Hanover are generally of two types: soils formed in young glacial till and soils formed in organic deposits, glacial lake sediment or glacial outwash. The former type is generally present on uplands in the Township and the latter type is found in the plains, terraces, depressions, along low-gradient streams and in broad lowland areas of the Township. Within these broad categories there is much variation, but several conditions characterize the Township's soils. First, many soils are characterized by a seasonal high water table within six feet of the surface. Second, many soils have poor to very poor internal drainage. These poor drainage characteristics in much of the Township are a significant limiting factor for development, including limitations for the design of stormwater runoff control. Figure 3 depicts the various soil types within the Township.

Township of Hanover Boundary on USGS Quadrangle

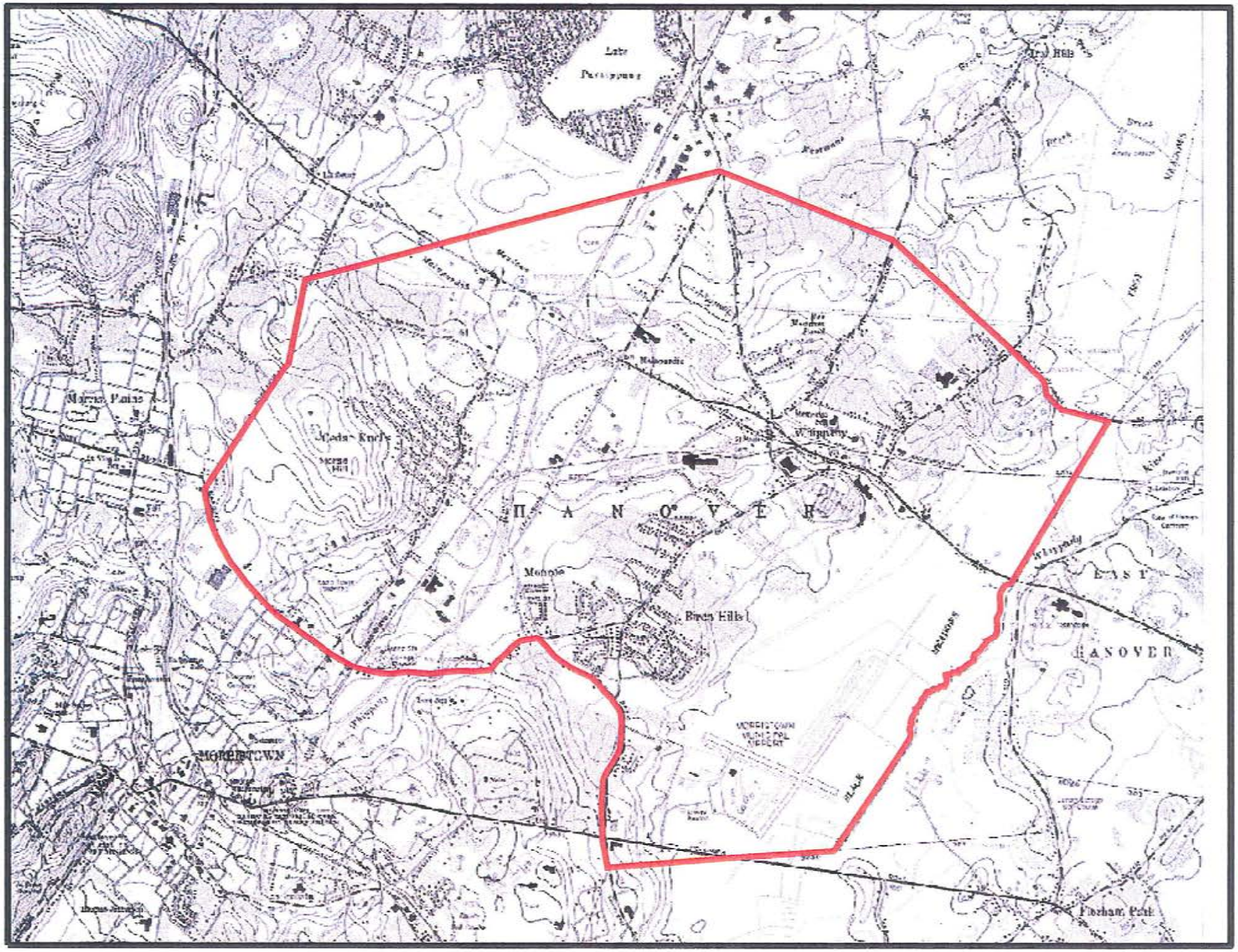
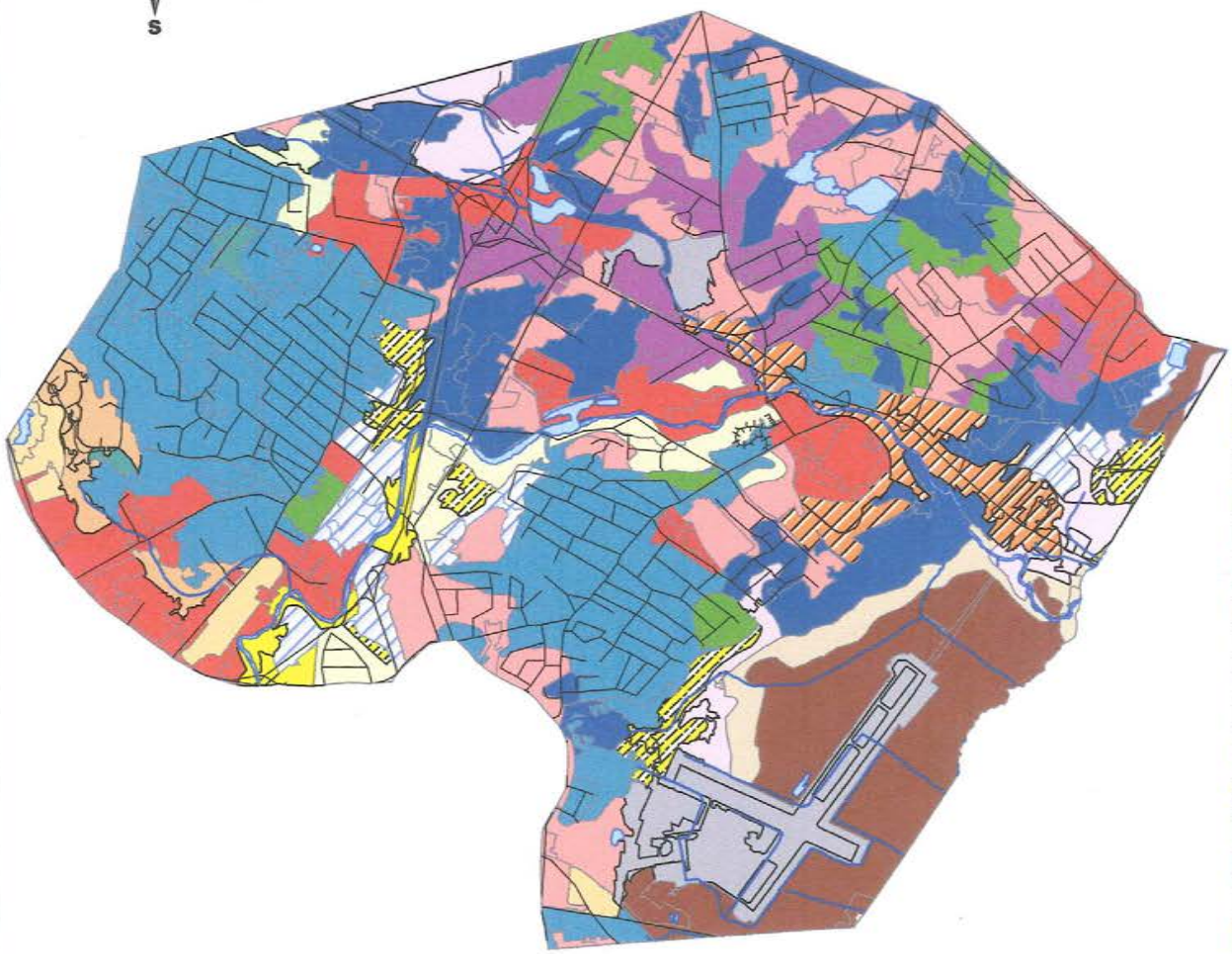


Figure 2

0 0.5 1 2 Miles

Township of Hanover Soils



Source: New Jersey Geological Survey (2002)

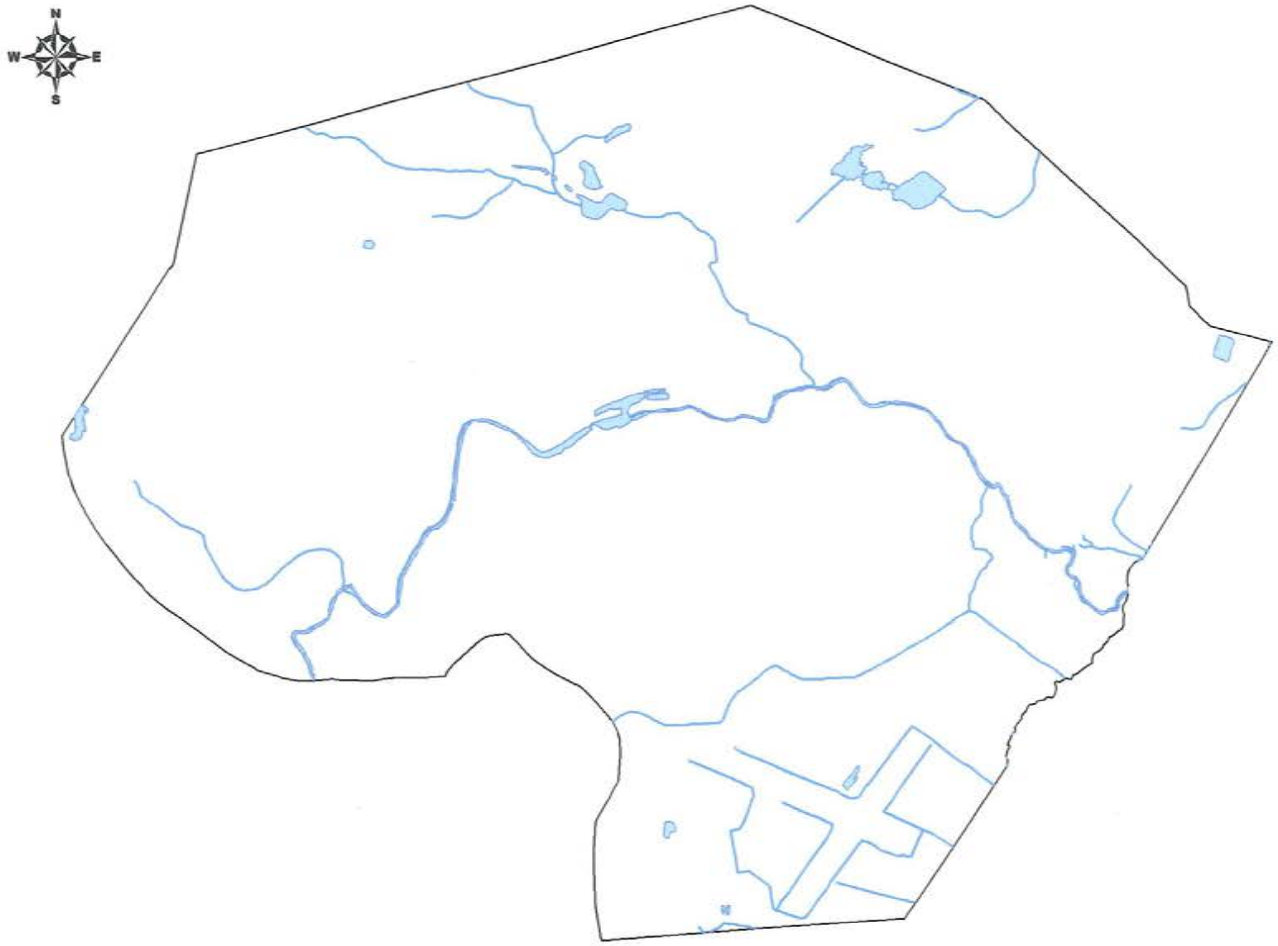
Figure 3

The Township of Hanover is entirely within the Whippany River Watershed. The Whippany River is the major river within the Township. The Black Brook, West Brook and Malapardis Brook (aka, Stoney Brook) also flow through the Township and are part of the Whippany River Watershed. Figure 4 illustrates the major waterways in the Township, and Figure 5 illustrates the Township's HUC-14 sub-watersheds. Information on the Whippany Watershed (which includes sub-watersheds, climate, wildlife, soils, geology, aquifers, water quality, land use, land cover, water supply, sewage treatment, infrastructure, and demographics may be found in the "Whippany River Watershed Characterization Report," prepared by the New Jersey Department of Environmental Protection and the Whippany River Watershed Characterization Committee, dated November 28, 1995. Copies of this report may be found in both the Township of Hanover Engineering and Health Departments.

Historically, the Township developed along roads that followed the Whippany River and its tributaries. Early development in the form of iron forges, sawmills, gristmills, cider mills and paper mills was similarly oriented to the river. Later industrial development also depended upon and was located adjacent to or near the Township's rivers and streams. As the railroad and highways expanded, additional development, especially industry and housing, occurred in the Township along these routes. At this point in time, the Township is suburban in character and almost fully developed, containing a mix of land uses, including single-family and multi-family residences, retail stores and shops, hotels, office buildings, industrial uses and similar land uses. Figure 6 portrays the existing land use/land cover map of the Township. The residential population of the Township has increased from 11,846 in 1980, to 11,538 in 1990, to 12,898 in 2000. The population increase has resulted in considerable changes in the landscape, which most likely increased stormwater runoff volumes and pollutant loads to the waterways of the Township. The existing zoning map is shown on Figure 7 and Figure 8 illustrates the Township's Open Space Map.

Much of the remaining undeveloped land in the Township is environmentally constrained by wetlands, flood plains, steep slopes and/or environmental contamination from prior uses. For several decades, industry has declined in the Township, as it has in much of the Northeast, and the Township has experienced adaptive reuse or redevelopment of former industrial sites. Although this trend has been accompanied by cleanup of soil and groundwater contamination on various former industrial and commercial properties, a number of contaminated properties remain that need environmental remediation. Appendix C contains a list of NJDEP Known Contaminated Sites in the Township.

Township of Hanover and Its Waterways

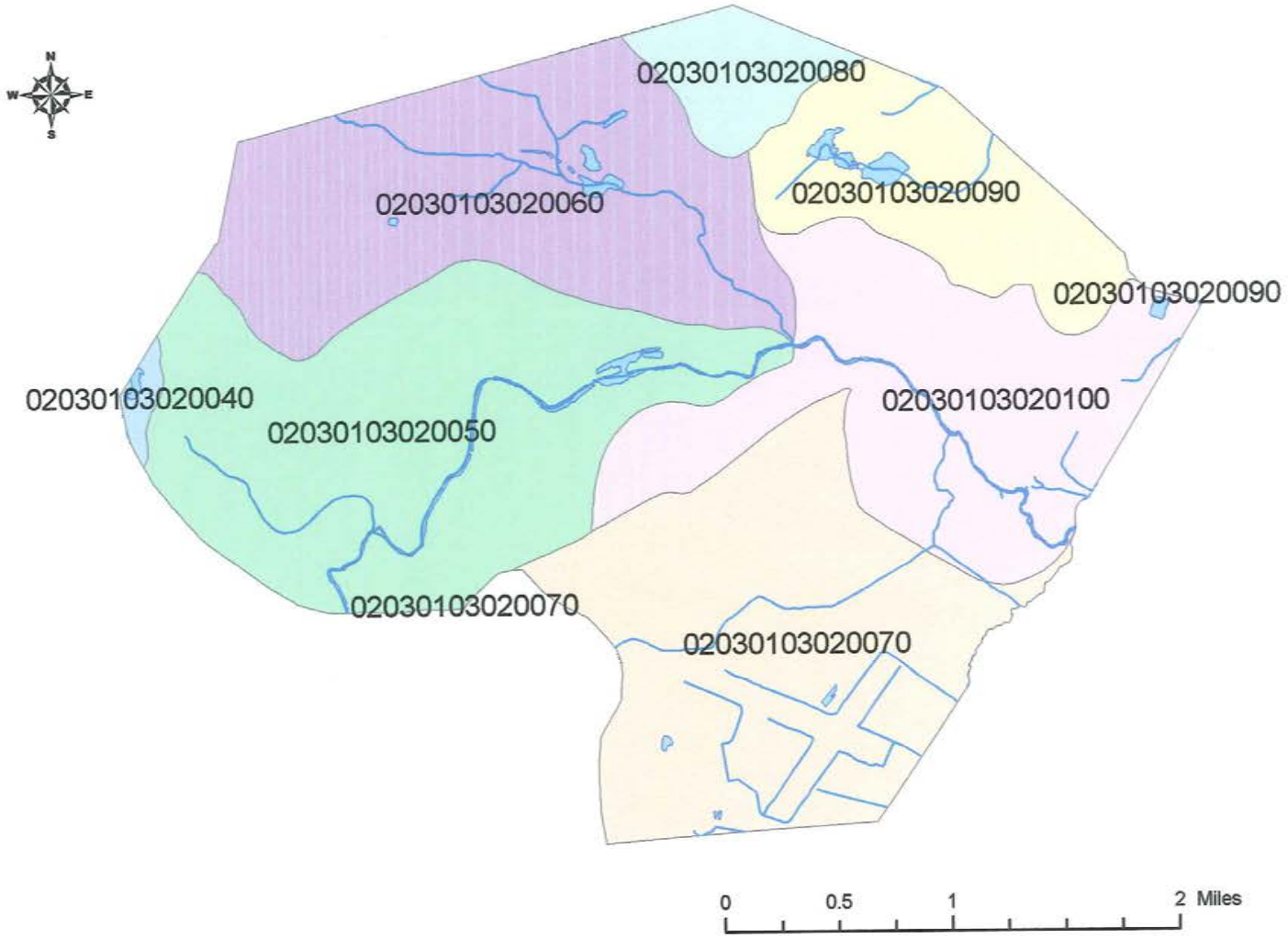


Source : NJDEP GIS Data

0 0.5 1 2 Miles

Figure 4

Township of Hanover HUC 14's Subwatersheds



Source: NJDEP GIS Data Layers

Figure 5

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Township of Hanover Land Use/ Land Cover

Data Source: NJDEP

Figure 6

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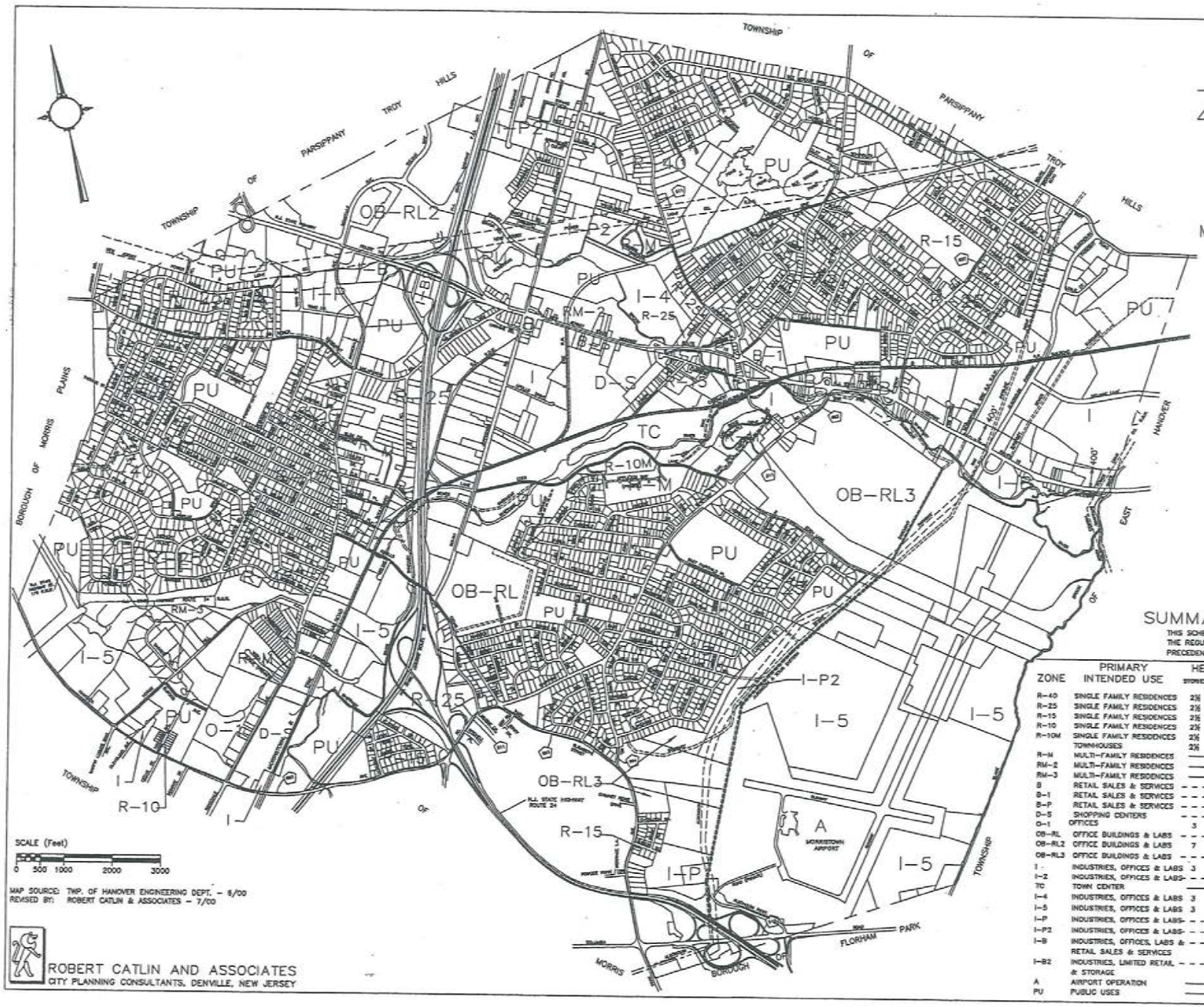

ZONING MAP

TOWNSHIP OF HANOVER

MORRIS COUNTY, NEW JERSEY

JULY, 2004

Figure 7

MAP SOURCE: TWP. OF HANOVER ENGINEERING DEPT. - 6/00
REVISED BY: ROBERT CATLIN & ASSOCIATES - 7/00

ROBERT CATLIN AND ASSOCIATES
CITY PLANNING CONSULTANTS, DENVILLE, NEW JERSEY

SUMMARY ZONING SCHEDULE

THIS SCHEDULE IS A SUMMARY OF REGULATIONS FOR EACH ZONE DISTRICT. THE REGULATIONS IN THE TEXT OF THE ORDINANCE SUPPLEMENT AND TAKE PRECEDENCE OVER THE SCHEDULE BELOW.

ZONE	PRIMARY INTENDED USE	HEIGHT STORIES	HEIGHT FEET	FRONT YARD	SIDE YARD ONE	SIDE YARD BOTH (% OF LOT WIDTH)	REAR YARD	MINIMUM LOT AREA	MINIMUM LOT WIDTH
R-40	SINGLE FAMILY RESIDENCES	2½	35	75'	20'	30%	50'	40,000 S.F.	150'
R-25	SINGLE FAMILY RESIDENCES	2½	35	50'	15'	30%	50'	25,000 S.F.	125'
R-15	SINGLE FAMILY RESIDENCES	2½	35	40'	15'	30%	40'	15,000 S.F.	100'
R-10	SINGLE FAMILY RESIDENCES	2½	35	40'	10'	30%	40'	10,500 S.F.	70'
R-10M	SINGLE FAMILY RESIDENCES	2½	35	40'	10'	30%	40'	10,500 S.F.	70'
	TOWNHOUSES	2½	35	40'	40'	80'	40'	10 ACRES	150'
R-M	MULTI-FAMILY RESIDENCES	SEE SECTION 166-180 OF THE LAND USE ORDINANCE							
RM-2	MULTI-FAMILY RESIDENCES	SEE SECTION 166-180.7 OF THE LAND USE ORDINANCE							
RM-3	MULTI-FAMILY RESIDENCES	SEE SECTION 166-180.13 OF THE LAND USE ORDINANCE							
B	RETAIL SALES & SERVICES	- - -	28	50'	15'	30'	25' OR 40'	- - - - - - -	- - -
B-1	RETAIL SALES & SERVICES	- - -	28	50'	40'	80'	25' OR 40'	- - - - - - -	- - -
B-P	RETAIL SALES & SERVICES	- - -	28	50'	15'	30'	25'	15,000 S.F.	100'
D-S	SHOPPING CENTERS	- - -	28	100'	60'	120'	60'	10 ACRES	- - -
O-1	OFFICES	3	45	75'	40'	40%	60'	60,000 S.F.	200'
OB-RL	OFFICE BUILDINGS & LABS	- - -	75	100'-300'	50'	40%	60'	60,000 S.F.	200'
OB-RL2	OFFICE BUILDINGS & LABS	7	100	100'	50'	100'	60'	60,000 S.F.	200'
OB-RL3	OFFICE BUILDINGS & LABS	- - -	75	100'-300'	50'	40%	60'	60,000 S.F.	200'
I	INDUSTRIES, OFFICES & LABS	3	45	75'	40'	40%	60'	60,000 S.F.	200'
I-2	INDUSTRIES, OFFICES & LABS	- - -	45	150'	40'	80'	40'	- - - - - - -	- - -
TC	TOWN CENTER	SEE SECTION 166-207.2 OF THE LAND USE ORDINANCE							
I-4	INDUSTRIES, OFFICES & LABS	3	45	75'-450'	50'	100'	50'	3 ACRES	200'
I-5	INDUSTRIES, OFFICES & LABS	3	45	75'	40'	40%	60'	60,000 S.F.	200'
I-P	INDUSTRIES, OFFICES & LABS	- - -	45	100'-150'	40'	40%	75'	- - - - - - -	350'
I-P2	INDUSTRIES, OFFICES & LABS	- - -	45	100'	40'	40%	75'	- - - - - - -	350'
I-B	INDUSTRIES, OFFICES, LABS & RETAIL SALES & SERVICES	- - -	28	75'	40'	40%	60'	60,000 S.F.	200'
I-B2	INDUSTRIES, LIMITED RETAIL & STORAGE	- - -	28	75'	40'	40%	60'	5 ACRES	300'
A	AIRPORT OPERATION	SEE SECTION 166-210 OF THE LAND USE ORDINANCE							
PU	PUBLIC USES	SEE SECTION 166-211.4 OF THE LAND USE ORDINANCE							

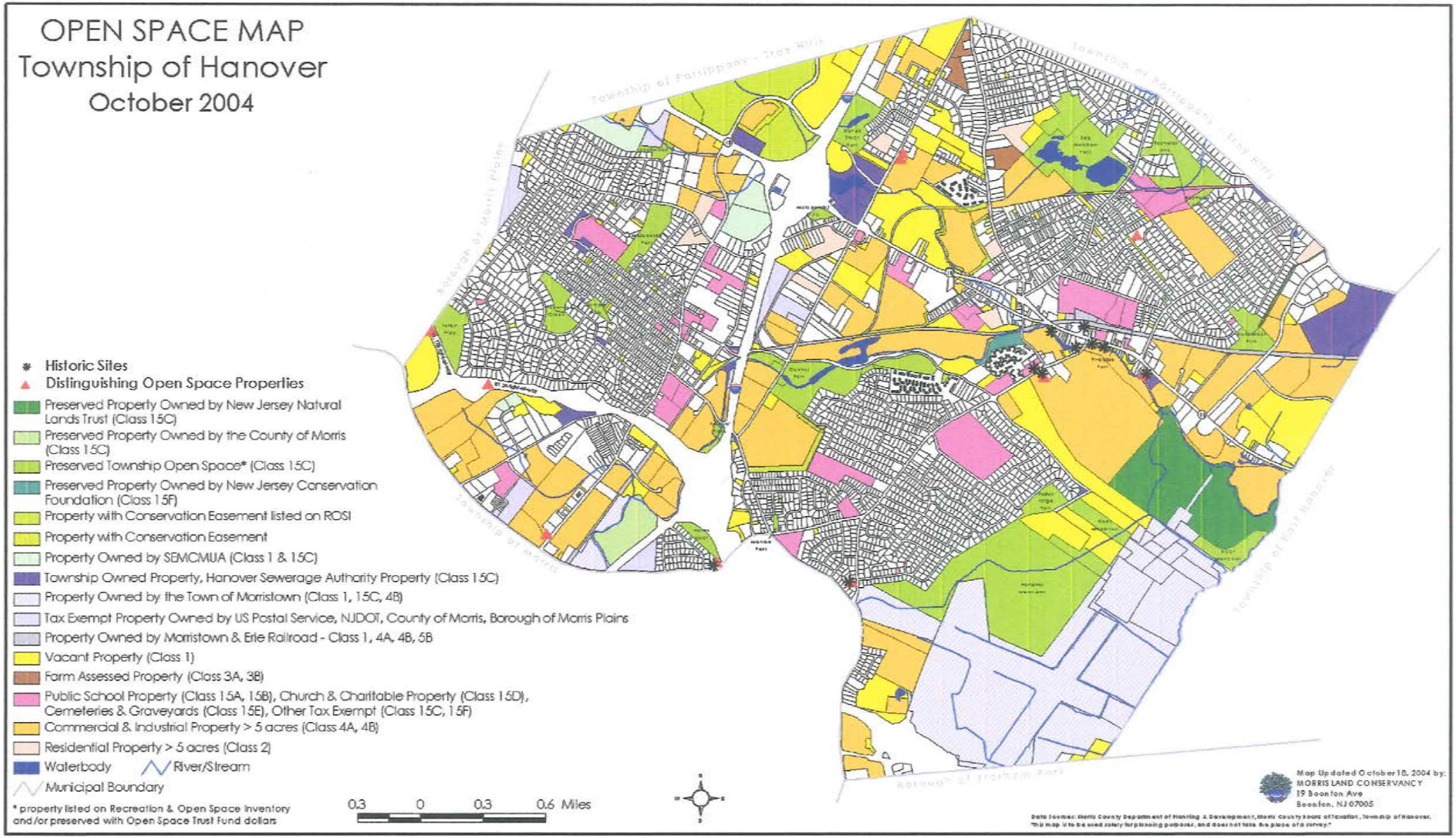

Figure 8
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Stormwater Issues in the Township of Hanover

The New Jersey Department of Environmental Protection (NJDEP) has established an Ambient Biomonitoring Network (AMNET) to document the health of the state's waterways. There are over 800 AMNET sites throughout the state of New Jersey. These sites are sampled for benthic macroinvertebrates by NJDEP on a five-year cycle. Streams are classified as non-impaired, moderately impaired, or severely impaired based on the AMNET data. The data is used to generate a New Jersey Impairment Score (NJIS), which is based on a number of biometrics related to benthic macroinvertebrate community dynamics. The following AMNET data was obtained from an NJDEP report titled "NJDEP Ambient Biomonitoring Network, Watershed Management Areas 3, 4, 5 and 6, Passaic Region, 1998 Benthic Macroinvertebrate Data, June 2000 Report":

Station	Date Monitored	Rating
Whippany River at Mt. Pleasant Rd. Mendham Twp.	7/15/98	Non-Impaired
Whippany River at Whitehead Road Morris Township	8/4/98	Moderately Impaired
Whippany River at Ridgedale Ave. Morristown	11/10/98	Non-Impaired
Whippany River at Jefferson Road Hanover Twp.	11/10/98	Moderately Impaired
Malapardis Brook at Mt. Pleasant Ave. Hanover Twp.	9/23/98	Non-Impaired
Troy Brook at Beverwyck Rd. Parsippany	7/15/98	Non-Impaired
Whippany River at Edwards Rd. Parsippany	7/15/98	Moderately Impaired

The above-mentioned stations are located within the Whippany River Watershed in or around the Township of Hanover.

Further discussion regarding the Whippany River's water quality assessment may be found in Appendix A of this plan. The Township of Hanover Health Department and the Whippany River Watershed Action Committee have conducted water quality studies, which provide valuable information on water quality, land use, soils, recharge, and sources of pollution within the Whippany River Watershed and the Township of Hanover. These studies are listed and summarized below. Copies of the entire reports may be found in the Township of Hanover Health Department. A summary of each report and their associated recommendation and conclusion may be found in Appendix B.

1) Project Name: Improving Stormwater Runoff Quality From a Low Density Residential Area Via an Information and Education Best Management Practice (BMP)
Date of Final Report: March 15, 2002
Project Officer: George Van Orden, Ph.D.

2) Project Name: Whippany River Water Quality Trend Analysis Study
Date of Final Report: March 24, 2003
Project Officer: George Van Orden, Ph.D.

3) Project Name: Sanitary Survey of the Whippany River Basin to Evaluate it's Sanitary Quality and to Identify Non-Point Sources of Contamination
Date of Final Report: June 30, 2004
Project Officer: George Van Orden, Ph.D.

In addition to water quality problems, the Township has exhibited severe water quantity problems including flooding, stream bank erosion, and diminished base flow in its streams.

The following list identifies specific areas that are affected by stormwater quantity problems.

Whippany River

- Flooding that occurs at the crossing of Route 10 Bridge and the Whippany River near the East Hanover border.
- Flooding that occurs on and near the Anchor Golf property.
- Flooding and water quality concerns as they relate to land uses in close proximity to the Whippany River, in general, from Parsippany Road Bridge to the Anchor Golf property.
- Erosion of the steep banks, from the existing Dam to Parsippany Road Bridge, and potential contamination from the Whippany Paper Board landfill.
- Siltation and sedimentation of the Whippany River from the South Jefferson Road Bridge to the Dam.
- Streambank erosion of the Whippany River along the section that has been straightened and relocated for the prior construction of N.J.S.H. F.A.I. 287.

Stoney Brook/Malapardis Brook

- Erosion and water quality as a result of the close proximity of developed properties to the stream. Severe erosion exists along the section parallel to Mt. Pleasant Avenue. The Army Corp. of Engineers is currently in the design phase of a streambank stabilization project for this section.
- Contamination and erosion of the landfill cap from the former landfill.

Unnamed stream rear of YMCA on Horse Hill Road

- Severe erosion of streambank and excess volume of runoff upstream.

Unnamed stream along Saddle Road

- Flooding at the intersection of Saddle Road and Horse Hill Road.
- Erosion of streambank and excess volume of runoff upstream particularly from the existing Trailwoods residential development.

West Brook

- Flooding and erosion concerns for the section from the rear of Bee Meadow School to Bea Meadow Parkway.

Nye Avenue/North Jefferson Road Drainage System

- Flooding of the roadways due to dams and other obstructions.

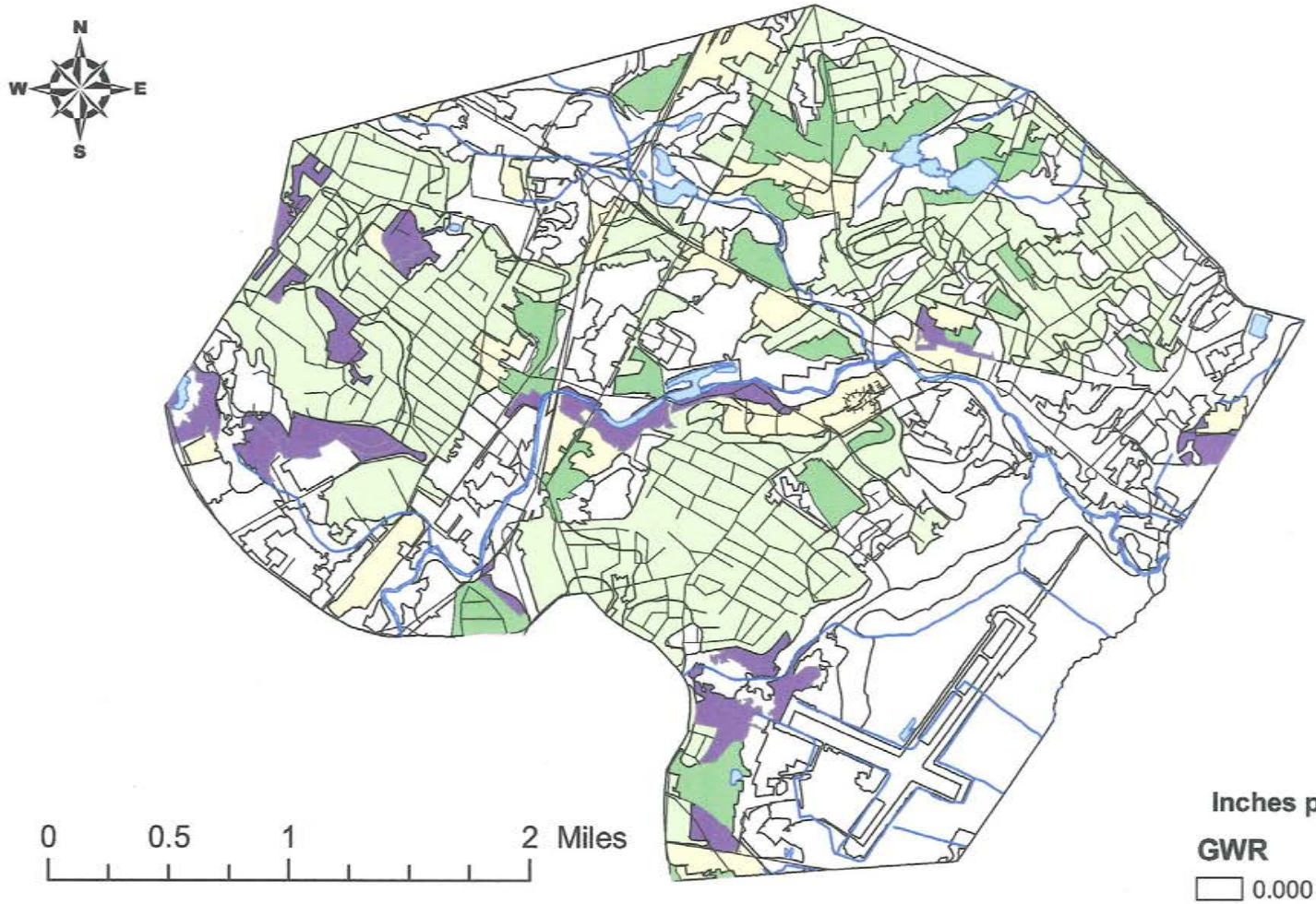
Crescent Dr./Hamilton Ct./Adams Dr. Drainage System

- Flooding due to volume of runoff from older residential development and size and design of drainage system.

As the imperviousness has increased in the Township, the peak and volumes of stream flows have also increased. The increased amount of water has resulted in stream bank erosion, which has in turn resulted in unstable areas at roadway/bridge crossings, and degraded stream habitats. The high imperviousness of the Township has also significantly decreased groundwater recharge, decreasing base flows in streams during dry weather periods. Lower base flows can have a negative impact on in-stream habitat during the summer months. A map of groundwater recharge areas is shown in Figure 9.

The New Jersey Department of Environmental Protection provides a statewide list of the known contaminated sites. There are 42 sites listed with on-site sources of contamination and 4 sites with closed cases with restrictions within the Township. Appendix C includes the NJDEP's list of Known Contaminated Sites, 2001 Edition. Particular concerns to the Township are three closed landfills located within the Township and the potential for groundwater contamination.

Township of Hanover Groundwater Recharge



Source: New Jersey Geological Survey (2002)

Figure 9
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Design and Performance Standards

The Township should, at a minimum, adopt the design and performance standards for stormwater management measures as established in N.J.A.C. 7:8-5 "Design and Performance Standards For Stormwater Management Measures" to minimize the adverse impact of stormwater runoff on water quality and water quantity and loss of groundwater recharge in receiving water bodies.

Stormwater Control Ordinance

On or before April 1, 2006, the Township of Hanover is required to adopt a stormwater control ordinance to implement the goals of this plan and to submit the adopted municipal stormwater management plan and ordinance to the county for approval. The Township of Hanover is also required to enforce the stormwater control ordinance, when approved, in accordance with N.J.A.C. 7:8-4 "Municipal Stormwater Management Planning." A draft copy of the stormwater control ordinance is included in Appendix E of this Plan.

The stormwater control ordinance is required to include, for all applicable proposed projects, standards for long-term preventative and corrective maintenance of stormwater management measures. The Township must require deed restrictions or adopt ordinances that require landowners to properly maintain the selected stormwater management measure. In addition said deed restriction or ordinance should prohibit the alteration or elimination of the measure, unless sufficient proof is provided that the alteration or elimination will not constitute a threat to public health and safety and will not undermine the goals of this Plan.

The stormwater control ordinance should also include the Safety Standards for Stormwater Management Basins established in N.J.A.C. 7:8-6 and. the standards set forth in Attachment C "Design Standard – Storm Drain Inlets" of the Township's NJPDES Stormwater General Permit to control passage of solids and floatable materials through storm drain inlets for storm drain inlets not installed by the Township of Hanover.

On or before April 1, 2006, the Township of Hanover must also ensure adequate long-term operation and maintenance of BMP improvements on property not owned or operated by the Township via required deeds, easements, or ordinances.

During the construction of any proposed project, the Township's inspectors will be required to observe the construction of the project to ensure that the stormwater management measures are constructed and function as designed.

Structural Stormwater Management Measures

The Township's stormwater control ordinance is required to put forth the standards for structural stormwater management measures. The New Jersey Stormwater Best Management Practices Manual should be identified as a source for technical guidance. The ordinance should also state that other stormwater management measures may be utilized, provided the design engineer demonstrates that the proposed measure and its design will accomplish the required water quantity, groundwater recharge and water quality design and performance standards. Finally, the ordinance should state that manufactured

treatment devices may be utilized provided that they are an accepted by the New Jersey Corporation for Advanced Technology and certified by the N.J.D.E.P.

Non-Structural Strategies

In order to more fully achieve the design and performance standards established in N.J.A.C. 7:8-5, "Design and Performance Standards for Stormwater Management Measures," the following non-structural strategies have been reviewed as they relate to the Code of the Township of Hanover.

1. Protect areas that provide water quality benefits or areas particularly susceptible to erosion and sediment loss.
2. Minimize impervious surfaces and break up or disconnect the flow of runoff over impervious surfaces.
3. Maximize the protection of natural drainage features and vegetation.
4. Minimize the decrease in the pre-construction "time of concentration".
5. Minimize land disturbance, including clearing and grading.
6. Minimize soil compaction.
7. Provide low maintenance landscaping that encourages retention and planting of native vegetation and minimizes the use of lawns, fertilizers, and pesticides.
8. Provide vegetated open-channel conveyance systems discharge into and through stable vegetated areas.
9. Provide preventative source controls 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 system;
    ii. Site design features that help to prevent discharge of trash and debris from drainage system;
    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.

In many ways, the regulations of the Township are consistent with the foregoing strategies. In some cases, however, the regulations need to be amended or supplemented to better promote the principles of nonstructural stormwater management, and to allow the implementation of nonstructural stormwater management techniques, also known as low impact development techniques. The results of this evaluation, and the recommendations for amending and supplementing the Township's plans and ordinances, are presented below:

Chapter 117: Dogs and Other Animals

Chapter 117 includes regulations of household pets and other animals. A new Article IV was recently added to require the immediate removal and proper disposal of pet solid waste, specifically to minimize the impact of non-point source pollution.

Recommendation: None.

Chapter 141: Floodplain Management

Chapter 141 regulates the use and development of all lands within areas of special flood hazard (i.e., the 100-year flood zone) of the Township, and is intended to prevent increased flooding and associated impacts, and to minimize impacts from existing flooding. Measures to accomplish these goals include the prohibition of encroachments within the floodway, and the elevation and flood proofing of structures within the floodplain.

Recommendation: At the same time that regulations for riparian buffers are prepared, Chapter 141 should be reviewed for consistency with the same and amended, if necessary, to be consistent. References to Chapter 141 should be made, where appropriate, in Chapters 158, 166 and 258.

Chapter 154: Garbage, Rubbish and Refuse

Chapter 154 establishes regulations for the placement and removal of refuse and recyclable materials for both residential and non-residential uses. Recent amendments included the addition of provisions for yard waste collection (i.e., leaves, grass clippings, and other vegetative material, specifically to minimize the impact of non-point source pollution. The provisions include requirements that yard waste, other than leaves, that are placed in the street for pickup is containerized. Leaves are not required to be placed in containers, but must not be placed within ten feet of storm drain inlets.

Recommendation: None.

Chapter 158: Grading

This chapter contains regulations that control the disturbance of land and the changes in grades by requiring provisions for surface water retention and drainage, minimization of soil erosion, protection of natural vegetation, and similar provisions. This chapter requires a permit, reviewed and issued by the Township Engineer, prior to the disturbance of land. Although most grading and disturbance is reviewed for site plan and subdivision applications, and the Soil Conservation District reviews and approves development applications with disturbance of at least 5,000 sq. ft., Chapter 158 ensures that disturbance not related to formal development applications is designed and performed properly.

Recommendation: At the same time that regulations for riparian buffers are prepared, Chapter 158 should be reviewed for consistency with the same and amended, if necessary, to be consistent. Also, any inconsistencies between Chapter 158 and other regulations that are prepared pursuant to this plan should be addressed. Currently, no inconsistencies exist, and therefore no amendments are necessary.

Chapter 166: Land Use and Development

Chapter 166 is the primary development legislation for the Township of Hanover, and includes the zoning, subdivision, site plan and official map regulations for all development in the Township.

- § 166-81 through § 166-89 establish the submission requirements, including plan information, for the various categories of development applications. Included are requirements to show natural features., including wooded areas, streams, drainage ditches, etc.; soil erosion and sedimentation control plans; existing trees; proposed landscaping and drainage plans and calculations.

  Recommendation: Revise the submission requirements to include a depiction of areas planted with lawn or other ground covers, forested areas as distinguished from other areas containing trees (i.e., containing native species and allowed to remain in a natural state), routes for construction vehicles and storage areas for construction equipment, materials and debris.

- § 166-91C requires granite block curbs along both sides of streets.

  Recommendation: Amend or supplement to allow gaps in curbing or drop curbs, where appropriate in the opinion of the Township Engineer, to allow stormwater runoff from the street to enter vegetative swale or other non-structural means of removing sediment and pollutants, encouraging recharge and reducing the time of concentration for runoff.

- § 166-91L requires that all areas that are required to be covered with topsoil, be seeded with grass lawn seed.

  Recommendation: Amend or supplement to limit the amount and location of lawn areas and to allow alternative groundcovers or other plantings that do not require fertilization.

- § 166-103C(7) sets forth minimum width standards for roadways.

  Recommendation: Amend or supplement to establish roadway widths based upon type of vehicles using the roadway, number of travel lanes, parking lanes and shoulders, with the intent being to permit, where appropriate, lesser roadway widths in order to reduce runoff and associated impacts.

- § 166-103E(2) requires, in the case of a subdivision traversed by a watercourse, drainageway, channel or stream, the establishment of a stormwater easement or drainage right-of-way.

  Recommendation: Revise and expand this provision to establish a riparian buffer requirement along all water bodies, and to make the same applicable to all development applications, not only subdivisions. Detailed requirements should be included as to the boundaries and dimensions of the buffer, limits on disturbance, required and prohibited plantings, etc. The ordinance should be reviewed for consistency with NJDEP stream encroachment requirements.

- § 166-103E(3) requires the preservation of natural features such as trees, brooks, hilltops and views in designing subdivisions.

Recommendation: Revise and expand this provision to provide more specificity concerning preservation requirements (tree preservation is already addressed by Chapter 258), and to make the same applicable to all development applications, not only subdivisions.

- § 166-104C requires that adequate provision be made for the disposal of stormwater, as approved by the Township Engineer.

  Recommendation: Greater specificity is needed in this requirement, and it should apply to all development, as appropriate. For major development, the stormwater control ordinance discussed above, will control. For other development, lesser standards should apply.

- § 166-104L requires the protection of trees during construction.

  Recommendation: Although Chapter 258 regulates the removal of trees, the accidental damage or destruction of trees by construction equipment, either through compaction of soil, excessive cut and fill around tree roots, alteration of surface drainage patterns, physical damage to tree roots, branches and trunks, and other factors occurs. To better ensure that such actions do not occur, regulations requiring the depiction on plans of areas of construction activity, construction equipment access and storage, and stockpiling of soil or other materials during construction should be adopted, and such areas should be required to be staked out and fenced in the field, particularly near trees. A minimum disturbance limit from tree trunks, determined by a ratio of distance to tree trunk size, should be established for trees that are to be preserved.

- § 166-113.1 regulates the amount of lot coverage by buildings, pavement and other improvements for single-family and two-family dwellings.

  Recommendation: None.

- § 166-124A(6) and B(5) prohibit the outdoor storage of hazardous, toxic or corrosive substances for residential and nonresidential uses.

  Recommendation: Amend and supplement the requirements to ensure that outdoor storage of other materials does not have the potential to negatively impact water quality due to the action of water, wind or other factors.

- § 166-125 requires, for certain uses in certain locations, buffers between uses and in front yards, and requires that such buffers be designed and maintained to function as a natural woodland, retaining canopy trees, understory trees, shrubs, ground covers and other low-growing natural plant material. The planting of grass or the use of mulch, except for natural leaf mulch is prohibited.

  Recommendation: The buffer regulations should be expanded to include buffer requirements at the edge of streams and other water bodies in the Township.

- § 166-131 limits the removal of trees by reference to Chapter 258.

  Recommendation: See discussion of Chapter 258, below.

- § 166-153A requires that parking areas be surfaced with bituminous concrete.

  Recommendation: Amend this requirement to permit overflow parking, when appropriate in the opinion of the Township Engineer, to be surfaced with porous materials.

- § 166-153B requires that oil separator devices be utilized in stormwater runoff structures for parking areas designed to accommodate 200 or more parking spaces, or for any parking area in which the stormwater runoff empties directly into a stream or water body.

  Recommendation: Amend and supplement this requirement to specify the permitted types of oil separators and to allow or require the use of non-structural methods of removing additional pollutants, not just oil, from runoff. Also, the requirement should be expanded to cover other large areas of pavement that do not necessarily have 200 parking spaces, such as loading dock areas for business and industry, contractor's service yards, etc. Maintenance requirements for oil separators should be added.

- § 166-153H requires that parking areas be enclosed by granite block curbing.

  Recommendation: Amend this requirement to eliminate the requirement for curbing, or to allow gaps in curbing to intercept runoff before it reaches a drainage inlet, where appropriate and beneficial for improving the water quality and quantity of stormwater runoff and improving groundwater recharge.

- § 166-153J requires that all portions of the property not used for off-street parking be landscaped with grass lawns, trees and shrubs as approved by the Planning Board.

  Recommendation: Amend and supplement this requirement to provide greater direction and control of the type of landscaping permitted. Such regulations should limit the amount and location of lawns where appropriate, particularly near water bodies, drainage inlets, steep slope areas and other areas, and should encourage the retention or the re-planting of woodlands, in order to reduce the usage of fertilizers, herbicides, fungicides and pesticides, and to provide other benefits for water quality and stormwater runoff control.

- § 166-153K establishes minimum setbacks for parking areas.

  Recommendation: These requirements should be amended to require minimum setbacks of parking areas from streams and water bodies, in order to maintain or allow for the establishment of riparian buffers.

- § 166-153M requires that parking islands be utilized between bays of parking areas containing more than 15,000 square feet.

  Recommendation: This requirement should be amended to allow the usage of such islands for vegetated swales and other storm water runoff features, and to allow greater flexibility in locating such islands, if such features and flexibility would improve stormwater runoff control in accordance with this plan.

- § 166-156B establishes minimum setbacks for loading areas.

Recommendation: These requirements should be amended to require minimum setbacks of loading areas from streams and water bodies, in order to maintain or allow for the establishment of riparian buffers.

- Articles XXV through XXXVIIIA establish the regulations for each of the 27 zone districts in the Township. Many of these regulations are beneficial to various aspects of stormwater management, including setback requirements, coverage requirements, floor area ratio requirements, residential cluster and planned development provisions (which include open space requirements), etc.

  Recommendation: Amend these requirements to establish minimum setback requirements from streams and other water bodies, in order to maintain or allow for the establishment of riparian buffers. Where improvement coverage limitations do not exist, they should be considered.

Chapter 171: Littering

This chapter contains the regulations against littering, and includes prohibitions of litter, garbage or rubbish in bodies of water, in gutters or drain inlets, in parks or on private property, except in areas and containers designed for that purpose.

Recommendation: § 171-5 should be revised to be consistent with Chapter 154, particularly as to minimum distance of leaves from drainage inlets.

Chapter 187: Oil-Water Separators and Water Quality Basins

The primary purpose of Chapter 187 is to ensure that privately owned oil-water separators and stormwater detention basins are properly maintained and repaired. Provisions for Township inspection and for penalties for non-compliance are also included.

Recommendation: This chapter should be amended to also include the maintenance and repair of non-structural features. A periodic reporting requirement, perhaps through the issuance of an annual license, should be considered, in order to aid enforcement efforts.

Chapter 210: Pesticides

Chapter 210 contains requirements that the application of pesticides comply with State and Federal requirements, including licensing of applicators.

Recommendation: None. Other recommendations in this report are intended to indirectly reduce the need for and use of pesticides (e.g., buffers, tree preservation, limitation of lawn areas, riparian buffers, etc .).

Chapter 218: Property Maintenance

Chapter 218 contains extensive requirements for the maintenance of property in the Township. Included are prohibitions against the accumulation of trash and debris, which can accumulate in stormwater collection structures and contribute to flooding and environmental damage, during rainfall events. Of

particular relevance to stormwater management is § 218-38, which requires drains to collect stormwater runoff, and prohibits the direction of the runoff to streets, parking areas or walkways.

Recommendation: This section should be amended to allow or require the use of nonstructural stormwater management designs, with reference to other ordinance provisions that directly regulate the same.

Chapter 233: Prohibiting Illicit Connections to the Municipal Separate Storm Sewer System Operated by the Township of Hanover

Chapter 233 is a new chapter that prohibits the discharge through an illicit connection any domestic sewage, non-contact cooling water, process wastewater or other industrial waste, other than stormwater.

Recommendation: None.

Chapter 234:Regulations Prohibiting the Improper Disposal of Waste

Chapter 234 is related to Chapter 233 and is also a new part of the Township Code that prohibits the spilling, dumping or disposal of materials other than stormwater to the municipal storm sewer system. Certain exemptions are allowed. Enforcement and penalty provisions are included.

Recommendation: None.

Chapter 241: Soil Removal

This chapter regulates the excavation, removal and movement of soil in the Township. Approval of the Township Committee is required for such activities, which is guided by considerations of soil erosion, drainage, soil fertility, lateral support slope and grades of streets and lands, land values and uses, and other factors. The retention of topsoil on properties is required.

Recommendation: Consideration should be given to amending this chapter to prohibit or limit the excavation and removal of soil within riparian corridors, steep slope areas and other environmentally sensitive areas.

Chapter 248: Streets and Sidewalks

Chapter 248 contains requirements and regulations for various activities within the Township's streets. Of particular relevance to stormwater management is § 248-5, § 248-35, § 248-36, § 248-37 and § 248-38, which prohibit the diversion of drainage onto Township streets so as to interfere with normal drainage; the filling or accumulation of gutters with dirt, fill material, snow, ice or other materials; and the obstruction or diversion of normal drainage within the streets.

Recommendation: None.

Chapter 258: Trees

Chapter 258 regulates the removal of trees, and encourages the preservation of existing trees. Where preservation is impractical, or where removal provides other benefits to the Township, replacement is permitted. Where on-site replacement is impractical, payment in lieu of replacement is permitted, with the fees deposited in the Township's tree fund.

Recommendation: Amend and supplement the regulations to require a minimum percentage of the site being developed to remain as woodland. Preservation and replacement of woodlands in environmentally sensitive areas such as along stream corridors, steep slopes and groundwater recharge areas, should be encouraged or required and given greater priority than other areas. Where on-site replacement is permitted, greater use of native species should be required. If trees are removed from woodland, replacement should be required to reestablish woodland; trees in parking areas and street trees should not be credited against replacement requirements. In general, greater emphasis should be given to preservation as opposed to replacement of trees.

Chapter 331: Swimming Pools

Chapter 331 requires the issuance of permits and licenses for the installation, repair, alteration or use of swimming pools, and includes a reference to the N.J. State Sanitary Code.

Recommendation: If the same do not already exist in the State Code, there should be adopted prohibitions against the backwashing or emptying of swimming pools in a manner that is detrimental to the quality of either surface or groundwater.

Other:

In addition to the above amendments, the following new regulations should be considered:

- Steep Slope regulations.

  The steep slope regulations would impose limits of disturbance based on areas characterized as having steep slopes. The regulations would apply to all development that exceed an established area of disturbance threshold. Steep slopes would be characterized into two classes. Those that have slopes ranging from 15% to 25% would be allowed limited disturbance and slopes that exceed 25% would not be permitted any disturbance unless there is no reasonable alternative. Greater restrictions would be established for areas within a set distance of the Whippany River, streams, lakes, or pond. The regulations would also impose grading and stabilization standards when recreating or mitigating a steep slope.

- Riparian Buffer regulations.

  The riparian buffer regulation would establish buffers along designated stream and waterbodies and would establish regulate activities within said buffers. The buffer widths(s) would depend upon various factors, including but not limited to:
  - Characteristics of waterbody
  - Slopes adjacent to waterbody
  - Existing development characteristics (i.e. lot size, location of building(s), pavement, use, etc.)

- Risk of flooding

The associated requirements of the buffer would include:

- Limitation on disturbance
- Limitations on construction
- Limitation on lawns within a certain distance
- Requirements to preserve/enhance native vegetation
- Prohibition/regulation of hazardous material

New Jersey Pollutant Discharge Elimination System (NJPDES Permit)

The Township shall also implement the elements, as required, of the New Jersey Pollutant Discharge Elimination System (NJPDES), N.J.A.C. 7:14A-25 "Municipal Stormwater Regulation Program". The Municipal NJPDES permit requirements and the N.J.A.C. 7:8 Stormwater Management Rules are closely related and integral to each other in addressing stormwater issues related to new development, redevelopment, and existing development.

The substantive elements of the NJPDES program include implementation of the Statewide Basic Requirements (SBRs). In addition to the municipal requirements outlined in this plan, the Township shall implement the following:

1. Local Public Education
   - Local Public Education Program
   - Storm Drain Inlet Labeling
2. Improper Disposal of Waste
   - Pet Waste Ordinance
   - Litter Ordinance
   - Improper Disposal of Waste Ordinance
   - Wildlife Feeding Ordinance
   - Yard Waste Ordinance/Collection Program
3. Illicit Connection Elimination and MS4 Outfall Pipe Mapping
   - Storm Sewer Outfall Pipe Mapping
   - Ordinance prohibiting Illicit Connections
   - Illicit Connection Elimination Program
4. Solids and Floatable Controls
   - Street Sweeping Program
   - Retrofit Storm Drain Inlets
   - Stormwater Facility Maintenance Program
   - Roadside Erosion Control Maintenance Program
   - Outfall Pipe Stream Scouring Remediation
5. Maintenance Yard Operations
   - De-icing Material Storage
   - Fueling Operations
   - Vehicle Maintenance
   - Good Housekeeping Practices
6. Employee Training
   - Annual Employee Training Program that covers the required topics in the permit.

Plan Consistency

At the present time a regional stormwater management plan does not exist for this area. However, the Township is an active participant in the preparation of a regional stormwater management plan for the West Brook that includes a tributary within the Township. When the West Brook regional stormwater management plans is adopted, or any other regional plans are adopted, this municipal stormwater management plan will be revised (if necessary) to comply.

If any regional stormwater management plans or TMDLs are developed in the future, this Municipal Stormwater Management Plan will be updated to be consistent. The Municipal Stormwater Management Plan is consistent with the Residential Site Improvement Standards (RSIS) at N.J.A.C. 5:21. The municipality will utilize the most current update of the RSIS in the stormwater management review of residential areas. This Municipal Stormwater Management Plan will be updated to be consistent with any future updates to the RSIS.

New Jersey, in 1998, had listed fecal coliform as Section 303(d) Known Water Quality Impairment for the Whippany River. The potential sources of the fecal coliform impairment had been (in 1998) identified as malfunctioning and older improperly sized septic systems, Canada Geese, pest waterfowl and other wildlife, pet waste and stormwater basins. Total Maximum Daily Loads (Tad's) are required, under Section 303(d) of the Federal Clean Water Act, to be developed for water bodies that cannot meet water quality standards after the implementation of technology-based effluent limitations. The State of New Jersey had proposed a TMDL for fecal coliform in the Whippany River. This proposal was published in the New Jersey Register dated Monday, August 2, 1999. The TMDL for fecal coliform in the Whippany River Watershed was established by the NJDEP on December 20, 1999. The TMDL establishes a load reduction target for fecal coliform of 58.6% to be achieved through implementation of the non-point source guide ("A Cleaner Whippany River Watershed – Non-point Source Pollution Control Guidance Manual for Municipal Officials, Engineers and Departments of Public Works, NJDEP, May 2000") and other short and long-term strategies.

From 2001 thru 2004 the Township of Hanover Health Department conducted a sanitary survey of the Whippany River Watershed. The goal of this project was to study the non-point source contribution of fecal coliform within the Whippany River Watershed. This study evaluated the sanitary quality of the Whippany River and attempted to identify and/or verify sources of fecal contamination (as mentioned above). This study concluded that there was a 63.0% decrease in fecal coliform from 1994-1995 to 2001-2003 during dry weather conditions.

This study showed that during dry weather conditions that most of the Whippany River does comply with the current NJDEP standards for fecal coliform. NJDEP surface water quality standard for the Whippany River (as per NJAC 7:9B1.14) is "Fecal coliform levels shall not exceed a geometric average of 200/100 ml nor should more than 10 percent of the total samples taken during any 30-day period exceed 400/100 ml."

During the above-mentioned study the Township of Hanover identified pet waste and wildlife waste as major sources of fecal contamination within the Whippany River Watershed. As stated in the study report, "pet waste may be a fecal source in the more densely developed residential areas (medium to high density area). During dry weather conditions most of the stations located within these areas met the 200 fecal

coliform/100 ml criteria. However, during wet weather conditions the fecal coliform levels recorded at these stations greatly exceeded the surface water criteria with concentrations which ranged from 727 to 34,979 organisms per 100 ml with a fecal coliform/fecal streptococcus ratio indicating animal sources. The low density residential areas during wet weather conditions had fecal coliform concentrations which were much lower and ranged from 143 to 1,271.6 organisms per 100 ml with a fecal coliform/fecal streptococcus ratio indicting animal sources. It makes sense to say that pet density is directly related to residential density. If residents are not picking up after their pets then pet waste in both medium and high density residential areas (medium and high density residential areas would also have more impervious coverage and more surface runoff then low density area) could be a significant sources of fecal contamination to the Whippany River during wet weather conditions."

This report further states "Throughout the Whippany Watershed there are very dense goose and deer populations. Goose populations are greatest in areas around ponds and in areas, which are open with mowed lawns (athletic fields, corporate lawns, parks, school yards, residential areas with large lawns, stormwater detention systems consisting of mowed lawn vegetation). Deer populations are greatest in the more wooded areas (forested areas, meadow areas, low and medium density residential areas). Droppings from these animals are deposited onto the ground and may wash into surface waters with runoff. Goose droppings in many of the above mentioned open areas are so dense that it becomes difficult to walk without soiling shoes."

On February 2, 2004, the New Jersey Department of Environmental Protection adopted the "Stormwater Management" regulations. These new regulations require municipalities to adopt and enforce pet waste, improper waste disposal, wildlife feeding, and illicit connection ordinances. These regulations also require municipalities to develop illicit connection elimination and stormwater facility maintenance programs. The Township of Hanover currently has a pet waste ordinance (Code of the Township of Hanover section 117-9) in place, which complies with these regulations and is enforced by the Township's Police Department. The Township has adopted a wildlife feeding ordinance and illicit connection ordinance, which complies with the State's stormwater regulations. The State's requirements can be found in NJAC 7:8.1 et seq. Since these regulations address many of the sources mentioned above, the sanitary quality of the Whippany River is expected to improve with their implementation. In an effort to meet the current TMDL for fecal coliform in the Whippany River the Township of Hanover will provide education to the public (as required under the State's stormwater requirements and will enforce the above-mentioned ordinances. The fecal coliform TMDL also requires (under short term management measures) that a diagnostic study be conducted of fecal coliform impairment in the Whippany River Watershed. This diagnostic study was conducted from 2001 thru 2004 by the Township of Hanover Health Department via a grant from the NJDEP. The findings from this study may be found in the report generated titled "Sanitary Survey of the Whippany River Basin to Evaluate It's Sanitary Quality and to Identify Non-Point Sources of Contamination," June 30, 2004, Township of Hanover Health Department. Copies of this report were distributed to all the municipalities within the Whippany Watershed. Copies for review may be found at the Township of Hanover Health Department, 1000 Route 10, Whippany, NJ.

The Township's Stormwater Management Ordinance will require all new development and redevelopment plans to comply with Morris County's Soil Erosion and Sediment Control Standards. During construction, Township's inspectors will observe on-site soil erosion and sediment control measures and report any inconsistencies to the Morris County Soil Conservation District.

Land Use Analysis

A detailed analysis of the Township's land parcels indicates that there remains 576 acres of vacant land within the Township. Of the remaining vacant land, the analysis indicates that only approximately 20% is developable due to various constraints that include; the probable existence of wetlands existing utility easements, landlocked parcels, and existing lots size and shape constraints. Figure 6 illustrates the Township's existing land use and land cover and Figure 8 illustrates the Township's Open Space Map. The figures illustrate preserved lands, parklands, Township properties, other public and semipublic uses, commercial and industrial properties, residential uses, and vacant land.

As permitted by N.J.A.C. 7:8-4.2(c) 10 the Township elects to not complete sections 7:8-4.2(c) 8 and 9 of Subchapter 4 "Municipal Stormwater Management Planning".

In addition to the land use map, Appendix D is a spreadsheet inventory of developable vacant land by Block and Lot. An analysis of development potential is provided which indicates a potential of 62 new housing units and an additional 1,852,100 square feet of commercial, office, and industrial floor area. The development potential relates to 123 acres of developable vacant land. Of course these future development estimates do not account for the redevelopment potential of existing land uses.

Mitigation Plans

The Township will adopt a Stormwater Mitigation Plan Ordinance to provide for a developer a method to meet the goals of the Municipal Stormwater Management Plan when a variance or exemption is required from the design and performance standards for a proposed project. The developer is required to build a mitigation project to offset the effect on groundwater recharge, stormwater quantity control, and/or stormwater quality control that was created by granting the variance or exemption. The developer is responsible for all elements of the project including study, design, and obtaining all necessary approvals and permits. The mitigation project must be completed concurrent with the proposed project and be viewed as part of the proposed project.

Mitigation Project Criteria:

The mitigation project must be implemented in the same drainage area as the proposed development and provide mitigation that is equivalent to the variance that is sought. 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.

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.

The municipality may allow a developer to provide funding or partial funding to the municipality for an environmental enhancement project that has been identified in a Municipal Stormwater Management Plan, or towards the development of a Regional Stormwater Management Plan.

The funding must be equal to or greater than the cost to implement the mitigation outlined above, including costs associated with purchasing the property or easement for mitigation, and the cost associated with the long-term maintenance requirements of the mitigation measure.

As reported earlier, specific areas of concern, within the Township, that are affected by stormwater problems include:

Whippany River

- Flooding that occurs at the crossing of Route 10 Bridge and the Whippany River near the East Hanover border.
- Flooding that occurs on and near the Anchor Golf property.
- Flooding and water quality concerns as they relate to land uses in close proximity to the Whippany River, in general, from Parsippany Road Bridge to the Anchor Golf property.

- Erosion of the steep banks, from the existing Dam to Parsippany Road Bridge, and potential contamination from the Whippany Paper Board landfill.
- Siltation and sedimentation of the Whippany River, from the South Jefferson Road Bridge to the Eden Lane Dam.
- Streambank erosion of the Whippany River along the section that has been straightened and relocated for the prior construction of N.J.S.H. F.A.I. 287.

Stoney Brook/Malapardis Brook

- Erosion and water quality as a result of the close proximity of developed properties to the stream. Severe erosion exists along the section parallel to Mt. Pleasant Avenue. The Army Corp. of Engineers is currently in the design phase of a streambank stabilization project for this section.
- Contamination and erosion of the landfill cap from the former landfill.

Unnamed Stream rear of YMCA

- Severe erosion of streambank and excess volume of runoff upstream.

Unnamed Stream along Saddle Road

- Flooding at the intersection of Saddle Road and Horse Hill Road.
- Erosion of streambank and excess volume of runoff upstream particularly from the Trailwoods residential development.

West Brook

- Flooding and erosion concerns for the section from the rear of Bee Meadow School to Bea Meadow Parkway.

Nye Avenue/North Jefferson Road Drainage System

- Flooding of the roadways due to dams and other obstructions.

Crescent Dr./Hamilton Ct./Adams Dr. Drainage System

- Flooding due to volume of runoff from older residential development and size and design of drainage system.

Listed below are examples that can be used to compensate for the deficit from the performance standards resulting from the proposed project. The Township Engineer shall approve of the scope and all details of the mitigation project.

Groundwater Recharge

- Retrofit existing detention basins to provide additional annual groundwater recharge.

Water Quantity

- Install stormwater management measures in appropriate lands to significantly reduce the peak flow from the upstream development on the receiving stream for the 2, 10, and 100-year storms respectively.
- Remediate stormwater pipe outfall scouring.

Water Quality

- Re-establish a vegetative buffer (minimum 50 foot wide) along a shoreline as a goose control measure and to filter stormwater runoff.
- Re-stabilize a stream to prevent soil erosion and sediment production and protecting the stream habitat.
- Provide goose management measures, including public education.
- Retrofit existing detention basins to provide the removal of 80 percent of total suspended solids.
- Retrofit existing parking areas to provide the removal of 80 percent of total suspended solids. Due to site constraints, the retrofit BMP must be installed underground and cannot reduce the existing number of parking spaces.
- Retrofit existing storm drain inlets with the new standard.

APPENDIX A

WATER QUALITY ASSESSMENT – WHIPPANY RIVER

The New Jersey Integrated Water Quality Monitoring and Assessment Report (305(b) and 303(d)) "Integrated List" is required by the federal Clean Water Act to be prepared biennially and is a valuable source of water quality information. This combined report presents the extent to which New Jersey waters are attaining water quality standards, and identifies waters that are impaired. Sublist 5 of the Integrated List constitutes the list of waters impaired or threatened by pollutants, for which one or more Total Maximum Daily Loads are needed.

The Federal Clean Water Act requires the identification of impaired water bodies, those waters for which technology-based pollution controls were not stringent enough to achieve the state's surface water quality standards. The state is required to establish Total Maximum Daily Loads (TMDLs) for these impaired water bodies based on a priority ranking. Impaired Water bodies Lists must be based on a documented methodology that includes an evaluation of existing and readily available data. Water bodies continue to be included on subsequent Impaired Water bodies Lists until:

1. TMDLs are completed; or
2. Applicable criteria are met; or
3. The original basis for the listing is shown to be flawed.

Integrated Water Quality Monitoring and Assessment Report

The close association between the two reporting requirements is evident in that the 305(b) report presents the water quality status of all waters of the state while the 303(d) list represents a subset of these waters that statutorily require a TMDL. Additionally, both efforts utilize shared data sets. In 2000 the United States Environmental Protection Agency (USEPA) encouraged states to integrate the two into a single document, which would be termed an Integrated Water Quality Monitoring and Assessment Report (Integrated Report).

New Jersey developed its first Integrated Report in 2002. USEPA guidance for the preparation of the Integrated Lists for 2004 is available at http://www.epa.gov/nheerl/arm/documents/epa2003_1466.pdf. The 2004-combined report presents the extent to which waters of the State are attaining water quality standards (pursuant to section 305(b)) and identifies waters that are impaired and need TMDLs as required under section 303(d) of the Act. The Integrated Report also identifies waters that are being removed from the 303(d) List because they are attaining water quality standards.

The Integrated Report describes attainment of designated uses specified in New Jersey's Surface Water Quality Standards (SWQS) which includes: aquatic life, recreation, drinking water, fish and shellfish consumption, industrial and agricultural. In addition, ongoing and planned strategies to maintain and improve water quality statewide are described. The Integrated Report provides water resources managers and citizens with information regarding the following:

- Methods used to assess water quality standards attainment status;
- Water quality standards attainment status;

- Pollutants and water bodies requiring Total Maximum Daily Loads (TMDLs);
- Management strategies (including TMDLs) under development to attain water quality standards;
- Delineation of water quality assessment units providing geographic display of assessment results;
- A delineation of the State's monitoring needs and monitoring project schedules;
- Progress toward achieving comprehensive assessment of all waters.

The Integrated List consists of five categories or lists (New Jersey terms them sublists). All assessed water bodies are placed on a sublist based upon:

- The degree of support of designated uses;
- How much is known about the waterway's water quality status; and
- The type of impairment preventing use support.

Based on USEPA's assessment and listing methodology, each waterway should be placed in only one of the five unique assessment sublists. Each sublist is described below as per USEPA's guidance:

Sublist 1. Attaining the water quality standard and no use is threatened. Threatened is defined as currently supporting uses but information suggests that such uses will not be met within the next two years. Waterways are listed in this sublist if there are data and information that meet the requirements of the state's assessment and listing methodology and support a determination that the water quality standard is attained and no use is threatened.

Sublist 2. Attaining some of the designated uses; no use is threatened; and insufficient or no data and information is available to determine if the remaining uses are attained or threatened. Waterways are listed in this sublist if there are data and information that meet the requirements of the state's assessment and listing methodology to support a determination that some, but not all, uses are attained and none are threatened. Attainment status of the remaining uses is unknown because there is insufficient or no data or information.

Sublist 3. Insufficient or no data and information to determine if any designated use is attained. Waterways are listed on this sublist where the data or information to support an attainment determination for any use is not available, consistent with the requirements of the state's assessment and listing methodology. To assess the attainment status of these waterways, the state should obtain supplementary data and information, or schedule monitoring as needed. This category also includes locations where there are sufficient data to make assessments, however, criteria or guidelines for making a use attainment assessment are currently not available.

Sublist 4. Impaired or threatened for one or more designated uses but does not require the development of a TMDL.

4A.TMDL has been completed. Waterways are listed on this sublist once all TMDL(s) have been developed and approved by USEPA that, when implemented, are expected to result in full attainment of the standard. Where more than one pollutant is associated with the impairment of a waterway, the water will remain on sublist 5 until all TMDLs for each pollutant have been completed and approved by USEPA.

4B.Other pollution control requirements are reasonably expected to result in the attainment of the water quality standard in the near future. Consistent with the regulation under §§130.7(b)(i), (ii), and (iii), waterways are listed on this sublist where other pollution control requirements required by local, state, or federal authority are stringent enough to attain any water quality standard applicable to such waters.

4C.Impairment is not caused by a pollutant. Waterways are listed on this sublist if the impairment is not caused by a pollutant but instead is due to factors such as habitat degradation, stream channeling, etc. States and territories should consider scheduling these waterways for monitoring to confirm that there continues to be no pollutant-caused impairment and to support water quality management actions necessary to address the cause(s) of the impairment.

Sublist 5. The water quality standard is not attained. The waterway is impaired or threatened for one or more designated uses by a pollutant(s), and requires a TMDL. This sublist constitutes the Section 303(d) list of waters impaired or threatened by a pollutant(s) for which one or more TMDL(s) are needed. A waterway should be listed on this sublist if it is determined, in accordance with the state's assessment and listing methodology, which a pollutant has caused, is suspected of causing, or is projected to cause an impairment. Where more than one pollutant is associated with the impairment of a single waterway, the waterway will remain on sublist 5 until TMDLs for all pollutants have been completed and approved by USEPA.

The Department (NJDEP) modified its listing methods and has chosen to develop the Integrated List by water body/parameter, not just by water body. This will enable the Department to present each parameter for each water body in the appropriate sublist and allows water bodies to be placed on multiple sublists. The water body/parameter assessment also results in the elimination of sublist 2 since a parameter is placed either on sublist 1 (full attainment) or sublist 3 (insufficient data).

The following information was obtained from the New Jersey Integrated Water Quality Monitoring and Assessment Report (305(b) and 303(d)) "Integrated List" for 2002 and 2004.

The State of New Jersey's 2002 Integrated Water Quality Monitoring and Assessment Report (NJDEP) lists the Whippany River at Morristown to be in non-attainment for fecal coliform with an EPA approved Total Maximum Daily Load (TMDL) for fecal coliform. This report also list the Whippany River near Pine Brook to be in non-attainment for fecal coliform and total phosphorus with Tad's for fecal coliform, total phosphorus and dissolved oxygen. Both Whippany River at Morristown and Whippany River at Pine Brook stations were listed for non-attainment of chromium and lead (in sediments), respectively.

A TMDL is the amount of a pollutant that can be accepted by a water body without causing an exceedance of water quality standards or interfering with the ability to use a water body for one or more of its designated uses. The allowable load is allocated to the various sources of the pollutant, such as stormwater and wastewater discharges, which require an N.J.P.D.E.S., permit to discharge, and non-point source, which includes stormwater runoff from agricultural areas and residential areas, along with a margin of safety. Provisions may also be made for future sources in the form of reserve capacity. An implementation plan is developed to identify how the various sources will be reduced to the designated allocations.
Implementation strategies may include improved stormwater treatment plants, adoption of ordinances, re-forestation of stream corridors, retrofitting stormwater systems, and other BMPs.

The State of New Jersey's 2004 Integrated Water Quality Monitoring and Assessment Report (NJDEP) provides the following additional information regarding water quality concerns within the Whippany River Watershed:

Under sublist 1 and 2

1) The Whippany River at Whitehead Road station located in Morris Township has been listed as attainment for the Phosphorus, temperature, dissolved oxygen, pH, Nitrate, Dissolved solids, Total suspended solids, and unionized ammonia parameters.

2) The Whippany River at Morristown station has been listed as attainment for temperature, pH, dissolved oxygen, nitrate, dissolved solids, total suspended solids, unionized ammonia, chromium, copper, lead, nickel, selenium and zinc.

3) The Whippany River near Pine Brook station has been listed as attainment for temperature, pH, dissolved oxygen, nitrate, dissolved solids, total suspended solids, unionized ammonia, chromium, copper, nickel, selenium, zinc.

4) The Whippany River at Mt. Pleasant Rd. in Mendham has been listed as attainment for benthic macroinvertebrates.

5) The Whippany River at Ridgedale Avenue in Morristown has been listed as attainment for benthic macroinvertebrates.

Under sublist 4

1) The Whippany River at Morristown was listed for fecal coliform with a TMDL approved by the USEPA.

2) The Whippany River near Pine Brook was listed for fecal coliform with a TMDL approved by the USEPA.

Under sublist 5(TMDL development is needed)

1) Whippany River at Jefferson Rd. in Hanover Twp. Was listed for benthic macroinvertebrates (low priority).

2) Whippany River at Morristown was listed for phosphorus (high priority).

3) Whippany River at Whitehead Road in Morris Twp. Was listed for benthic macroinvertebrates (low priority)

4) Whippany River near Pine Brook was listed for lead (high priority).

5) Whippany River near Pine Brook was listed for phosphorus (medium priority).

The Whippany River near Pine Brook was delisted in 2004 for both dissolved oxygen and total suspended solids (due to new information, more recent and more accurate data demonstrates that a designated use or surface water quality criteria is being met for the water body).

APPENDIX B

WATER QUALITY STUDIES OF THE WHIPPANY RIVER

1. Project Name: **Improving Stormwater Runoff Quality From a Low Density Residential Area Via an Information and Education Best Management Practice (BMP)**

Date of Final Report: March 15, 2002

Project Officer: George Van Orden, Ph.D.

Summary of Project:

The purpose of this study was to determine `stormwater quality from a low-density residential area, identify pollutants of concern, develop and implement an education and outreach program which would target the pollutant of concern and then resample stormwater to determine the effectiveness of the education and outreach effort. The data from this study indicated that a short-term educational process (approximately 2 years) was not effective in reducing stormwater pollutants originating from a residential area. During this period the characteristics of the study area did not change. Stormwater quality comparisons were made between June storm events (the June 12, 1998 storm before education and outreach and the June 8th, 2000 storm after the education and outreach) and November storm events (the November 8, 1996 storm before education and outreach and the November 9, 2000, storm after education and outreach). Accumulated pollutant loads were plotted over time for a visual comparison. These plots can be found in appendix 6. The data clearly shows that there were reductions in ortho-phosphorus after the education and outreach program. However, the remaining pollutants (CBOD, TKN, NH3, NO3, TP, TSS, TDS and fecal coliform) did not show improvement.

The education and outreach effort did include free seminars, brochures and education packets, which were mailed to the residents located within the study area. The outreach program (targeting homeowners, landscapers and pet owners) was based on enhancing awareness and effecting behaviors that would reduce specific potential sources of non-point contaminants identified by previous stormwater quality sampling. A more detailed description of the education and outreach program may be found in appendix 4.

During the education and outreach effort it appeared that residents had little interest. Free soil sampling was offered twice to all residents within the sampling area (approximately 200 residents are in the sample area). Only 23 residents too advantage of the free soil sampling. Seminar were publicized and poorly attended. In speaking directly to a few residents during field investigations it appeared that they had little or no interest in the material, which was being sent to them.

It appears from this study that the education and outreach effort may have been too short-term for it to have been effective. Residents who have developed habits over many years (i.e. lawn care, not picking up after pets) become resistant to change. To break the habits, residents must first be interested in the educational material. Interest may be stimulated by showing how the changes will affect them in a

positive way. The benefit of the change must be demonstrated and must be significant. Demonstration projects would benefit the education and outreach effort. However, to effect change the demonstration project should show benefits (both short term and long term) which are significant to the residents. These benefits should include factors such as cost, aesthetics and improved health. The education and outreach effort offered during this study did not include a demonstration project component.

There was one very positive observation made during this study, which is worth mentioning here. Stormwater quality did appear to significantly improve after the storm drain catch basins in the study area were cleaned. Stormwater data was plotted for the November 8, 1996, April 12, 1997 and June 12, 1998 storms to show the effect that catch basin cleaning had on stormwater runoff quality. These plots can be found in Appendix 3. During the November 1996 and April 1997 storm events the catch basins located in the study area will filled to capacity with decaying vegetative matter. Stormwater passing through these catch basins most likely was picking up pollutants from the decay of this vegetative matter. The catch basins were cleaned during July and August of 1997. The storm event sampled during June of 1998 showed a significant reduction of pollutants when compared to the storm events prior to cleaning. Some of the reduction may be due to sampling during the June 12, 1998 storm which started slightly later into the storm when compared to the two prior storm events. Some of the first flush of the June 12, 1998 storm may have been missed. However, after closely reviewing the data it appears that a majority of the reduction was not due to time of sampling (sampling later into the storm). Significant reductions in the pollutant loading of the June 12, 1998 storm were due to some other factor, most likely due to cleaning the catch basins. The majority of the catch basins in the study area were not cleaned again after August of 1997. Vegetation was allowed to accumulate from August 1997 to the completion of this study (July 2001). This was confirmed in January of 2002 when an investigation revealed that most of the catch basins in the study area were again filled to capacity with dead vegetation (mostly leaves and grass). The Township of Hanover Public Works Department confirmed this observation by stating that the catch basins in the study area were all cleaned in August of 1997 and since then they were only spot cleaned if their was a complaint about a specific basin. This may be the reason why stormwater quality appeared to degrade from June 2000 through July 2001 when compared to the June 1998 storm event when all the catch basins were clean. Also, please note than when comparing the June and November storm events (to evaluate the effectiveness of the education and outreach effort) that the June 12, 1998, storm event was used as a "before" education and outreach storm. The June 12, 1998 storm event had the best water quality of all storms evaluated during this study. This was most likely due to cleaning of the catch basins. Including this storm as a "before" storm way have introduced error into the education and outreach evaluation. By including this storm into the evaluation another variable was introduced into the study (the "before" and "after" conditions of the catch basins were not held constant during the study). This is an important variable since it did seem to have a significant impact on stormwater runoff quality.

In summary, the short-term education and outreach effort implemented during this study appeared to have little impact on stormwater quality. However, the impact from catch basin cleaning appeared to have be significant (much more significant than effects caused by education and outreach) and may have erroneously influenced the evaluation of the education and outreach effort. When comparing the November 8, 1996, April 12, 1997 and June 12, 1998 storm events the reductions observed after catch basin cleaning (which occurred between July and August of 1997) were 90% CBOD, 83% TKN, 63% NH3, 54% NO3, 80% TP and 99% Ortho-P. This observation was made using a small data set (only included 3 storm events) and may not be truly representative of the actual conditions. Additional studies would be needed to better define and evaluate the effectiveness of storm drain catch basin cleaning on reducing pollutant loading.

2. Project Name: **Whippany River Water Quality Trend Analysis Study**

Date of Final Report: March 24, 2003

Project Officer: George Van Orden, Ph.D.

Summary of Project:

TABLE 1		
Whippany River Parameter Mean Values for the Periods 1994/1995 and 2001/2002 – Dry Weather Conditions -		
SAMPLE PARAMETER	**1994/1995 RIVER MEAN**	**2001/2002 RIVER MEAN**
Temperature (degree C)	15.5	17.9
Dissolved Oxygen (mg/l)	9.2	9.8
pH	8.04	7.87
Specific Conductivity microsiemens)	456	590
CBOD-5 (mg/l)	<1.4	<5.5
NH3-N (mg/l)	<0.054	<0.078
NO2-N (mg/l)	<0.019	<0.019
NO3-N (mg/l)	2.93	2.80
TKN (mg/l)	1.36	1.15
Ortho-P (mg/l)	<0.42	0.17
Total P (mg/l)	0.44	0.21
TSS (mg/l)	10.7	3.1
TDS (mg/l)	283.1	369.
Alkalinity (mg/l)	74.8	85.4
Chloride (mg/l)	64.8	103.8
Chlorophyll A (ppb)	9.8	2.2
Fecal coliform #/100ml)	375.2	237.4
Flow (cfs) at Morristown Gage	22.9	15.3

Discussion

Samples were collected at each of the above-mentioned sampling locations on nine (9) separate occasions during 1994/1995 and on four (4) separate occasions during 2001/2002. Twenty parameters were measured at each sample location during each sampling event. A mean value and standard deviation was

calculated for each parameter at each sample location for the 1994/1995 period and for the 2001/2002 period. While performing the calculations all values received from the laboratory were included (K descriptor values refer to an actual concentration which is less than the reported concentration, J descriptor values refer to an estimated concentration). However, if a K value or J value was used in the calculation the final mean value calculated was labeled with the appropriate symbol (i.e. if a "K" value was used in the calculation, the final mean value was given a "K" label indicating that the actual mean value is less than the calculated and reported mean value). The geometric mean and geometric standard deviation was used in the bacterial parameter (i.e. fecal coliform, fecal streptococcus and enterococcus) calculations for each location. The calculated mean and standard deviation values for each sampling location may be found in **Appendix C** of the above-mentioned report. A river mean value and standard deviation for each parameter measured was then calculated for each of the study periods (1994/1995 and 2001/2002) using the mean values generated at each of the sampling locations. The river mean value may be used in this study for comparison purposes (comparing the river mean for 1994/1995 to river mean 2001/2002) since they were generated from the same five sample locations during each sample period. However, the river mean values only include data from five sampling locations (which were not equally spaced) along the river and may not be an accurate representation of an overall spatially weighted river mean. The river standard deviation calculated for each parameter is an estimate of the spatial variability (along the river) of the mean values calculated at all of the stations. River mean and standard deviations for all test parameters may be found in **Appendix C** of the above-mentioned report.

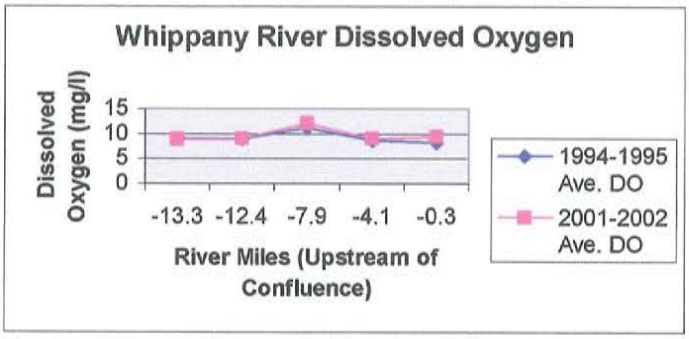
Dissolved oxygen, total phosphorus, total suspended solids and fecal coliform data was plotted and may be found in Figures 1, 2, 3 and 4, respectively. These figures provide comparison of the data for each of the parameters mentioned averaged over the 1994/1995 and 2001/2002 periods. Data was plotted using the average concentration for the reporting period (y-axis) versus sampling station location (mile) on the x-axis. Sampling station locations are located at mile -13.3, -12.4, -7.9, -4.1 and –0.3 for the Lake Valley Road (Morris Township), Speedwell Avenue (Morristown), South Jefferson Road (Hanover Township), Melanie Lane (East Hanover Township) and Edwards Road (Parsippany) stations, respectively. The negative values (-) on the x-axis refer to miles upstream (negative direction) of the Whippany River confluence with the Rockaway River, which has a reference point of mile zero (0).

A comparison of 2001/2002 data to 1994/1995 data reveals the following:

Temperature: River temperatures during sampling were slightly higher during the 2001/2002 period. Higher water temperature impacts water quality (mostly causing degradation of water quality) by causing a decrease in dissolved oxygen concentrations (dissolved oxygen saturation decreases as water temperature increases) and increase the rates of nitrification, biosynthesis and biodegradation.

Dissolved Oxygen: Dissolved oxygen concentrations in the river slightly improved from 1994/1995 to 2001/2002. Dissolved oxygen in the River increased by approximately 0.5 mg/l. However, when considering the increase in water temperature during sampling events (as mentioned above), the actual dissolved oxygen improvement would be slightly higher.

Figure 1 Average Dissolved Oxygen concentration for the Whippany River at the Lake Valley Road (mile –13.3), Speedwell Avenue (mile –12.4), S. Jefferson Road (mile –7.9), Melanie Lane (mile – 41.) and Edwards Road (mile – 0.3) sampling stations for the periods 1994/1995 and 2001/2002.



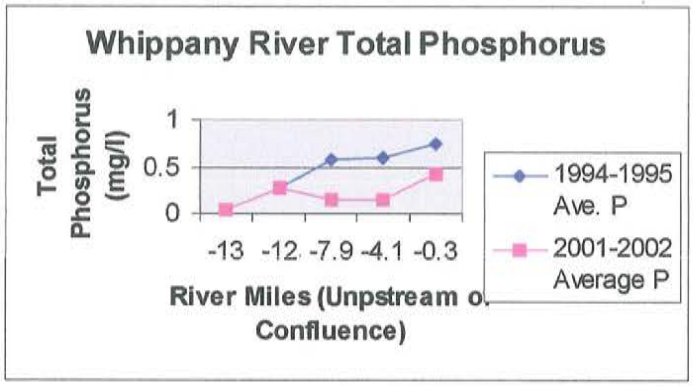
Specific Conductivity, total dissolved solids, Chloride: The specific conductivity, total dissolved solids concentration and chloride concentration did show a significant increase between the 1994/1995 and 2001/2002 sampling periods. This data reflects an increase in the river's salt concentration between the sampling periods. Increases could be due to an increase in treated effluent flow into the river (wastewater treatment plants do not typically remover salts) and/or a decrease in river dilution (river flows measured at the Morristown gage station were significantly lower during the 2001/2002 sampling period).

Nitrogen series (Ammonia, nitrite, nitrate, organic nitrogen): There seemed to be little or no difference in the Ammonia (NH3-N), Nitrite (NO2-N), Nitrate (NO3-N) and organic nitrogen (TKN) concentrations between the sampling periods.

Ortho Phosphorus and Total Phosphorus: Ortho and total phosphorus concentration observed during the 2001/2002 sampling events were significantly lower than the concentrations observed during the 1994/1995 sampling events (see Figure 2 below). The decrease in river phosphorus concentration between the 1994/1995 and 2001/2002 sampling periods may be due to the Morristown Sewage Treatment Plant (located at mile – 9.3 which is upstream of the South Jefferson Road station) which implemented phosphorus removal in 1996 (total phosphorus concentration in their treated effluent was reduced from approximately 3 mg/l to approximately 0.4 mg/l). This is clearly seen in Figure 2 where the 2001/2002 total phosphorus concentrations significantly decrease when compared to 1994/1995 concentrations between the Speedwell Avenue and South Jefferson Road stations. Reductions may also reflect the effects of an active watershed management program within the Whippany River Watershed.

A statistical comparison (using the t-test) was made between the total phosphorus concentrations observed during the 1994/1995 sampling events and concentrations observed during the 2001/2002 sampling events at the Edwards Road sampling station (which is the lowest sampling point along the Whippany River, located 0.3 miles upstream of the Rockaway River confluence). At Edwards Road there was a statistical difference ($p < 0.05$) between the 1994/1995 and the 2001/2002 total phosphorus data. The total phosphorus concentration at Edwards Road observed in 2001/2002 were statistically less than the concentrations observed during the 1994/1995 sampling events.

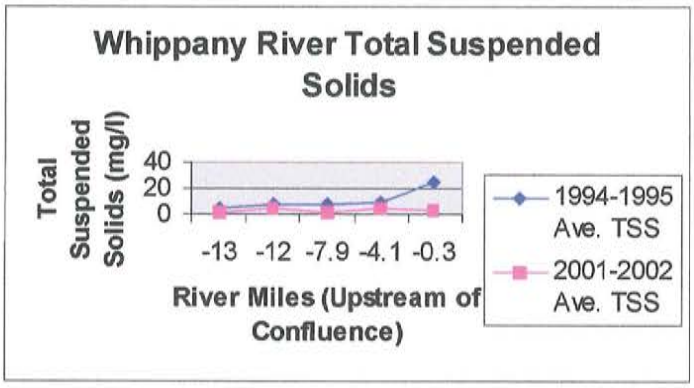
Figure 2 Average Total Phosphorus concentration for the Whippany River at the lake Valley Road (mile –13.3), Speedwell Avenue (mile –12.4), S. Jefferson Road (mile –7.9), Melanie Lane (mile – 41.) and Edwards Road (mile – 0.3) sampling stations for the periods 1994/1995 and 2001/2002.



Chlorophyll A: Chlorophyll A concentrations (planktonic Chlorophyll A) observed during the 2001/2002 sampling events were significantly lower than concentrations observed during the 1994/1995 sampling events. This may be due to the observed decrease in phosphorus (nutrient) mentioned above.

Total Suspended Solids (TSS): The total suspended solids concentrations also decrease significantly over the study period. The calculated river TSS concentration decreases from 10.7 mg/l to 3.1 mg/l between 1994/1995 and 2002/2002. The reduction of TSS may be due to the effectiveness of watershed management, which is being actively practiced in the study area (reducing the amount of suspended solids being discharged with stormwater which accumulate in the sediments) and/or the reduction of phosphorus and algal productivity as mentioned above.

Figure 3 Average Total Suspended Solids concentration for the Whippany River at the lake Valley Road (mile –13.3), Speedwell Avenue (mile –12.4), S. Jefferson Road (mile –7.9), Melanie Lane (mile – 41.) and Edwards Road (mile – 0.3) sampling stations for the periods 1994/1995 and 2001/2002.

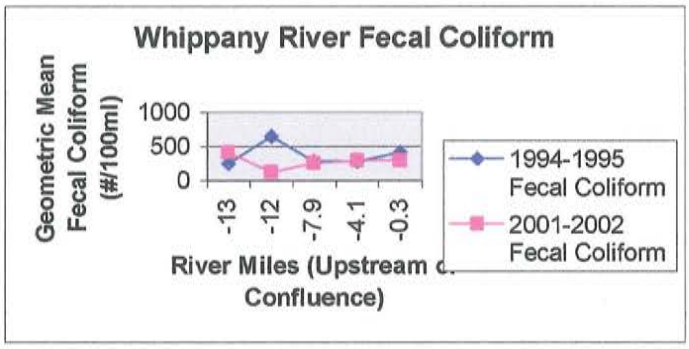


A statistical comparison (using t-test) was made between the 1994/1995 and 2001/2002 TSS data collected at Edwards Road (located 0.3 miles upstream of the confluence with the Rockaway River). There was a statistical difference ($p < 0.005$) between the TSS data collected during 1994/1995 and the

data collected during 2001/2002. TSS concentrations observed during the 2001/2002 sampling period were significantly less that the TSS concentration obtained during 1994/1995 sampling period at the Edwards Road station.

Fecal Coliform: Fecal Coliform concentrations decreased from a 1994/1995 river mean of 375.2 per 100ml to a 2001/2002 river mean of 237.4 per 100ml. This represents a 37% decrease in fecal coliform from 1994/1995 to 2001/2002. The observed decrease over time may be due to an active watershed management program, which is aimed at reducing TSS in runoff, goose management and the proper disposal of pet feces.

Figure 4 Average Fecal Coliform concentration for the Whippany River at the lake Valley Road (mile – 13.3), Speedwell Avenue (mile –12.4), S. Jefferson Road (mile –7.9), Melanie Lane (mile – 41.) and Edwards Road (mile – 0.3) sampling stations for the periods 1994/1995 and 2001/2002.



Conclusions and Recommendations:

Based on the data collected during this study, Whippany River water quality (as measured using DO, phosphorus, total suspended solids and fecal coliform parameters) under dry weather conditions significantly improvement from 1994/1995 to 2001/2002.

Water quality improvement observed over this period may be due to the following actions, which occurred within the Whippany River Watershed between the 1994/1995 and 2001/2002 periods:

1. Many of the Watershed Management efforts, as mentioned earlier in this report, occurring within the Whippany River watershed which include public education and outreach, storm drain catch basin cleaning and maintenance, stream bank restoration, goose management, pet waste disposal, and adoption of stormwater related ordinances.

2. Morristown Wastewater Treatment Plant was upgraded in 1996 to include Phosphorus removal. The outfall of this plant is located at mile – 9.3 (9.3 miles upstream of the confluence with the Rockaway River). Prior to this upgrade the Morristown plant was discharging an effluent with a total phosphorus concentration of approximately 3 mg/l. The effluent concentration after the upgrade ranged between 0.2 to 0.6 mg/l.

3. The St. Mary's Abby wastewater treatment facility (which did not provide phosphorus removal) which had an outfall located upstream of the Lake Valley Road sampling station (mile –13.3) was eliminated in 2001. The wastewater from this facility was diverted to the Morris Township Butterworth Plant which has an outfall located immediately downstream of Lake Valley Road, Morris Township. The Butterworth Treatment Plant provides phosphorus removal. This plant has a seasonal phosphorus permit limit which ranges from 2.44 to 3.04 mg/l. This plant normally discharges between 1.0 and 1.5 mg/l total phosphorus.

It is important to note that a severe drought existed within the study area during the spring and summer of 2002. This resulted in a relatively small amount of rainfall and stormwater runoff. Stormwater runoff generally contains suspended solids which are bound with phosphorus and which settle out into the sediments of the receiving waters. The lack of runoff within the study area could have had an effect on the water quality observed in September and October of 2002. It is possible that the normal suspended solids loading to the river, associated with stormwater runoff, was reduced by the drought. This could have lead to a reduction of settled solids in the Rivers sediments over time. Hypothetically, if this did occur, the phosphorus loading (normally associated with the stormwater runoff within the watershed) to the river sediments during the drought period would have decreased. This could have result in a corresponding decrease in phosphorus release from river sediments over time.

The sampling stations used in this study should be re-sampled in 2004/2005 under dry weather conditions and for the same water quality parameters in an effort to further evaluate water quality trends over time within the Whippany River. Trend analysis is needed to evaluate the effectiveness of the actions performed under watershed management.

3. Project Name: **Sanitary Survey of the Whippany River Basin to Evaluate it's Sanitary Quality and to Identify Non-Point Sources of Contamination**

Date of Final Report: June 30, 2004

Project Officer: George Van Orden, Ph.D.

Summary of Report:

Conclusions and Recommendations

During this study an extensive sanitary survey of the Whippany River Watershed was conducted which included an extensive sampling of surface waters (under both dry and wet weather conditions), suspected sources, sediments and fecal matter; field surveys; GIS mapping (which included digital orthophotography and topographic map overlays) and analysis; and an evaluation of historic water quality data. The following conclusions are made based on the findings from this investigation:

a) **HISTORIC ANALYSIS OF DRY WEATHER TRENDS**

Dry weather data collected over time was analyzed in an effort to determine fecal coliform trends within the Whippany River over an 18-year period. Fecal coliform data from five locations along the Whippany

River were used in the analysis. These locations include the stations at Lake Valley Road (Morris Township), Speedwell Lake Outfall at Speedwell Ave. (Morristown), South Jefferson Road Bridge (Hanover Township), Melanie Lane Bridge (East Hanover), and Edwards Road (Parsippany). Fecal coliform averages were calculated over the periods of 1985 (where data exist), 1994-1995(NJDEP data) and 2001-2003. The following table shows the results from this analysis:

Geometric Mean Fecal Coliform Concentrations (# orgs/100ml)

Station Location	1985	1994-1995	2001-2003
Lake Valley Road		246.5	233.8
Speedwell Lake Outfall	200.0	646.9	107.0
S. Jefferson Road	531.3	286.9	133.0
Melanie Lane		279.1	149.4
Edwards Road		416.8	70.7
DRY WEATHER RIVER MEAN FOR PERIOD		**375.2**	**138.8**

Note: River Mean is based on data from the above five mentioned stations.

The 1985 data was very limited (data existed for only 2 of the 5 above mentioned stations) and should only be used to compare data at the Speedwell Lake and S. Jefferson Road stations. Fecal coliform concentrations decreased from a 1994-1995 River mean of 375.2 organisms per 100 ml to a 2001-2003 River mean of 138.8 organisms per 100 ml. This represents a 63.0% decrease in fecal coliform from 1994-1995 to 2001-2003 during dry weather conditions.

This study shows that during dry weather conditions that most of the Whippany River does comply with the current NJDEP standards for fecal coliform. NJDEP surface water quality standard for the Whippany River (as per NJAC 7:9B1.14) is "Fecal coliform levels shall not exceed a geometric average of 200/100 ml nor should more than 10 percent of the total samples taken during any 30-day period exceed 400/100 ml."

b) **HISTORIC ANALYSIS OF WET WEATHER TRENDS**

Wet weather data was collected in an effort to evaluate fecal coliform trends over time for the Whippany River. Wet weather samples were collected during the periods from 1996-1998 and 2001-2003. The 1996-1998 data was collected by Killam Associates through a grant from the NJDEP. It is important to note that the 1996-1998 data consisted of multiple grab samples collected throughout 3 storms during that period. The data provides a good representation of the variability, which occurred during each storm. The 2001-2003 data consist of one grab sample collected during each storm event (six storm events were sampled), which does not provide a good representation of the variability, which can occur during each storm (concentration could vary significantly depending on when the sample was collected during the storm). For this reason the comparison over time is made with the understanding that a significant amount of error does exist in the method used. This is based on the limited number of samples collected during the 2001-2003 storm events.

The Edwards Road station (last station on the Whippany River located approximately 1/4 mile upstream of the confluence with the Rockaway River) is the only Whippany River station in this study where both historical data and current wet weather data sets exist together. Therefore this is the only station where an evaluation of the historical trends could be made. The following table shows the results from this analysis:

Geometric Mean Fecal Coliform Concentrations (# orgs/100ml)

Station Location	1996-1998	2001-2003
Edwards Road (Parsippany)	1,326.0	876.1

Important note: 1996-1998 data consists of multiple grab samples collected throughout each storm event. This provides for a good accounting of the variability occurring throughout each storm event. 2001-2003 data consists of one grab sample collected during each storm event. This does not provide for a good accounting of the variability and introduces error into this analysis.

From an analysis of the data collected during this study, during wet weather conditions the majority of the Whippany Watershed does not comply with the above-mentioned NJDEP criteria for fecal coliform.

c) **SOURCES OF FECAL CONTAMINATION WITHIN THE WHIPPANY WATERSHED**

From the data collect during this study the following statements are made regarding sources of fecal contamination:

1) Septic systems, which are located primarily in the upper portion (Mendham Township, Morris Township) of the Whippany Watershed, do not appear to be a significant source of fecal contamination during the time of this study. Local health departments appear to be very effective in identifying and remediating malfunctioning septics in a timely manner within the study area.

2) Sanitary sewerage systems (which are separate from the storm drain collection systems), which serve the remaining watershed, appear to be functioning properly. Systems (both collection and treatment) do not appear to be over capacity. There are five publicly owned wastewater treatment plants which discharge treated effluent to the Whippany River (Greystone State Hospital which discharges to Watnong Brook, Morris Township Butterworth Plant which discharges below Lake Valley Road, Morristown which discharges below Hanover Avenue, Hanover which discharges above Troy Road in East Hanover, and Parsippany Troy Hills which discharges below Edwards Road before the confluence with the Rockaway River). When sewage back-ups do occur the sewerage authorities and/or health authorities do respond quickly to remediate the condition. Back-ups do not appear to be a common occurrence within the watershed.

3) During this study two sanitary sewage discharges to the Whippany River were identified. These discharges were located at Saddle Road in Hanover Township and near Center Street in Morristown. The Saddle Road discharge was from a building sanitary sewer line, which clogged and backed up onto the surface of the ground and into the storm drain system. This source was immediately remediated once it was detected The Center Street (Morristown) discharge appears to be intermittent and still existing. This discharge has been brought to the attention of the Morristown Health

Department for their follow-up and action. Detailed information on both discharges can be found in the main body of this report.

4) Data from this study indicates that there may be a human source of fecal contamination upstream of the Lake Valley Road (Morris Township) site. This area receives drainage from all of the stations listed above this point (please refer to "Data Analysis by Station" in the above discussion section) and some additional forested and low to medium density residential areas, schools and recreational fields. Some of the low-density residential areas mentioned here are on septic systems (Washington Valley Road area). As per the Morris Township Health Department, the Washington Valley Road area has historically been a problem area for septic systems. The soil in this area is poor (usually encounter clay layers) for septic systems. The Health authority for Morris Township has stated that as of this time the Health Department is not aware of any malfunctioning septic systems in this area. The medium density residential areas mentioned here are sewered (Sussex Ave./Lake Road areas). The areas mentioned here have heavy deer and geese populations. The Morris Township (Butterworth) sewage treatment plant is located immediately downstream of this sampling station. During dry weather conditions the fecal coliform geometric mean was 233.8 organisms per 100 ml with a fecal coliform/fecal streptococcus ratio indicating mixed (possibly animal and human) sources. During wet weather conditions the fecal coliform geometric mean was 993.3 organisms per 100 ml with a fecal coliform/fecal streptococcus ratio indicating mixed (possibly animal and human) sources. During wet weather sampling, when samples were collected during the storm event, the fecal coliform/fecal streptococcus ratios indicated animal sources. When wet weather samples were collected one and two days after the storm event the fecal coliform/fecal streptococcus ratios indicated mixed (possibly animal and human) sources.

5) Data from this study indicates that there may be a possible human source of feces upstream of the Watnong Brook at Lake Road (Morris Township) sampling location. This station receives drainage from both low and medium density residential areas, forested areas, agriculture, recreational fields, Greystone State Hospital, major roadways (Hanover Ave. and Route 10) and some commercial areas (including Powder Mill area and Shop Rite – goose problem areas). The residential areas are mostly sewered (except for a small area in Parsippany (Puddingstone area) next to Greystone State Hospital which is on septic systems). Greystone State Hospital has a sanitary sewerage system with a wastewater treatment plant, which discharges to Watnong Brook upstream of this sampling point. This area has a heavy deer and goose population. A County leaf composting facility is also located in this area. Mount Tabor Lake and Powder Mill Pond discharge to this Brook along with Jaqui and Watnong Ponds (both of which have a documented goose problem). During dry weather conditions the fecal coliform geometric mean was 228.4 organisms per 100 ml with a fecal coliform/fecal streptococcus ratio indicating mixed (possibly animal and human) sources. During wet weather conditions the fecal coliform geometric mean was 2,787.5 organisms with a fecal coliform/fecal streptococcus ratio indicating animal sources.

6) Data collected from the Center Street storm sewer outfall (Morristown) indicate that there may be both animal and human fecal sources within the storm drain collection system upgradient of the outfall. Animal sources may be from rodent and other terrestrial wildlife living within the storm drain collection system. This station receives drainage from the Burnham Pond outfall and is part of a storm water collection system for Morristown. The area in Morristown, which drains (stormwater runoff) to this system is mostly a medium and high-density urban area, which is sewered. During dry weather conditions the fecal coliform geometric mean was 740.4 organisms per 100 ml with a fecal

coliform/fecal streptococcus ratio indicating mixed (possibly animal and human) sources. During wet weather conditions the fecal coliform geometric mean was 1,828.3 organisms per 100 ml with a fecal coliform/fecal streptococcus ratio indicating animal sources.

7) Pet waste may be a fecal source in the more densely developed residential areas (medium to high density area). During dry weather conditions most of the stations located within these areas met the 200 fecal coliform/100 ml criteria. However, during wet weather conditions the fecal coliform levels recorded at these stations greatly exceeded the surface water criteria with concentrations which ranged from 727 to 34,979 organisms per 100 ml with a fecal coliform/fecal streptococcus ratio indicating animal sources. The low density residential areas during wet weather conditions had fecal coliform concentrations which were much lower and ranged from 143 to 1,271.6 organisms per 100 ml with a fecal coliform/fecal streptococcus ratio indicting animal sources. It makes sense to say that pet density is directly related to residential density. If residents are not picking up after their pets then pet waste in both medium and high density residential areas (medium and high density residential areas would also have more impervious coverage and more surface runoff then low density area) could be a significant sources of fecal contamination to the Whippany River during wet weather conditions.

8) Throughout the Whippany Watershed there are very dense goose and deer populations. Goose populations are greatest in areas around ponds and in areas, which are open with mowed lawns (athletic fields, corporate lawns, parks, school yards, residential areas with large lawns, stormwater detention systems consisting of mowed lawn vegetation). Deer populations are greatest in the more wooded areas (forested areas, meadow areas, low and medium density residential areas). Droppings from these animals are deposited onto the ground and may wash into surface waters with runoff. Goose droppings in many of the above mentioned open areas are so dense that it becomes difficult to walk without soiling shoes.

9) Animals living in storm drain collections systems appear to be a source of fecal contamination in stormwater runoff. This was first observed at the Boulevard Road site in Hanover Township. Groundwater base flow moving through the storm drain system in this area was picking up fecal contamination (under dry weather conditions) from what appeared to be animal sources. The dry weather geometic mean for fecal coliform at this sampling location (which is the outfall for an underground stormwater collection system in a medium density residential area which was sewered) was 145.6 organisms per 100 ml and the fecal streptococcus concentration was 569.6 organisms per 100 ml. The dry weather FC/FS ratio was 0.3, which strongly indicates animal source. A survey of the drainage area above this sampling point did not reveal any human sources. People living in this area did state that on numerous occasions they did observe raccoons and cats entering and leaving the storm sewer catch basins. It appears that the raccoons are living in this system (and may be depositing feces into this system). There is flow in this system most of the time that appears to be groundwater base flow. The only time this system is dry (no flow at the sampling location) is when there is an extended dry period (no rain for at least a two week period) in the region. This is seen more often in the late summer/early fall months. This observation is probably a common occurrence in most of the stormdrain collection systems throughout the watershed. In systems where there is no flow during dry weather periods, fecal matter from these animals could accumulate and then be flushed out with stormwater runoff during a storm event.

10) Sediments in ponds, which have large goose populations, could act as a source of fecal matter and fecal coliform. If the grounds surrounding a pond have heavy accumulations of fecal matter the fecal matter could wash into the pond with runoff during a storm event. Ponds tend to act as settling basins for sediments and suspended solids. Fecal matter entering the pond could settle to the bottom and become part of the pond sediments. Fecal mater in these sediments will decompose over time. However, fecal coliform and fecal streptococcus may survive for an extended period in these sediments (Van Orden, 1990). Escherichia coli (a fecal coliform organism) has been found to multiply in sediments (Solo-Gabriele, et al 2000) as well. During heavy rains the sediments in a pond could be scoured off the bottom (as flow through the pond increases) and re-suspended into the water column. These sediments would then be discharged with the pond outfall. This could include indicator organisms, which may be present in the pond sediments. Sediment samples collected from the bottom of Sunrise Lake (Morris Township) were tested for fecal coliform and fecal streptococcus. 30 fecal coliform per gram and 40 fecal streptococcus per gram were found. Sampling of the water column above these sediments (under dry weather conditions at Sunrise lake) revealed that <10 fecal coliform/100 ml and 10 fecal streptococcus per 100 ml were present in the epilimnion. 30 fecal coliform/100 ml and 20 fecal streptococcus/100 ml were found in the hypolimnion immediately above the sediments. This data suggests that pond sediments may be acting as a minor sources of the fecal indicators found in the ponds outfall during a storm event. More studies are needed in this area to better understand the role pond (or lake) sediments play as a source of fecal indicators.

Note: listing of all animal fecal sources (by location) identified during this study may be found in **Appendix 3** of the above-mentioned report.

d) **SEASONAL VARIABLITY OF FECAL COLIFORM CONCENTRATIONS**

The data generated during this study clearly shows that, during dry weather periods, seasonal variability exists with respect to fecal coliform and fecal streptococcus in surface waters. The fecal coliform and fecal streptococcus concentrations in surface waters throughout the watershed were much lower in the colder winter month when compared to the warmer summer months. Freezing temperature appears to have a negative effect on the fecal indicators. This was observed when comparing data from fecal samples collected during this study. Frozen fresh goose droppings contained significantly less fecal coliform and fecal streptococcus than fresh droppings collected during the summer months (this data is presented in the discussion section of this report). Dry fecal droppings also contained significantly less fecal indicators than moist droppings. The negative effect that freezing appears to have on the indicator organisms in combination with a decrease in animal activity during winter months may provide some explanation for the decreases observed (of fecal bacteria) in the surface water during colder weather. Aftergrowth of the indicator organisms in the environment is also a function of temperature. Warmer water temperatures could increase the growth rate of fecal indicators in the surface water environment (aftergrowth) thereby increasing their concentration. It has been well documented that some of the fecal indicator species have the ability to multiply naturally in a water environment. Therefore, the seasonal variability appears to be due to the effects of freezing temperatures (increasing the death rate) on the indicator bacteria, the effect warmer temperatures have on aftergrowth and a decrease of animal activity during the cold winter months. More research is needed to verify this hypothesis.

Final Note

On February 2, 2004, the New Jersey Department of Environmental Protection adopted the "Stormwater Management" regulations. These new regulations will require municipalities to adopt and enforce pet waste, improper waste disposal, wildlife feeding, and illicit connection ordinances. The new regulations also require municipalities to develop illicit connection elimination and stormwater facility maintenance programs. These requirements can be found in NJAC 7:8.1 et seq. Since these regulations address many of the sources mentioned above, the sanitary quality of the Whippany River is expected to improve with their implementation.

APPENDIX C

NJDEP KNOWN CONTAMINATED SITES

Township of Hanover
Morris County

KCS-NJ County - Municipality Listing (2001 Edition)
County and Municipality: MORRIS HANOVER TOWNSHIP

County: MORRIS
Municipality: HANOVER TOWNSHIP

A SITES WITH ON-SITE SOURCE(S) OF CONTAMINATION

Site Name / Contact	Case Number	Site Address / Case Status	- Status Date	Site Identifier / Control/Remedial Action Type
102 RIDGEDALE AVE BFO-N	980622131734	102 RIDGEDALE AVE ACTIVE	- 7/20/98	NJL800419632
1363 ROUTE 10 BFO-IN	NJL800048613-001	1363 RTE 10 ACTIVE	- 3/30/94	NJL800048613
7 JOSEPH ST BFO-N	000712145123	7 JOSEPH ST ACTIVE	- 8/7/00	NJL800585804
ABC SUPPLY COMPANY BFO-N	940526162926	8 FREDERICK PL ACTIVE	- 6/27/94	NJL800063026
ALS SERVICE STATION WHIPPANY BFO-CA	960569	145 RTE 10 E PENDING	- 5/13/96	NJL800219487
AMOCO SERVICE STATION HANOVER TOWNSHIP BUST	0223076	172 RTE 10 W ACTIVE	- 3/12/93	NJD986615466
ARZEE SUPPLY CORPORATION BUST	0272388	15 TO 17 FREDERICK PLZA E ACTIVE	- 3/2/99	NJL800449084
AT&T TECHNOLOGIES INCORPORATED BEECRA	E95515	67 WHIPPANY RD ACTIVE	- 4/24/96	NJD048804488
BERLEX LABORATORIES INCORPORATED BFO-N	920919081030	110 HANOVER AVE E ACTIVE	- 6/16/97	NJD098262173
BOONTON ELECTRONICS CORPORATION BFO-N	910962	17 EASTMANS RD ACTIVE	- 9/23/91	NJD980536122
CAMPBELL PRATT OIL COMPANY BFO-N	970343	260 RTE 10 W PENDING	- 3/11/97	NJD011459260
CARGILLE PHARMACEUTICAL COMPANY BFO-N	940526162326	4 FREDERICK PL E ACTIVE	- 6/27/94	NJD000576934
CEDAR KNOLLS POWER EQUIPMENT BFO-N	NJL820007201	122 RIDGEDALE AVE PENDING	- 9/16/93	NJL820007201
COLLOID CHEMICAL BCM	NJD002198760	225 CEDAR KNOLLS RD ACTIVE	- 7/27/94	NJD002198760
COMPTON PRESS INCORPORATED BFO-IN	E20010029	140 HANOVER AVE ACTIVE	- 1/18/01	NJD002198646

KCS-NJ County - Municipality Listing (2001 Edition)
County and Municipality: MORRIS HANOVER TOWNSHIP

A SITES WITH ON-SITE SOURCE(S) OF CONTAMINATION

Site Name / Contact	Case Number	Site Address / Case Status	- Status Date	Site Identifier / Control/Remedial Action Type
DOSCH KING COMPANY INCORPORATED		16 TROY HILLS RD		NJD011863784
BFO-N	9008212220N	ACTIVE	- 7/22/92	
EXXON SERVICE STATION HANOVER TOWNSHIP		54 TO 56 RIDGEDALE AVE		NJD986600179
BUST	0086060	ACTIVE	- 7/30/91	
FOSTER & COMPANY INCORPORATED		15 WING DR		NJD002136034
BUST	0140311	ACTIVE	- 7/25/88	
GALE & WENTWORTH CORPORATION		80 JEFFERSON RD S		NJL800487241
BFO-N	990423091647	ACTIVE	- 10/4/99	
GULF SERVICE STATION		2 PARSIPPANY RD		NJL800434714
BUST	0151724	ACTIVE	- 10/8/98	
LITTON INDUSTRIES AIRTRON DIVISION		200 HANOVER AVE		NJD030239412
BCM	NJD030239412	ACTIVE	- 3/17/94	
MOBIL SERVICE STATION EAST HANOVER TWP		143 RTE 10		NJL600198626
BFMCR	NJL600198626-001	ACTIVE	- 9/14/00	
MOBIL SERVICE STATION HANOVER TOWNSHIP		610 RTE 10		NJD986586246
BUST	0162687	ACTIVE	- 3/21/94	
MOBIL SERVICE STATION HANOVER TOWNSHIP		1235 RTE 10		NJD986605749
BUST	0062372	ACTIVE	- 12/11/92	
MORRIS COUNTY DEPARTMENT OF PUBLIC WORK		120 HANOVER AVE		NJD982739690
BFO-N	9112191624N	ACTIVE	- 7/10/92	
MORRISTOWN MUNICIPAL AIRPORT		8 AIRPORT RD		NJD982189326
BUST	0110413	ACTIVE	- 1/22/90	
BFO-N	940202154129	ACTIVE	- 8/15/94	
MORRISTOWN WASTE WATER TREATMENT PLANT		HANOVER AVE		NJD986583656
BFO-N	970908	PENDING	- 9/3/97	
NORTHERN NEW JERSEY RADIO		55 HORSEHILL RD		NJL600259337
BFO-N	000324125515	ACTIVE	- 6/5/00	
PETES GARAGE		RTE 10 & TROY RD		NJL800552382
BFO-N	000228113112	ACTIVE	- 4/17/00	
PHILLIP FRITZE & SONS INCORPORATED		10 SCHOOL ST		NJL600105480
BUST	0168780	ACTIVE	- 4/1/99	
PINE PLAZA SHOPPING CENTER		RTE 10		NJL800472300
BFO-N	990218011946	ACTIVE	- 3/4/99	
PRUDENTIAL PARCEL C		NORTH JEFFERSON RD		NJL800061871
BFO-N	940520174853N	ACTIVE	- 7/1/94	

KCS-NJ County - Municipality Listing (2001 Edition)
County and Municipality: MORRIS HANOVER TOWNSHIP

A SITES WITH ON-SITE SOURCE(S) OF CONTAMINATION

Site Name / Contact	Case Number	Site Address / Case Status	Status Date	Site Identifier / Control/Remedial Action Type
QUAKER STATE OIL REFINING CORPORATION		55 JEFFERSON RD S		NJD002570539
BUST	0020288	ACTIVE	6/4/88	
ROBERT L HERMAN COMPANY WAREHOUSE		64 SOUTH JEFFERSON RD		NJL000066902
BFO-CA	930614	PENDING	11/2/95	
ROWE INTERNATIONAL INCORPORATED		75 TROY HILLS RD		NJD042902916
BEECRA	E85319	ACTIVE	7/26/85	
BEECRA	E89542	ACTIVE	7/25/90	
BEECRA	E88C51	ACTIVE	7/27/90	
SHELL SERVICE STATION HANOVER TOWNSHIP		RTE 10 & WHIPPANY RD		NJL000064824
BUST	0032311	ACTIVE	1/18/96	
SIMMONDS PRECISION MOTION CONTROLS INC		197 RIDGEDALE AVE		NJD002167443
BEECRA	E99464	ACTIVE	3/6/00	
SOUTHEAST MORRIS COUNTY MUA TODD WELL		RIDGEDALE AVE		NJL000070771
BCM	NJL000070771	ACTIVE	4/13/99	
STANDARD ROOFINGS INCORPORATED		19 FREDERICK PL E		NJP000884296
BFO-N	951018131118	ACTIVE	7/22/96	
WHIPPANY ASSOCIATES		29 JEFFERSON RD		NJL600134282
BFO-N	990318020027	ACTIVE	4/19/99	
WHIPPANY PAPER BOARD COMPANY INC		10 NORTH JEFFERSON RD		NJD986576809
BEECRA	E87068	ACTIVE	11/18/87	
WYCOFF OIL		1373 RTE 10		NJL800392854
BFO-IN	980330110635	ACTIVE	3/30/98	

42 SITES WITH ON-SITE SOURCE(S) OF CONTAMINATION IN HANOVER TOWNSHIP

C SITES WITH CLOSED CASE(S) WITH RESTRICTIONS

Site Name / Contact	Case Number	Site Address / Case Status	Status Date	Site Identifier / Control/Remedial Action Type
AT&T TECHNOLOGIES INCORPORATED		88 HORSE HILL RD		NJD986581114
BFO-N	940624115903	NFA-A	11/12/99	Restricted
OLSON PRESERVATIVE & PAINT		74 S JEFFERSON RD		NJD002191666
BEECRA	E85436	NFA-E	8/11/90	CEA
PITNEY BOWES		16 WING DR		NJD033496746
BUST	0183837	NFA-A	7/10/97	CEA

KCS-NJ County - Municipality Listing (2001 Edition)
County and Municipality: MORRIS HANOVER TOWNSHIP

C SITES WITH CLOSED CASE(S) WITH RESTRICTIONS

Site Name / Contact	Case Number	Site Address / Case Status	- Status Date	Site Identifier / Control/Remedial Action Type
STANDARD ROOFINGS INCORPORATED		19 FREDERICK PL E		NJP000884296
BUST	0098364	NFA	- 7/31/95	CEA

4 SITES WITH CLOSED CASE(S) WITH RESTRICTIONS IN HANOVER TOWNSHIP

APPENDIX D

LAND USE ANALYSIS – DEVELOPMENT POTENTIAL

Township of Hanover
Morris County

TOWNSHIP OF HANOVER

Land Use Analysis - Development Potential

January, 2005

BLOCK	LOT	ACREAGE	CLASS	STREET	OWNER_NAME	DESCRIPTION	ZONING	DEVELOPMENT POTENTIAL RESIDENTIAL UNITS	DEVELOPMENT POTENTIAL NON-RESIDENTIAL TOTAL FLOOR AREA
Recreation and Open Space Inventory									
1201	7	16.600	15C	MALAPARDIS PARK	TOWNSHIP OF HANOVER	Malapardis Park	R-25		
1201	2	0.169	15C	74 PLEASANT AVE	TOWNSHIP OF HANOVER	Pleasant Avenue	R-10		
2302	3	1.780	15C	CEDAR KNOLLS RD	TOWNSHIP OF HANOVER	Patriot's Path	I		
2302	4	1.470	15C	CEDAR KNOLLS RD, REAR	TOWNSHIP OF HANOVER	Patriot's Path	I		
2302	5	0.256	15C	CEDAR KNOLLS RD, OFF	TOWNSHIP OF HANOVER	Patriot's Path	I		
3002	7	22.090	15C	65 N. JEFFERSON ROAD	TOWNSHIP OF HANOVER	Stoney Brook Park	IPR4		
3704	1	1.263	15C	79 SO JEFFERSON RD	TOWNSHIP OF HANOVER	Central Park	OBRL		
3704	2	39.636	15C	75 SO JEFFERSON RD	TOWNSHIP OF HANOVER	Central Park	OBRL		
3503	22	1.970	15C	MONROE PARK	TOWNSHIP OF HANOVER	Monroe Park			
8104	2	17.514	15C	BEE MEADOW PARK	TOWNSHIP OF HANOVER	Bee Meadow Park	R-40		
8401	9	71.560	15C	BEE MEADOW PARK	TOWNSHIP OF HANOVER	Bee Meadow Park			
7005	7	7.410	15C	BLACK BROOK DR	TOWNSHIP OF HANOVER	Black Brook Park	R-25		
7101	26	11.100	15C	BLACK BROOK DR	TOWNSHIP OF HANOVER	Black Brook Park			
605	6	18.701	15C	FOREST WAY REAR	TOWNSHIP OF HANOVER	Forest Way	R-25		
803	16	9.401	15C	70 COUNTRYWOOD DR	TOWNSHIP OF HANOVER	Hanover Green	R-40		
803	18	8.370	15C	OFF POPLAR DRIVE	TOWNSHIP OF HANOVER	Hanover Green	R-25		
801	9	3.500	15C	BETWEEN NO & SO BELA	TOWNSHIP OF HANOVER	Summit Avenue	R-10		
801	4	0.366	15C	61 SUMMIT AVE	TOWNSHIP OF HANOVER	61 Summit Avenue	R-10		
1002	9	5.100	15C	61 CROSS RD	TOWNSHIP OF HANOVER	Knollwood (Cross Road)	R-25		
2901	1	3.210	15C	ROUTE 10	TOWNSHIP OF HANOVER	Malapardis/Rte. 10	R-25		
2403	12	4.080	15C	72 SO JEFFERSON RD	TOWNSHIP OF HANOVER	Central Park West	I		
2403	3	1.050	15C	74 SO JEFFERSON RD	TOWNSHIP OF HANOVER	Central Park West	I		
3704	32	1.250	15C	EDEN LANE	TOWNSHIP OF HANOVER	Central Park East	R-15		
4402	17	11.030	15C	33-65 EDEN LANE	TOWNSHIP OF HANOVER	Central Park East	R10M		
4402	49	1.550	15C	EDEN LANE	TOWNSHIP OF HANOVER	Central Park East	R-15		
3704	20	0.248	15C	80 FAIRCHILD PL	TOWNSHIP OF HANOVER	Fairchild/Fieldstone	R-15		
3602	8	0.300	15C	FIELDSTONE DR	TOWNSHIP OF HANOVER	Fieldstone	R-15		
2006	1	7.494	15C	370 WHIPPANY RD	TOWNSHIP OF HANOVER	Herms Tract	R-25		
8001	12	26.690	15C	130 REYNOLDS AVE	TOWNSHIP OF HANOVER	Reynolds Avenue	R-25		
8001	6	4.770	15C	126 REYNOLDS AVE	TOWNSHIP OF HANOVER	Schindler Court	R-40		
7901	38	3.000	15C	GROVE PLACE	TOWNSHIP OF HANOVER	Reynolds Avenue	R-25		
5901	3	0.262	15C	459 ROUTE 10	TOWNSHIP OF HANOVER	Riverside Park	B		
5703	36	11.640	15C	VALLEY FORGE DR	TOWNSHIP OF HANOVER	Valley Forge Park	R-25		
5101	1	195.140	15C	REAR PARK AVE	TOWNSHIP OF HANOVER	Hanover Meadows	I		
6301	13	12.120	15C	195 WHIPPANY RD	TOWNSHIP OF HANOVER	Hanover Meadows	I		
6301	16	17.650	15C	ALGONQUIN PKWY	TOWNSHIP OF HANOVER	Black Meadows	I/IP		
6202	2	14.500	15C	BLACK BROOK MEADOWS	TOWNSHIP OF HANOVER	Black Meadows	I		
3301	1	31.090	1	1298 ROUTE 10	PARSIPPANY CAMPUS REALTY ASSOC LLC	Lee Meadows Consv. Easmnt.	OBRL		
3401	1	55.660	1	1400 ROUTE 10	PARSIPPANY CAMPUS REALTY ASSOC LLC	Lee Meadows Consv. Easmnt.	OBRL		
3401	2	8.800	1	1402 ROUTE 10	PARSIPPANY CAMPUS REALTY ASSOC LLC	Lee Meadows Consv. Easmnt.	OBRL		
		0.890			TOWNSHIP OF HANOVER	Patriot's Path W. Cons. Easmnt.			
		9.780			TOWNSHIP OF HANOVER	Bear Stearns Consv. Easmnt.			
		0.650			TOWNSHIP OF HANOVER	Eden Lane Condos Esmnt.			
		2.190			TOWNSHIP OF HANOVER	Patriot's Path E. Cons. Easmnt.			
		10.06			TOWNSHIP OF HANOVER	Tiffany Buffer Consv.Easmnt.			
		3.63			TOWNSHIP OF HANOVER	Algonquin Buffer Consv. Easmnt.			
Other Township Properties									
7801	3	2.080	15A	REAR REYNOLDS AVE	TOWNSHIP OF HANOVER	Wetlands Probable	R-25		
1305	13	0.241	15C	41 MOUNTAIN AVE	TOWNSHIP OF HANOVER		R-10		
2201	12	0.306	15C	CEDAR KNOLLS RD, OFF	TOWNSHIP OF HANOVER		R-25		
2402	4	1.480	15C	REAR BOULEVARD RD	TOWNSHIP OF HANOVER	Between RR and I-287/River	OBRL		
2601	15	0.046	15C	RT 287, OFF	TOWNSHIP OF HANOVER	ARC Home	R-25		
2601	16	0.441	15C	EDEN LANE & OFF 287	TOWNSHIP OF HANOVER	ARC Home	R-25		
2901	4	0.073	15C	1039 ROUTE 10	TOWNSHIP OF HANOVER	Malapardis/Rte. 10	R-25		
3001	2	0.343	15C	1040 ROUTE 10	TOWNSHIP OF HANOVER	Municipal Complex	R-25		
3001	3	0.325	15C	1050 ROUTE 10	TOWNSHIP OF HANOVER	Municipal Complex	R-25		
3001	4	0.590	15C	1060 ROUTE 10	TOWNSHIP OF HANOVER	Municipal Complex	R-25		
3001	5	0.239	15C	1064 ROUTE 10	TOWNSHIP OF HANOVER	Municipal Complex	R-25		
3301	2	6.800	15C	1294 ROUTE 10	TOWNSHIP OF HANOVER	Ridgedale Ave. Ext. & Rte. 10 W.	OBRL		
4101	19	0.220	15C	7 LEGION PL	TOWNSHIP OF HANOVER	Next to American Legion	R-15		
5703	37	0.574	15C	EDEN LANE, OFF	TOWNSHIP OF HANOVER		IP		
5901	15	2.310	15C	325 ROUTE 10	TOWNSHIP OF HANOVER	Cemetery	B		
5901	23	0.249	15C	REAR ROUTE 10	TOWNSHIP OF HANOVER		IB		
601	5	3.200	15C	42 HORSEHILL RD	TOWNSHIP OF HANOVER	Future ARC Home	I		
601	6	3.067	15C	24 HORSEHILL RD	TOWNSHIP OF HANOVER	Steep	R-15		
611	17	0.790	15C	36 MCNAB AVE	TOWNSHIP OF HANOVER		R-25		
7301	5	0.113	15C	400 ROUTE 10	TOWNSHIP OF HANOVER		B		
7901	18	1.520	15C	BEE MEADOW PKWY	TOWNSHIP OF HANOVER	JCP&L Easement	R-25		

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BLOCK	LOT	ACREAGE	CLASS	STREET	OWNER_NAME	DESCRIPTION	ZONING	DEVELOPMENT POTENTIAL RESIDENTIAL UNITS	DEVELOPMENT POTENTIAL NON-RESIDENTIAL TOTAL FLOOR AREA
803	1	0.104	15C	81 NO BELAIR AVE	TOWNSHIP OF HANOVER		R-10		
803	4	0.227	15C	91 NO BELAIR AVE	TOWNSHIP OF HANOVER		R-10		
8503	2	0.600	15C	OFF PARSIPPANY RD	TOWNSHIP OF HANOVER		R-40		
8601	10	0.760	15C	REAR REYNOLDS AVE	TOWNSHIP OF HANOVER		R-15		
903	11	0.184	15C	20 OAKVIEW RD	TOWNSHIP OF HANOVER		R-25		
904	16	1.990	15C	32 MOUNTVIEW RD	TOWNSHIP OF HANOVER	Adj. To Mountview Rd. School	R-15		
905	16	0.900	15C	MOUNTAIN AVE	TOWNSHIP OF HANOVER		R-15		
7703	44	1.970	1	ADDIE LA	OWNER UNKNOWN C/O HANOVER TWP	Long & Narrow	R-25		
904	22	0.194	1	281 MALAPARDIS RD	OWNER UNKNOWN C/O HANOVER TWP		R-15		
9202	16	0.058	1	WOODLAND AVE REAR	OWNER UNKNOWN C/O HANOVER TWP		R-40		
Approved Developments Prior to 2005 on Previous Vacant Land									
601	3	6.780	1	REAR HORSEHILL RD	ORMONT INDUSTRIAL PARK % SORANNO	1/2 of Vierra	I	40	
903	10	0.367	1	22 OAKVIEW RD	MELORO, RALPH T IV,/JEANETTE		R-25	1	
1204	7.02	0.248	1	32 PINE BLVD	SARASOTA INDUSTRIES LLC		R-10	1	
1502	17.01	0.000	1	33 FREDERICK PL	FUCCHINO, ANTHONY/JANICE		R-15	1	
2007	1	5.200	1	147 CEDAR KNOLLS RD	CEDAR KNOLLS ESTATES LLC		R-25	5	
2102	8	0.230	1	15 TOWNSEND AVE	PAULIC, FRANK JR.		R-15	1	
2401	2.02	0.476	1	97 BOULEVARD RD	SCALLEY, BRIAN & VIRGINIA		R-10	1	
3601	13	2.390	1	91 SO JEFFERSON RD	GORDON SOUTH JEFFERSON ASSOC, LLC	Medical Office	OBRL		21,310
3901	18	12.457	1	29 SO JEFFERSON RD	WXV/WHIPPANY LAND LLC	Slater Property	I		108,000
4204	8	0.595	1	28 WHIPPANY RD	BLANCHARD, HERBERT L	Approved-Pending Conditions	B		3,325
4301	7.01	2.160	1	16 EDEN LANE	BROOKSIDE PROPERTIES LLC	Office	OBRL		15,000
4701	27	0.368	1	297 WHIPPANY RD	299 WHIPPANY RD % JOHN & JOHNSON		R-15	1	
4901	2	16.080	1	REAR PARK AVE	DE BIASSE,% F. ARENA WP COMMERCIAL		IP		150,000
6601	13	12.810	1	OFF ROUTE 10	SCHNEPER, WILLIAM & FRED	Warnock Approval	I		56,000
7601	3	0.176	1	9 POLHEMUS TERR	MC HUGH, DONALD M		R-15	1	
7602	27	0.612	1	64 REYNOLDS AVE	BAGLEY/MINIERO, CHRIS/ELIZABETH		R-15	1	
7801	1	35.170	1	75 TROY HILLS RD	WHIPPANY VENTURE I LLC	Forest Hills/Residential	I	50	
8401	2	0.558	1	10 HOWELL ST	LARACCA, VINCENT E.		R-40	1	
8502	12	0.495	1	61 KEARNEY AVE	COBANE, ROBERT/PATRICIA		R-15	1	
8901	11.01	0.000	1	119 PARSIPPANY ROAD	RIVER PARK RESIDENTIAL CENTER LLC		R-25	4	
9001	1	30.396	1	10 NO JEFFERSON RD	HANOVER RENAISSANCE LLC	Mixed	IP	160	15,000
903	13	0.368	1	42 OAKVIEW RD	SLATTERY HOME BUILDERS CORP	Single Home	R-15	1	
9202	13.01	2.480	1	WOODLAND AVE	JATO ASSOCIATES LP	Sterling Woods/Residential	R-40	2	
9202	14.01	7.250	1	60 N JEFFERSON RD	UKRAINIAN CATHOLIC ARCHDIOCESE	Church/Cultural Center	R-40	0	32,305
9202	3	9.710	1	175 PARSIPPANY RD	JATO ASSOCIATES LP	Sterling Woods/Residential	R-40	8	
Other Entities									
6202	1	146.100	15C	REAR ROUTE 10	NJ NATURAL LANDS TRUST	Protected	A		
4301	6	6.500	15F	39 PARSIPPANY RD	NEW JERSEY CONSERVATION FOUNDATION	Protected	I		
303	12	20.100	1	OFF MALAPARDIS RD	SOUTHEAST MORRIS CTY MUN UTIL AUTH	JCP&L/Wetlands Probable	R-25		
701	9.01	2.493	1	25 SADDLE RD	SOUTHEAST MORRIS CTY MUN UTIL AUTH	Maintenance Shed	I		
803	17	0.246	1	COUNTRYWOOD DR	SOUTHEAST MORRIS CTY MUN UTIL AUTH	Pump Station	R-40		
1102	5	1.610	1	9 RIDGEDALE AVE	SOUTHEAST MORRIS CTY MUN UTIL AUTH	Pump Station	IP		
2801	10	14.130	1	ROUTE 10 & 287, REAR	SOUTHEAST MORRIS CTY MUN UTIL AUTH	Well Field	R-25		
2801	10.01	18.920	1	RIDGEDALE AVE	SOUTHEAST MORRIS CTY MUN UTIL AUTH	Well Field	R-25		
3602	7	0.057	1	45 FIELDSTONE DR	SOUTHEAST MORRIS CTY MUN UTIL AUTH	Water Tower Access	R-15		
4903	1	0.451	1	COLUMBIA RD, OFF	SOUTHEAST MORRIS CTY MUN UTIL AUTH	Pump Station	IP		
7702	15	0.130	1	REAR NEMIC LANE	HANOVER TWP BOARD OF EDUCATION	Portion of Bee Meadow School	R-15		
903	9	0.201	15A	25 MOUNTVIEW RD	HANOVER TWP BOARD OF EDUCATION	Portion of Mountview Rd. School	R-15		
905	14	0.094	15A	101 MOUNTAIN AVE	HANOVER TWP BOARD OF EDUCATION	Portion of Mountview Rd. School	R-15		
905	15	0.300	15A	MOUNTAIN AVE	HANOVER TWP BOARD OF EDUCATION	Portion of Mountview Rd. School	R-15		
2301	10.01	4.760	15A	CEDAR KNOLLS RD	HANOVER TWP BOARD OF EDUCATION	Allegro School Ball Field			
2301	7	7.500	15A	147 RIDGEDALE AVE	HANOVER TWP BOARD OF EDUCATION	Vacant/Wetlands Probable	R-15		
7502	10	5.530	15A	35 HIGHLAND AVE	HANOVER TWP BOARD OF EDUCATION	Vacant/Wetlands Probable	R-15		
7702	16	1.330	15A	100 REYNOLDS AVE	HANOVER TWP BOARD OF EDUCATION	Portion of Bee Meadow School	R-25		
7702	37	1.536	15A	NEMEC LANE, OFF	HANOVER TWP BOARD OF EDUCATION	Portion of Bee Meadow School	R-15		
7801	2	10.550	15A	REAR REYNOLDS AVE	HANOVER TWP BOARD OF EDUCATION	Wetlands Probable	R-25		
7901	14	1.900	15A	REYNOLDS AVE	HANOVER TWP BOARD OF EDUCATION	Wetlands Probable	R-25		
8001	2	2.610	15A	REAR REYNOLDS AVE	HANOVER TWP BOARD OF EDUCATION	JCP&L/Wetlands Probable	R-25		
1306	10	0.241	15F	19 MOUNTAIN AVE	COMMISSIONERS OF FIRE DIST 3	Parking Lot	R-10		
1306	12	0.313	15F	84 RIDGEDALE AVE	COMMISSIONERS OF FIRE DIST 3	Parking Lot	B		
1307	1	0.197	15F	20 MOUNTAIN AVE	COMMISSIONERS OF FIRE DIST 3	Parking Lot	R-10		
1002	10	8.900	15C	ROUTE 10	N.J.STATE DEPT. OF TRANSPORTATION	Dryden Way Jughandle	R-25		
1901	10	0.208	15C	23 ACADEMY DR EAST	N.J.STATE DEPT. OF TRANSPORTATION	Vacant	R-15		
2201	13	0.076	15C	CEDAR KNOLLS RD, OFF	N.J.STATE DEPT. OF TRANSPORTATION	Edge of Cedar Knolls Rd.	R-25		
2201	14	0.006	15C	CEDAR KNOLLS RD, OFF	N.J.STATE DEPT. OF TRANSPORTATION	Edge of Cedar Knolls Rd.	R-25		
2201	15	0.337	15C	CEDAR KNOLLS RD, OFF	N.J.STATE DEPT. OF TRANSPORTATION	Previous Whippany River	R-25		
2402	5	0.505	15C	ROUTE 287, OFF	N.J.STATE DEPT. OF TRANSPORTATION	Relocated Whippany River	OBRL		
2602	11	0.060	15C	EDEN LANE, OFF	N.J.STATE DEPT. OF TRANSPORTATION	Maintenance Garage	I		
2602	13	11.590	15C	211 EDEN LANE	N.J.STATE DEPT. OF TRANSPORTATION	Maintenance Garage	IR25		
2602	13.01	0.196	15C	EDEN LANE, REAR	N.J.STATE DEPT. OF TRANSPORTATION	Maintenance Garage	I		

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BLOCK	LOT	ACREAGE	CLASS	STREET	OWNER_NAME	DESCRIPTION	ZONING	DEVELOPMENT POTENTIAL RESIDENTIAL UNITS	DEVELOPMENT POTENTIAL NON-RESIDENTIAL TOTAL FLOOR AREA
2602	13.02	0.240	15C	ROUTE 287, OFF	N.J.STATE DEPT. OF TRANSPORTATION	Maintenance Garage	I		
2602	4	0.004	15C	EDEN LANE	N.J. STATE DEPT. OF TRANSPORTATION	Maintenance Garage	I		
5901	2	0.200	15C	481 ROUTE 10	N.J. STATE DEPT. OF TRANSPORTATION	Edge Rte. 10 Near Riverside Park	B		
6101	5	0.296	15C	71 ROUTE 10	N.J.STATE DEPT. OF TRANSPORTATION	Rte. 10 Comdemnation	IB		
6101	6	0.314	15C	65 ROUTE 10	N.J.STATE DEPT. OF TRANSPORTATION	Rte. 10 Comdemnation	IB		
7503	2	0.112	15C	ROUTE 10, OFF	N.J.STATE DEPT. OF TRANSPORTATION	Whippany Rd. Jughandle	B		
8803	16	0.193	15C	775 ROUTE 10	N.J. STATE DEPT.OF TRANSPORTATION	Edge Rte. 10	R-15		
2602	10	8.320	15C	54 SO JEFFERSON RD	UNITED STATES POSTAL SERVICE	Mail Handling Facility	I		
2602	9	1.880	15C	56 SO JEFFERSON RD	UNITED STATES POSTAL SERVICE	Mail Handling Facility	I		
2602	5	0.550	1	EDEN LANE	GPU ENERGY/ATTEN:R.E. DEPT	Substation	I		
2602	5.01	0.080	1	EDEN LANE	GPU ENERGY/ATTEN:R.E.DEPT	Substation	I		
9202	6	0.884	1	24 WOODLAND AVE	GPU ENERGY/ R.E. DEPT	Tower	R-40		
1701	1	0.670	15C	4 HIGHVIEW AVE	COUNTY OF MORRIS	Garage	R-10		
1902	6	31.220	15C	ROUTE 24	COUNTY OF MORRIS	Vacant/Wetlands Probable	R-15		
5101	2	36.950	15C	AIRPORT	TOWN OF MORRISTOWN	Clear Zone	A		
6202	1.01	6.890	15C	BLACK BROOK MEADOWS	DM AIRPORT DEVELOPERS, INC., LESSEE	Clear Zone	A		
6202	1.02	3.900	15C	BLACK BROOK MEADOWS	DM AIRPORT DEVELOPERS, INC., LESSEE	Clear Zone	A		
6301	1.01	3.540	15C	BLACK BROOK MEADOWS	DM AIRPORT DEVELOPERS, INC., LESSEE	Clear Zone	A		
6301	10	3.200	15C	BLACK BROOK MEADOWS	DM AIRPORT DEVELOPERS, INC., LESSEE	Clear Zone	A		
6301	11	16.600	15C	BLACK BROOK MEADOWS	DM AIRPORT DEVELOPERS, INC., LESSEE	Clear Zone	A		
6301	16.01	5.700	15C	BLACK BROOK MEADOWS	DM AIRPORT DEVELOPERS, INC., LESSEE	Clear Zone	A		
6301	17.02	2.190	15C	BLACK BROOK MEADOWS	DM AIRPORT DEVELOPERS, INC., LESSEE	Clear Zone	A		
6301	5.M	0.400	15C	BLACK BROOK MEADOWS	DM AIRPORT DEVELOPERS, INC,. LESSEE	Clear Zone	A		
6301	8	4.100	15C	BLACK BROOK MEADOWS	DM AIRPORT DEVELOPERS, INC., LESSEE	Clear Zone	A		
6301	9	1.980	15C	BLACK BROOK MEADOWS	DM AIRPORT DEVELOPERS, INC., LESSEE	Clear Zone	A		
6401	2.M	9.100	15C	AIRPORT	DM AIRPORT DEVELOPERS,INC., LESSEE	Clear Zone	A		
6501	1.01	2.140	1	COLUMBIA RD	DM AIRPORT DEVELOPERS, INC. LESSEE	Clear Zone	A		
103	17.M	0.021	1	REAR POPLAR DRIVE	STEVENS, WILLIAM R &PATRICIA H	Partial Morris Plains	R-40		
103	18.M	0.075	1	REAR POPLAR DRIVE	SLOJKOWSKI, FRANCIS E	Partial Morris Plains	R-40		
103	19.M	0.349	1	REAR POPLAR DRIVE	BISHOP, HENRY I & ELAINE	Partial Morris Plains	R-40		
103	20.M	0.210	1	REAR POPLAR DRIVE	HARTH, ALLEN J & ELLEN K	Partial Morris Plains	R-40		
103	21.M	0.174	1	REAR POPLAR DRIVE	CIESIELKA, ALBERT J & REGINA M	Partial Morris Plains	R-40		
103	22.M	0.054	1	REAR POPLAR DRIVE	FEARY, VAUGHANA M.	Partial Morris Plains	R-40		
102	8	12.100	15C	REAR THONUS ST	MORRIS PLAINS BOROUGH	Vacant/Park	R-25		
2802	3	0.613	1	1189 ROUTE 10	TOWN OF MORRISTOWN/FINANCE DEPT.	Vacant/Narrow	IB		
1601	5	3.550	1	79 HORSEHILL RD	YOUNG MENS CHRISTIAN ASSOC/MSTN	YMCA Facility	I		
2503	6.01	0.000	15C	18 ELM PLACE	CHILDRENS CTR FOR THERAPY	Parking Lot	R-10		
2701	18.02	0.355	15D	13 HALKO DR	CHURCH OF NOTRE DAME	Rectory	R-10		
4301	2.01	2.572	15D	100 WHIPPANY RD	CHURCH OF OUR LADY OF MERCY	Church	OBRL		
2701	9	8.960	15E	21 RIDGEDALE AVE	BETH ISRAEL CEMC/O ALISE FORD	Cemetery	R-25		
2701	1	3.050	15E	1 RIDGEDALE AVE	BETH ISRAEL CEM.%ALISE FORD	Cemetery	R-25		
4101	22	5.730	15E	25 LEGION PL	ST MARY'S CEMETERY ASSOCIATION	Cemetery	R-15		
Vacant Land									
101	13.06	1.283	1	355 MALAPARDIS RD	PEACH, ARTHUR E III/SUSAN G		R25	1	
201	9	0.024	1	12 WHITE BIRCH DR	PODEIELSKI, GARY & WALTER	Home in Parsippany	R-15	0	
202	17	0.785	1	17 CROSS RD	KAPPOCK, ELEANOR	Landlocked	R-15	0	
303	13	0.620	1	REAR CROSS ROAD	DIALOGIC CORPORATION	Parking Lot	IP		0
602	1	18.900	1	250 HANOVER AVE	AMERICAN HI-TECH PARK LLC	Punia Open Space Probable	I	0	0
604	57	0.482	1	23 FOREST WAY	LK. ASSOCIATES		R-25	1	
701	2	0.600	1	180 HANOVER AVE	FABRICATED PLASTICS INC.	Used with Lot 3	I		6,000
701	9	2.223	1	23 SADDLE RD	SADDLE ROAD, LLC	Pending Office Approval	I		18,000
801	12.01	0.241	1	28 CHESTNUT RD	FREDA, FRANK J		R-10	1	
801	3	0.416	1	59 SUMMIT AVE	CONKLIN, CALVIN & MARGUERITE		R-10	1	
803	8	0.042	1	107 NO BELAIR AVE	FERULLO, THOMAS H/TRACY	Narrow Site/Small	R-15	0	
901	5	0.294	1	19 QUINLISK RD	HRYNOWESKI, GARY ET ALS	Narrow Site	R-25	0	
901	6	0.628	1	23 QUINLISK RD	DRUMMOND, RAYMOND	Wetlands Probable	R-25	0	
902	3	0.156	1	239 MALAPARDIS RD	MONEY, JOSEPH D	Narrow Site/Small	R-25	0	
907	6	0.241	1	92 GRAND AVE	D&Y BUILDERS		R-10	1	
907	7	0.241	1	94 GRAND AVE	D&Y BUILDERS		R-10	1	
1101	3	0.635	1	1309 ROUTE 10	RICCIARDI, WALTER & ROBERT L	Wetlands Probable/JCP&L	IP	0	0
1201	1	0.112	1	76 PLEASANT AVE	SPILLERT, META V.		R-10	1	
1204	2	0.147	1	54 RIDGEDALE AVE	EXXON CORPORATION	Parking Lot	R-10	0	0
1301	4	0.186	1	12 SUMMIT AVE	WRIGHT, HARRY F & EVELYN		R-10	1	
1304	13	0.241	1	69 MOUNTAIN AVE	DONOFRIO, WINNIE		R-10	1	
1307	17.01	0.115	1	29 OAK BLVD	CLEMENS, KATHLEEN		R-10	1	
1307	17.02	0.230	1	33 OAK BLVD	CLEMENS, KATHLEEN		R-10	1	
1311	3	0.132	1	44 OAK BLVD	AMADORI, DAVID A & PATRICIA M		R-10	1	
1401	7.01	0.241	1	22 SO BELAIR AVENUE	KOZAK, STANISLAW/MALGORZATA A		R-10	1	
1405	9	0.257	1	22 MCNAB AVE	ARDOLINO, EDNAMAE		R-15	1	
1501	17.02	0.060	1	3 HORSEHILL RD	PILLION, SUE	Driveway Access/Small	R-15	0	
1801	2	0.360	1	88 HANOVER AVE	INTERSTATE REALTY CO., LLC	Small/Narrow Site	I		3,000

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								RESIDENTIAL UNITS	NON-RESIDENTIAL TOTAL FLOOR AREA
2007	3	1.315	1	350 WHIPPANY RD	ESPOSITO, MARY	Odd Shape/Used by Adj. Lot	R-25	1	
2007	4	0.022	1	352 WHIPPANY RD	VAN BOSSUYT, ELIZABETH	Small Site	R-25	0	
2102	7	3.890	1	171 RIDGEDALE AVE	IGLAR, VALENTIN J	Open Space Probable	R-15	0	
2103	3	1.730	1	OFF TOWNSEND AVE	HIGGINSON/CARROLL TRUSTEES	No Access	I		0
2104	9	4.610	1	2 E.FREDERICK PL	CARGILLE KNOLL CORP.	Wetlands Probable	I		0
2201	11	0.983	1	195 CEDAR KNOLLS RD	MC EWAN, MILDRED BEACH	Whippany River	R-25	0	
2201	7.01	0.548	1	167 CEDAR KNOLLS RD	LANDI, FRANCIS P. & NANCY		R-25	1	
2201	9.02	0.580	1	149 CEDAR KNOLLS RD	ONE TWELVE CORP C/O D MANDELBAUM	Narrow Site	R-25	0	
2401	2.01	2.230	1	91 BOULEVARD RD	MICHAS, GEORGE & HARRY	Odd Shape/Stream/San. Easemen	R-10	1	
2401	3	1.000	1	75 BOULEVARD RD	MICHAS, GEORGE W & HARRY		R-25	1	
2501	18	0.246	1	294 CEDAR KNOLLS RD	QUINN, MARY ANN & DONALD		R-10	1	
2501	5	0.181	1	105 RIDGEDALE AVE	MINAKAKIS, GEORGE	Narrow/Drainage Easement	R-10	0	
2502	2	0.766	1	22 ORCHARD ST.	MENDHAM INVESTMENT CO LP		R-10	1	
2502	3	2.679	1	84 BOULEVARD RD	MENDHAM INVESTMENT CO LP	Wetlands Probable	R-25	2	
2503	6.02	0.365	1	18 ELM PLACE	STERLING AT CEDAR GLEN LLC	Halko School Pkg. Lot	R-10	0	
2601	14	0.857	1	13 BOULEVARD RD	FEDSCHON, VICTOR/JOAN	Wetlands Probable	R-25	1	
2601	14.01	0.857	1	15 BOULEVARD RD	FEDSCHUN, VICTOR/JOAN	Wetlands Probabale	R-25	1	
2602	1.01	2.247	1	ROUTE 287, REAR	MORRISTOWN & ERIE RR	RR Siding	I		0
2903	1	2.530	1	SO JEFFERSON RD	MORRISTOWN & ERIE R R	RR Siding	R-25	0	
2903	17	0.790	1	43 MALAPARDIS RD	MOROZ, JEAN MARY		R-25	1	
2903	23	7.270	1	OFF MALAPARDIS RD	HANSCH, H&B JR & MATAKITIS, R&E	Landlocked/Wetlands Probable	R-25	0	
2904	11	0.750	1	20 SO JEFFERSON RD	P & G INVESTMENT GRP LLC	Part Wetlands Probable	I		5,200
3002	6	8.830	1	EASTMANS ROAD	PARSIPPANY CAMPUS REALTY ASSOC.	Power Lines/ Ponds/Wetlands	PU	0	0
3002	8	2.839	1	NO JEFFERSON RD,OFF	COLUMBIA GAS TRANS.CORP.	Gas Transmission Line/Narrow	R-40	0	0
3002	9	3.030	1	28 FANOK RD	KRET, RUTH	Power Lines	R-40	1	
3101	10	0.287	1	105 NO JEFFERSON RD	BIRCHWOOD MANOR, INC	Birchwood Manor Grounds	I-P2		0
3101	11	0.115	1	109 NO JEFFERSON RD	BIRCHWOOD MANOR, INC	Birchwood Manor Grounds	I-P2		0
3101	12	15.717	1	121 NO JEFFERSON RD	M & M REALTY CO.	Large Cleared Field	I-P2		136,900
3101	14	3.108	1	15 EASTMANS RD	WON, MIN H & WON, W&E TRUSTEES		I-P2		27,000
3101	6	0.297	1	43 NYE AVE	MARINO, MICHAEL		R-40	1	
3102	1	1.610	1	46 NYE AVE	MARINO, MARY ANNE	Wetlands Probable	R-40	1	
3104	1	0.230	1	32 NYE AVE	MARINO, MICHAEL JR & MARYANNE	Birchwood Manor Grounds	R-40	0	
3104	2	0.344	1	95-99 JEFFERSON RD	MARINO, MICHAEL JR.	Birchwood Manor Grounds	R-40	0	
3104	3	0.930	1	101 NO JEFFERSON RD	MARINO, MICHAEL JR.	Birchwood Manor Grounds	R-40	0	
3104	4	0.430	1	36 NYE AVE	MARINO, MICHAEL JR.	Birchwood Manor Grounds	R-40	0	
3201	1	32.000	1	ROUTE 287	PARSIPPANY CAMPUS REALTY ASSOC.	Partial Wetlands	OBRL-2		1,200,000
3201	2	6.440	1	ROUTE 287	MACK-CALI REALTY LP	Wetlands/Combine w/Lot 1	OBRL-2		0
3201	3	2.240	1	ROUTE 287	HARTZ MT.INDUSTRIES	Wetlands/Combine w/Lot 1	OBRL		0
3501	11	0.251	1	140 CEDAR KNOLLS RD	HORNLEIN, EDWARD E		R-25	1	
3503	17	0.164	1	REAR PERRY ST	ELSON, PETER	Landlocked/Small	R-15	0	
3901	23.01	0.513	1	REAR ROUTE 10	SKIBIC AMBROSE REALTY LLC	NJDOT Jughandle	B		4,500
3902	2	0.550	1	OFF RTE 10	MATLAGA, STEPHEN & ANN	Narrow/NJDOT Jughandle	B		0
4101	1	3.370	1	47 PARSIPPANY RD	RIVER PARK BUSINESS CENTER, LLC	Narrow/Adj to RR	TC	0	22,000
4101	18	0.506	1	OFF MT PLEASANT AVE	SCHLEIFER REALTY	Landlocked	R-15	0	
4101	23	4.240	1	31-49 LEGION PL	RIVER PARK BUSINESS CENTER, LLC	Steep/Adj to RR	TC	7	
4202	3	0.326	1	9 MT PLEASANT AVE	PINKIN,JAMES & LOIS % CORP COMMUN.	Stream/Shape	B		0
4202	4	0.410	1	REAR PARSIPPANY RD	PINKIN,JAMES & LOIS % CORP COMMUN.	Part of 4201/1	B		0
4204	11	1.590	1	8 WHIPPANY RD	PETER, CHRISTIAN N/MARIE S	Whippany River/Dam	B		0
4301	8	7.340	1	26 EDEN LANE	RIVER PARK BUSINESS CENTER, INCLLC		TC	13	0
4402	14	0.000	1	EDEN LANE	EDEN LANE C/O TAYLOR MAGMT CO	Common Area	R-M	0	
4601	31	0.478	1	300 WHIPPANY RD	A C J LAND INC	Parking Lot (Lot 32)	R-15	0	
4901	19	4.524	1	21 AIRPORT RD	AIRPORT PARK, L.L.C.	Combine with 4901/02	IP		0
4902	2	1.080	1	COLUMBIA ROAD, OFF	COLUMBIA EXECUTIVE PLAZA ASSOC.	Inaccessible/Steep	IP		0
5301	9.01	0.052	1	HILLTOP CIRCLE	ALBOHN, ARTHUR R/REGINA A	Narrow Site/Small	R-15	0	
5801	1.01	53.284	1	85 WHIPPANY RD	LTI NJ FINANCE LLC	Part of Lucent Site	OBRL		0
5901	1	0.357	1	507 ROUTE 10	TRUSTEE OF COLUMBIA UNIV% K.MALOY	Narrow/River	B		0
5901	22	0.860	1	REAR ROUTE 10	PETER, CHRISTIAN	Wetlands Probable	OBRL-3		0
5901	7	0.643	1	ROUTE 10	GMEJ, LLC	Parking Lot/River/Jughandle	B		0
5901	8	0.574	1	REAR ROUTE 10	CASTELLANA, ANTHONY & PHYLLIS	NJDOT Jughandle/River	B		0
6301	1	31.240	1	BLACK BROOK MEADOWS	DM AIRPORT DEVELOPERS, INC. LESSEE	Wetlands Probable	I-5		0
6301	14	19.800	1	ALGONQUIN PKWY	HANSCH, HENRY & HELEN	Wetlands Probable	I-5/I-P2		0
6301	15	17.800	1	ALGONQUIN PKWY	LAYTON, HERBERT W & JACQUELINE C	Wetlands Probable	I-5/I-P2		0
6301	17	12.570	1	ALGONQUIN PKWY	FELTS, WILLIAM & FLORENCE	Wetlands Probable	I-5/I-P2		0
6301	4	9.000	1	BLACK BROOK MEADOWS	DM AIRPORT DEVELOPERS, INC. LESSEE	Wetlands Probable	I-5		0
6301	5	9.990	1	BLACK BROOK MEADOWS	DM AIRPORT DEVELOPERS,INC.LESSEE	Wetlands Probable	I-5/A		0
6401	1	3.400	1	COLUMBIA RD	ELIAS, STEPHEN & PHILOMENA	Elis' Pet Fish Store/Florham Pk.	I		0
6401	2	23.570	1	BLACK BROOK	DM AIRPORT DEVELOPERS, INC.LESSEE	Wetlands Probable	I-5/A		0
6401	2.02	0.900	1	REAR COLUMBIA RD	ROYAL AUTO REALTY LLC	Cadilac Dealer/Florham Park/Wet	I-5		0
6401	3	46.800	1	BLACK BROOK	DM AIRPORT DEVELOPERS, INC.LESSEE	Wetlands Probable	I		0
6501	1	22.260	1	BLACK BROOK	DM AIRPORT DEVELOPERS, INC.LESSEE	Hangars/Wetlands	A		0
6501	3	0.083	1	COLUMBIA RD	DM AIRPORT DEVELOPERS, INC LESSEE	Shape/Small	A		0

TOWNSHIP OF HANOVER

Land Use Analysis - Development Potential

January, 2005

BLOCK	LOT	ACREAGE	CLASS	STREET	OWNER_NAME	DESCRIPTION	ZONING	DEVELOPMENT POTENTIAL RESIDENTIAL UNITS	DEVELOPMENT POTENTIAL NON-RESIDENTIAL TOTAL FLOOR AREA
6601	12	45.649	1	24 MELANIE LANE	HARTZ MOUNTAIN HANOVER SQUARE	Wetlands Probable (40%)	I/I-B		400,000
6601	13.01		1	Route 10	Warnock Subdivision	Wetlands	IB		7,500
6601	2	0.388	1	90 ROUTE 10	SCHNEPER, WILLIAM & FRED	Wetlands Probable	IB		0
6601	3	0.060	1	78 ROUTE 10	SCHNEPER, WILLIAM & FRED	Narrow/Small/Wetlands	IB		0
6601	4	0.298	1	88 ROUTE 10	MARINO, MARYANNE	Narrow/Wetlands	IB		0
6601	5	0.300	1	80 ROUTE 10	MARINO, MICHAEL	Not Vacant	IB		0
6801	5	1.480	1	120 ALGONQUIN PKWY.	HARTZ MOUNTAIN HANOVER SQUARE	Odd Shape	I		15,000
7301	9.01	1.800	1	ROUTE 10	EPCO SERVICES, INC.	Part of Front Parcel/Wetlands	I		0
7401	2	0.270	1	19 TROY HILLS RD	FERRAIUOLO, A JR & SONS INC	Merge w/Adj. Lot.	R-15	0	
7402	5	0.211	1	420 ROUTE 10	ALBEKAMO REALTY LLC	Narrow Site/Small	B		0
7501	7	0.207	1	510 ROUTE 10	PNC BANK, N.A./ PNC REALTY SERVICE	Narrow Site/Small/Jughandle	B		0
7502	21	0.730	1	REAR ROUTE 10	FLEMMING, PETER	Landlocked/Utility Easement	B		0
7502	22.01	0.712	1	REAR ROUTE 10	MORRISTOWN & ERIE RR	Railroad	B		0
7502	23	1.000	1	REAR 494 RTE 10	MORRISTOWN & ERIE RR	Railroad	B/P-U		0
7601	40.01	0.110	1	5 BEHRENS DR	HANSCH CONSTRUCTION, INC.	Narrow Site/Small	R-15	0	
7702	10.02	0.490	1	99 LOUIS ST	YANOTTA, ARLENE ZAGURSKY		R-15	1	
7702	31	0.330	1	100 LOUIS ST	LOUIS STREET ASSOCIATES		R-15	1	
8104	1	4.000	1	BEEKMAN PLACE REAR	TOMPKINS, KENNETH W. & MARGARET		R-40	2	
8202	6.01	0.344	1	21 HANDZEL RD	GENOBLE, LEONORA		R-40	1	
8203	1	0.582	1	262 PARSIPPANY RD	TBR PROPERTIES % SAFILO USA, INC		R-40	1	
8305	8	4.000	1	REAR REYNOLDS AVE	TOMPKINS, KENNETH	Steep/Wetlands Probable	R-40	2	
8401	10	1.000	1	199 REYNOLDS AVE	COLUMBIA GAS TRANS.CORP.	Gas Transmission Line	R-40	0	
8502	19	0.459	1	44-46 WASHINGTON AVE	BRANNAN, PEARL		R-15	1	
8503	19	0.230	1	REAR WASHINGTON AVE	DELUKEY,JOSEPH A JR & HELEN J	Landlocked	R-15	0	
8601	7	2.000	1	77 REYNOLDS AVE	DELMONICO, FRANCIS		R-15	2	
8803	17	0.562	1	92 MT PLEASANT AVE	PINE PLAZA ASSOCIATES LLC	Narrow Site/Double Frontage	R-15	0	
8803	6.01	1.060	1	691 ROUTE 10	PADKOWSKY & PADKOWSKY, INC.	Stream/Steep	B-1		8,000
8901	5	0.267	1	135 PARSIPPANY RD	HOWELL, BARBARA THOMPSON		R-25	1	
9101	17	0.000	1	SUNRISE DR	SUNRISE AT HANOVER C/O INTEGRA MAGN	Common Area	R-M	0	
9201	3	0.115	1	9 LILLIAN PL	MARINO, ANNA F	Narrow Site/Small	R-40	0	
9201	8	5.660	1	OFF NYE AVE	FERRARA, DEBRA MACALUSO ETALS	Wetlands Probable	R-40	0	
9201	9	1.157	1	78 NO JEFFERSON RD	BARCELLONA, GAETANO		R-40	1	
9202	4	0.280	1	163 PARSIPPANY RD	BRUNNER, FRED C & GERALDINE	Narrow Site/Small	R-40	0	
9202	5	0.758	1	10 WOODLAND AVE	GRAVES, WILLIAM & ALICE	JCP&L Easement	R-40	0	
9304	9	0.344	1	110 NO JEFFERSON RD	MARINO, MICHAEL JR.	Narrow Site/Small/Pond	R-40	0	
3801	3	0.102	15C	REAR EDEN LANE	M & E ASSOCIATES	Small	TC	0	0

LAND INVENTORY SUMMARY

1805.968	**Total Acreage**
676.990	**Acreage of Recreation and Open Space Inventory**
31.994	**Other Township Properties**
449.143	**Other Properties**
147.376	**Approved Developments in 2004 on Previous Vacant Land**
500.465	**Remaining Vacant Land**

Development Potential		
	62	**1,852,100**
(Associated Acreage = 123 Ac.)		
Approved Developments Prior to 2005		
	280	**400,940**
Existing Development		
	5024	**9,905,330**
Future Growth Potential		
	5,366	**12,158,370**

Summary of Classification

Class 1	- Vacant Land	Class A	- Public School	Class D	- Charitable
Class 3A	- Farm (Regular)	Class B	- Other Property	Class E	- Cemetary
Class 3B	- Farm (Qualified)	Class C	- Public Property	Class F	- Miscellaneous

APPENDIX E

DRAFT

TOWNSHIP OF HANOVER

MUNICIPAL STORMWATER CONTROL ORDINANCE

January, 2005

Section 1: Scope and Purpose

A. Policy Statement

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

B. Purpose

It is the purpose of this ordinance to establish minimum stormwater management requirements and controls for "major development," as defined in Section 2.

C. Applicability

2. This ordinance shall be applicable to all site plans and subdivisions for the major developments that require preliminary or final site plan or subdivision review:

    a. Non-residential major developments; and
    b. Aspects of residential major developments that are not pre-empted by the Residential Site Improvement Standards at N.J.A.C. 5:21.

3. This ordinance shall also be applicable to all major developments undertaken by the Township of Hanover.

D. Compatibility with Other Permit and Ordinance Requirements

Development approvals issued for subdivisions and site plans pursuant to this ordinance are to be considered an integral part of development approvals under the subdivision and site plan review process and do not relieve the applicant of the responsibility to secure required permits or approvals for activities regulated by any other applicable code, rule, act, or ordinance. In their interpretation and application, the provisions of this ordinance shall be held to be the minimum requirements for the promotion of the public health, safety, and general welfare. 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.

Section 2: Definitions

Unless specifically defined below, words or phrases used in this ordinance shall be interpreted so as to give them the meaning they have in common usage and to give this ordinance its most reasonable application. The definitions below are the same as or based on the corresponding definitions in the Stormwater Management Rules at N.J.A.C. 7:8-1.2.

"Compaction" means the increase in soil bulk density.

"Core" means a pedestrian-oriented area of commercial and civic uses serving the surrounding municipality, generally including housing and access to public transportation.

"County review agency" means an agency designated by the County Board of Chosen Freeholders to review municipal stormwater management plans and implementing ordinance(s). The county review agency may either be:

- A county planning agency; or
- A county water resource association created under N.J.S.A 58:16A-55.5, if the ordinance or resolution delegates authority to approve, conditionally approve, or disapprove municipal stormwater management plans and implementing ordinances.

"Department" means the New Jersey Department of Environmental Protection.

"Designated Center" means a State Development and Redevelopment Plan Center as designated by the State Planning Commission such as urban, regional, town, village, or hamlet.

"Design engineer" means a person professionally qualified and duly licensed in New Jersey to perform engineering services that may include, but not necessarily be limited to, development of project requirements, creation and development of project design and preparation of drawings and specifications.

"Development" means the division of a parcel of land into two or more parcels, the construction, reconstruction, conversion, structural alteration, relocation or enlargement of any building or structure, any mining excavation or landfill, and any use or change in the use of any building or other structure, or land or extension of use of land, by any person, for which permission is required under the Municipal Land Use Law, N.J.S.A. 40:55D-1 et seq. In the case of development of agricultural lands, development means: any activity that requires a State permit; any activity reviewed by the County Agricultural Board (CAB) and the State Agricultural Development Committee (SADC), and municipal review of any activity not exempted by the Right to Farm Act, N.J.S.A 4:1C-1 et seq.

"Drainage area" means a geographic area within which stormwater, sediments, or dissolved materials drain to a particular receiving waterbody or to a particular point along a receiving waterbody.

"Environmentally critical areas" means an area or feature which is of significant environmental value, including but not limited to: stream corridors; natural heritage priority sites; habitat of endangered or threatened species; large areas of contiguous open space or upland forest; steep slopes; and well head protection and groundwater recharge areas. Habitats of endangered or threatened species are identified using the Department's Landscape Project as approved by the Department's Endangered and Nongame Species Program.

"Erosion" means the detachment and movement of soil or rock fragments by water, wind, ice or gravity.

"Impervious surface" means a surface that has been covered with a layer of material so that it is highly resistant to infiltration by water.

"Infiltration" is the process by which water seeps into the soil from precipitation.

"Major development" means any "development" that provides for ultimately disturbing one or more acres of land or increasing impervious surface by one-quarter acre or more. Disturbance for the purpose of this rule is the placement of impervious surface or exposure and/or movement of soil or bedrock or clearing, cutting, or removing of vegetation. Projects undertaken by any government agency which otherwise meet the definition of "major development" but which do not require approval under the Municipal Land Use Law, N.J.A.C. 40:55D-1 et seq., are also considered "major development".

"Municipality" means any city, borough, town, township, or village.

"Node" means an area designated by the State Planning Commission concentrating facilities and activities, which are not organized in a compact form.

"Nutrient" means a chemical element or compound, such as nitrogen or phosphorus, which is essential to and promotes the development of organisms.

"Person" means any individual, corporation, company, partnership, firm, association, Township of Hanover, or political subdivision of this State subject to municipal jurisdiction pursuant to the Municipal Land Use Law, N.J.S.A. 40:55D-1 et seq.

"Pollutant" means any dredged spoil, solid waste, incinerator residue, filter backwash, sewage, garbage, refuse, oil, grease, sewage sludge, munitions, chemical wastes, biological materials, medical wastes, radioactive substance (except those regulated under the Atomic Energy Act of 1954, as amended (42 U.S.C. 2011 et seq.), thermal waste, wrecked or discarded equipment, rock, sand, cellar dirt, industrial, municipal, agricultural, and construction waste or runoff, or other residue discharged directly or indirectly to the land, ground waters or surface

waters of the State, or to a domestic treatment works. "Pollutant" includes both hazardous and nonhazardous pollutants.

"Recharge" means the amount of water from precipitation that infiltrates into the ground and is not evapotranspired.

"Sediment" means solid material, mineral or organic, that is in suspension, is being transported, or has been moved from its site of origin by air, water or gravity as a product of erosion.

"Site" means the lot or lots upon which a major development is to occur or has occurred.

"Soil" means all unconsolidated mineral and organic material of any origin.

"State Development and Redevelopment Plan Metropolitan Planning Area (PA1)" means an area delineated on the State Plan Policy Map and adopted by the State Planning Commission that is intended to be the focus for much of the state's future redevelopment and revitalization efforts.

"State Plan Policy Map" is defined as the geographic application of the State Development and Redevelopment Plan's goals and statewide policies, and the official map of these goals and policies.

"Stormwater" means water resulting from precipitation (including rain and snow) that runs off the land's surface, is transmitted to the subsurface, or is captured by separate storm sewers or other sewage or drainage facilities, or conveyed by snow removal equipment.

"Stormwater runoff" means water flow on the surface of the ground or in storm sewers, resulting from precipitation.

"Stormwater management basin" means an excavation or embankment and related areas designed to retain stormwater runoff. A stormwater management basin may either be normally dry (that is, a detention basin or infiltration basin), retain water in a permanent pool (a retention basin), or be planted mainly with wetland vegetation (most constructed stormwater wetlands).

"Stormwater management measure" means any structural or nonstructural strategy, practice, technology, process, program, or other method intended to control or reduce stormwater runoff and associated pollutants, or to induce or control the infiltration or groundwater recharge of stormwater or to eliminate illicit or illegal non-stormwater discharges into stormwater conveyances.

"Urban Redevelopment Area" is defined as previously developed portions of areas delineated on the State Plan Policy Map (SPPM) as the Metropolitan Planning Area (PA1), Designated Centers, Cores or Nodes;

"Waters of the State" means the ocean and its estuaries, all springs, streams, wetlands, and bodies of surface or ground water, whether natural or

artificial, within the boundaries of the State of New Jersey or subject to its jurisdiction.

"Wetlands" or "wetland" means an area that is inundated or saturated by surface water or ground water at a frequency and duration sufficient to support, and that under normal circumstances does support, a prevalence of vegetation typically adapted for life in saturated soil conditions, commonly known as hydrophytic vegetation.

Section 3: 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 Section 4. To the maximum extent practicable, 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.

Section 4: Stormwater Management Requirements for Major Development

A. The development shall incorporate a maintenance plan for the stormwater management measures incorporated into the design of a major development in accordance with Section 10.

B. Stormwater management measures shall avoid adverse impacts of concentrated flow on habitat for threatened and endangered species as documented in the Department' Landscape Project or Natural Heritage Database established under N.J.S.A. 13:1B-15.147 through 15.150, particularly Helonias bullata (swamp pink) and/or Clemmys muhlnebergi (bog turtle).

C. The following linear development projects are exempt from the groundwater recharge, stormwater runoff quantity, and stormwater runoff quality requirements of Sections 4.F and 4.G:

1. The construction of an underground utility line provided that the disturbed areas are revegetated upon completion;
2. The construction of an aboveground utility line provided that the existing conditions are maintained to the maximum extent practicable;
3. The construction of a public pedestrian access, such as a sidewalk or trail with a maximum width of 14 feet, provided that the access is made of permeable material.

D. A waiver from strict compliance from the groundwater recharge, stormwater runoff quantity, and stormwater runoff quality requirements of Sections 4.F and 4.G may be obtained for the enlargement of an existing public roadway or railroad; or the construction or enlargement of a public pedestrian access, provided that the following conditions are met:

1. The applicant demonstrates that there is a public need for the project that cannot be accomplished by any other means;
2. The applicant demonstrates through an alternatives analysis, that through the use of nonstructural and structural stormwater management strategies and measures, the option selected complies with the requirements of Sections 4.F and 4.G to the maximum extent practicable;
3. The applicant demonstrates that, in order to meet the requirements of Sections 4.F and 4.G, existing structures currently in use, such as homes and buildings, would need to be condemned; and
4. The applicant demonstrates that it does not own or have other rights to areas, including the potential to obtain through condemnation lands not falling under D.3 above within the upstream drainage area of the receiving stream, that would provide additional opportunities to mitigate the requirements of Sections 4.F and 4.G that were not achievable on-site.

E. Nonstructural Stormwater Management Strategies

1. To the maximum extent practicable, the standards in Sections 4.F and 4.G shall be met by incorporating nonstructural stormwater management strategies set forth at Section 4.E into the design. The applicant shall

identify the nonstructural measures incorporated into the design of the project. If the applicant contends that it is not feasible for engineering, environmental, or safety reasons to incorporate any nonstructural stormwater management measures identified in Paragraph 2 below into the design of a particular project, the applicant shall identify the strategy considered and provide a basis for the contention.

2. Nonstructural stormwater management strategies 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. Such source controls include, but are not limited to:

      a) Site design features that help to prevent accumulation of trash and debris in drainage systems, including features that satisfy Section 4.E.3. below;

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

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

d) 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.

3. Site design features identified under Section 4.E.2.i.(2) above shall comply with the following standard to control passage of solid and floatable materials through storm drain inlets. For purposes of this paragraph, "solid and floatable materials" means sediment, debris, trash, and other floating, suspended, or settleable solids. For exemptions to this standard see Section 4.E.3.c below.

   a. Design engineers shall use either of the following grates whenever they use a grate in pavement or another ground surface to collect stormwater from that surface into a storm drain or surface water body under that grate:

      (1) The New Jersey Department of Transportation (NJDOT) bicycle safe grate, which is described in Chapter 2.4 of the NJDOT Bicycle Compatible Roadways and Bikeways Planning and Design Guidelines (April 1996); or

      (2) A different grate, if each individual clear space in that grate has an area of no more than seven (7.0) square inches, or is no greater than 0.5 inches across the smallest dimension.

      Examples of grates subject to this standard include grates in grate inlets, the grate portion (non-curb-opening portion) of combination inlets, grates on storm sewer manholes, ditch grates, trench grates, and grates of spacer bars in slotted drains. Examples of ground surfaces include surfaces of roads (including bridges), driveways, parking areas, bikeways, plazas, sidewalks, lawns, fields, open channels, and stormwater basin floors.

   b. Whenever design engineers use a curb-opening inlet, the clear space in that curb opening (or each individual clear space, if the curb opening has two or more clear spaces) shall have an area of no more than seven (7.0) square inches, or be no greater than two (2.0) inches across the smallest dimension.

   c. This standard does not apply:

      (1) Where the review agency determines that this standard would cause inadequate hydraulic performance that could not practicably be overcome by using additional or larger storm drain inlets that meet these standards;

      (2) Where flows from the water quality design storm as specified in Section 4.G.1 are conveyed through any device (e.g., end of pipe netting facility, manufactured treatment device, or a catch basin hood) that is designed, at a minimum, to prevent delivery of all

solid and floatable materials that could not pass through one of the following:

(a) A rectangular space four and five-eighths inches long and one and one-half inches wide (this option does not apply for outfall netting facilities); or

(b) A bar screen having a bar spacing of 0.5 inches.

(3) Where flows are conveyed through a trash rack that has parallel bars with one-inch (1") spacing between the bars, to the elevation of the water quality design storm as specified in Section 4.G.1; or

(4) Where the New Jersey Department of Environmental Protection determines, pursuant to the New Jersey Register of Historic Places Rules at N.J.A.C. 7:4-7.2(c), that action to meet this standard is an undertaking that constitutes an encroachment or will damage or destroy the New Jersey Register listed historic property.

4. Any land area used as a nonstructural stormwater management measure to meet the performance standards in Sections 4.F and 4.G 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.

5. Guidance for nonstructural stormwater management strategies is available in the New Jersey Stormwater Best Management Practices Manual. The BMP Manual may be obtained from the address identified in Section 7, or found on the Department's website at www.njstormwater.org.

F. Erosion Control, Groundwater Recharge and Runoff Quantity Standards

1. This subsection contains minimum design and performance standards to control erosion, encourage and control infiltration and groundwater recharge, and control stormwater runoff quantity impacts of major development.

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 at Section 5, 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 projects within the "urban redevelopment area," or to 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 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 at Section 5, 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 pre-construction 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

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.

G. 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.

Table 1: Water Quality Design Storm Distribution

Time (Minutes)	Cumulative Rainfall (Inches)	Time (Minutes)	Cumulative Rainfall (Inches)
0	0.0000	65	0.8917
5	0.0083	70	0.9917
10	0.0166	75	1.0500
15	0.0250	80	1.0840
20	0.0500	85	1.1170
25	0.0750	90	1.1500
30	0.1000	95	1.1750
35	0.1330	100	1.2000
40	0.1660	105	1.2250
45	0.2000	110	1.2334
50	0.2583	115	1.2417
55	0.3583	120	1.2500
60	0.6250		

2. For purposes of TSS reduction calculations, Table 2 below presents the presumed removal rates for certain BMPs designed in accordance with the New Jersey Stormwater Best Management Practices Manual. The BMP Manual may be obtained from the address identified in Section 7, or found on the Department's website at www.njstormwater.org. The BMP Manual and other sources of technical guidance are listed in Section 7. TSS reduction shall be calculated based on the removal rates for the BMPs in Table 2 below. Alternative removal rates and methods of calculating removal rates may be used if the design engineer provides documentation demonstrating the capability of these alternative rates and methods to the review agency. A copy of any approved alternative rate or method of calculating the removal rate shall be provided to the Department at the following address: Division of Watershed Management, New Jersey Department of Environmental Protection, PO Box 418 Trenton, New Jersey, 08625-0418.

3. If more than one BMP in series is necessary to achieve the required 80 percent TSS reduction for a site, the applicant shall utilize the following formula to calculate TSS reduction:

$$R = A + B - (AXB)/100$$

Where

R = total TSS percent load removal from application of both BMPs, and
A = the TSS percent removal rate applicable to the first BMP
B = the TSS percent removal rate applicable to the second BMP

Table 2: TSS Removal Rates for BMPs	
Best Management Practice	TSS Percent Removal Rate
Bioretention Systems	90
Constructed Stormwater Wetland	90
Extended Detention Basin	40-60
Infiltration Structure	80
Manufactured Treatment Device	See Section 6.C
Sand Filter	80
Vegetative Filter Strip	60-80
Wet Pond	50-90

4. If there is more than one onsite drainage area, the 80 percent TSS removal rate shall apply to each drainage area, unless the runoff from the sub-areas converge on site in which case the removal rate can be demonstrated through a calculation using a weighted average.

5. Stormwater management measures shall also be designed to reduce, to the maximum extent feasible, the post-construction nutrient load of the anticipated load from the developed site in stormwater runoff generated from the water quality design storm. In achieving reduction of nutrients to the maximum extent feasible, the design of the site shall include nonstructural strategies and structural measures that optimize nutrient removal while still achieving the performance standards in Sections 4.F and 4.G.

6. Additional information and examples are contained in the New Jersey Stormwater Best Management Practices Manual, which may be obtained from the address identified in Section 7.

7. In accordance with the definition of FW1 at N.J.A.C. 7:9B-1.4, stormwater management measures shall be designed to prevent any increase in stormwater runoff to waters classified as FW1.

8. Special water resource protection areas shall be established along all waters designated Category One at N.J.A.C. 7:9B, and perennial or intermittent streams that drain into or upstream of the Category One waters as shown on the USGS Quadrangle Maps or in the County Soil Surveys, within the associated HUC14 drainage area. These areas shall be established for the protection of water quality, aesthetic value,

exceptional ecological significance, exceptional recreational significance, exceptional water supply significance, and exceptional fisheries significance of those established Category One waters. These areas shall be designated and protected as follows:

a. The applicant shall preserve and maintain a special water resource protection area in accordance with one of the following:

   (1) A 300-foot special water resource protection area shall be provided on each side of the waterway, measured perpendicular to the waterway from the top of the bank outwards or from the centerline of the waterway where the bank is not defined, consisting of existing vegetation or vegetation allowed to follow natural succession is provided. (2) Encroachment within the designated special water resource protection area under Subsection (1) above shall only be allowed where previous development or disturbance has occurred (for example, active agricultural use, parking area or maintained lawn area). The encroachment shall only be allowed where applicant demonstrates that the functional value and overall condition of the special water resource protection area will be maintained to the maximum extent practicable. In no case shall the remaining special water resource protection area be reduced to less than 150 feet as measured perpendicular to the top of bank of the waterway or centerline of the waterway where the bank is undefined. All encroachments proposed under this subparagraph shall be subject to review and approval by the Department.

b. All stormwater shall be discharged outside of and flow through the special water resource protection area and shall comply with the Standard for Off-Site Stability in the "Standards For Soil Erosion and Sediment Control in New Jersey," established under the Soil Erosion and Sediment Control Act , N.J.S.A. 4:24-39 et seq.

c. If stormwater discharged outside of and flowing through the special water resource protection area cannot comply with the Standard For Off-Site Stability in the "Standards for Soil Erosion and Sediment Control in New Jersey," established under the Soil Erosion and Sediment Control Act , N.J.S.A. 4:24-39 et seq., then the stabilization measures in accordance with the requirements of the above standards may be placed within the special water resource protection area, provided that:

   (1) Stabilization measures shall not be placed within 150 feet of the Category One waterway;

   (2) Stormwater associated with discharges allowed by this section shall achieve a 95 percent TSS post-construction removal rate;

   (3) Temperature shall be addressed to ensure no impact on the receiving waterway;

(4) The encroachment shall only be allowed where the applicant demonstrates that the functional value and overall condition of the special water resource protection area will be maintained to the maximum extent practicable;

(4) A conceptual project design meeting shall be held with the appropriate Department staff and Soil Conservation District staff to identify necessary stabilization measures; and

(5) All encroachments proposed under this section shall be subject to review and approval by the Department.

d. A stream corridor protection plan may be developed by a regional stormwater management planning committee as an element of a regional stormwater management plan, or by a municipality through an adopted municipal stormwater management plan. If a stream corridor protection plan for a waterway subject to Section 4.G(8) has been approved by the Department of Environmental Protection, then the provisions of the plan shall be the applicable special water resource protection area requirements for that waterway. A stream corridor protection plan for a waterway subject to G.8 shall maintain or enhance the current functional value and overall condition of the special water resource protection area as defined in G.8.a.(1) above. In no case shall a stream corridor protection plan allow the reduction of the Special Water Resource Protection Area to less than 150 feet as measured perpendicular to the waterway subject to this subsection.

e. Paragraph G.8 does not apply to the construction of one individual single family dwelling that is not part of a larger development on a lot receiving preliminary or final subdivision approval on or before February 2, 2004 , provided that the construction begins on or before February 2, 2009.

Section 5: Calculation of Stormwater Runoff and Groundwater Recharge

A. Stormwater runoff shall be calculated in accordance with the following:

1. The design engineer shall calculate runoff using one of the following methods:

   a. The USDA Natural Resources Conservation Service (NRCS) methodology, including the NRCS Runoff Equation and Dimensionless Unit Hydrograph, as described in the NRCS National Engineering Handbook Section 4 - Hydrology and Technical Release 55 - Urban Hydrology for Small Watersheds; or

   b. The Rational Method for peak flow and the Modified Rational Method for hydrograph computations.

2. For the purpose of calculating runoff coefficients and groundwater recharge, there is a presumption that the pre-construction condition of a site or portion thereof is a wooded land use with good hydrologic condition. The term "runoff coefficient" applies to both the NRCS methodology at Section 5.A.1.a and the Rational and Modified Rational Methods at Section 5.A.1.b. A runoff coefficient or a groundwater recharge land cover for an existing condition may be used on all or a portion of the site if the design engineer verifies that the hydrologic condition has existed on the site or portion of the site for at least five years without interruption prior to the time of application. If more than one land cover have existed on the site during the five years immediately prior to the time of application, the land cover with the lowest runoff potential shall be used for the computations. In addition, there is the presumption that the site is in good hydrologic condition (if the land use type is pasture, lawn, or park), with good cover (if the land use type is woods), or with good hydrologic condition and conservation treatment (if the land use type is cultivation).

3. In computing pre-construction stormwater runoff, the design engineer shall account for all significant land features and structures, such as ponds, wetlands, depressions, hedgerows, or culverts, that may reduce pre-construction stormwater runoff rates and volumes.

4. In computing stormwater runoff from all design storms, the design engineer shall consider the relative stormwater runoff rates and/or volumes of pervious and impervious surfaces separately to accurately compute the rates and volume of stormwater runoff from the site. To calculate runoff from unconnected impervious cover, urban impervious area modifications as described in the NRCS Technical Release 55 - Urban Hydrology for Small Watersheds and other methods may be employed.

5. If the invert of the outlet structure of a stormwater management measure is below the flood hazard design flood elevation as defined at N.J.A.C. 7:13, the design engineer shall take into account the effects of tailwater in the design of structural stormwater management measures.

B. Groundwater recharge may be calculated in accordance with the following: The New Jersey Geological Survey Report GSR-32 A Method for Evaluating Ground-Water Recharge Areas in New Jersey, incorporated herein by reference as amended and supplemented. Information regarding the methodology is available from the New Jersey Stormwater Best Management Practices Manual; at http://www.state.nj.us/dep/njgs/; or at New Jersey Geological Survey, 29 Arctic Parkway, P.O. Box 427 Trenton, New Jersey 08625-0427; (609) 984-6587.

Section 6: Standards for Structural Stormwater Management Measures

A. Standards for structural stormwater management measures are as follows:

1. Structural stormwater management measures shall be designed to take into account the existing site conditions, including, for example, environmentally critical areas, wetlands; flood-prone areas; slopes; depth to seasonal high water table; soil type, permeability and texture; drainage area and drainage patterns; and the presence of solution-prone carbonate rocks (limestone).

2. Structural stormwater management measures shall be designed to minimize maintenance, facilitate maintenance and repairs, and ensure proper functioning. Trash racks shall be installed at the intake to the outlet structure as appropriate, and shall have parallel bars with one-inch (1") spacing between the bars to the elevation of the water quality design storm. For elevations higher than the water quality design storm, the parallel bars at the outlet structure shall be spaced no greater than one-third (1/3) the width of the diameter of the orifice or one-third (1/3) the width of the weir, with a minimum spacing between bars of one-inch and a maximum spacing between bars of six inches. In addition, the design of trash racks must comply with the requirements of Section 8.D.

3. Structural stormwater management measures shall be designed, constructed, and installed to be strong, durable, and corrosion resistant. Measures that are consistent with the relevant portions of the Residential Site Improvement Standards at N.J.A.C. 5:21-7.3, 7.4, and 7.5 shall be deemed to meet this requirement.

4. At the intake to the outlet from the stormwater management basin, the orifice size shall be a minimum of two and one-half inches in diameter.

5. Stormwater management basins shall be designed to meet the minimum safety standards for stormwater management basins at Section 8.

B. Stormwater management measure guidelines are available in the New Jersey Stormwater Best Management Practices Manual. Other stormwater management measures may be utilized provided the design engineer demonstrates that the proposed measure and its design will accomplish the required water quantity, groundwater recharge and water quality design and performance standards established by Section 4 of this ordinance.

C. Manufactured treatment devices may be used to meet the requirements of Section 4 of this ordinance, provided the pollutant removal rates are verified by the New Jersey Corporation for Advanced Technology and certified by the Department.

Section 7: 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, New Jersey 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.

2. The New Jersey Department of Environmental Protection Stormwater Management Facilities Maintenance Manual, as amended.

B. Additional technical guidance for stormwater management measures can be obtained from the following:

1. The "Standards for Soil Erosion and Sediment Control in New Jersey" promulgated by the State Soil Conservation Committee and incorporated into N.J.A.C. 2:90. Copies of these standards may be obtained by contacting the State Soil Conservation Committee or any of the Soil Conservation Districts listed in N.J.A.C. 2:90-1.3(a)4. The location, address, and telephone number of each Soil Conservation District may be obtained from the State Soil Conservation Committee, P.O. Box 330, Trenton, New Jersey 08625; (609) 292-5540;

2. The Rutgers Cooperative Extension Service, 732-932-9306; and

3. The Soil Conservation Districts listed in N.J.A.C. 2:90-1.3(a)4. The location, address, and telephone number of each Soil Conservation District may be obtained from the State Soil Conservation Committee, P.O. Box 330, Trenton, New Jersey, 08625, (609) 292-5540.

Section 8: 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 section applies to any new stormwater management basin.

B. 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 paragraph 3, 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 identified in Section 8.C a free-standing outlet structure may be exempted from this requirement.

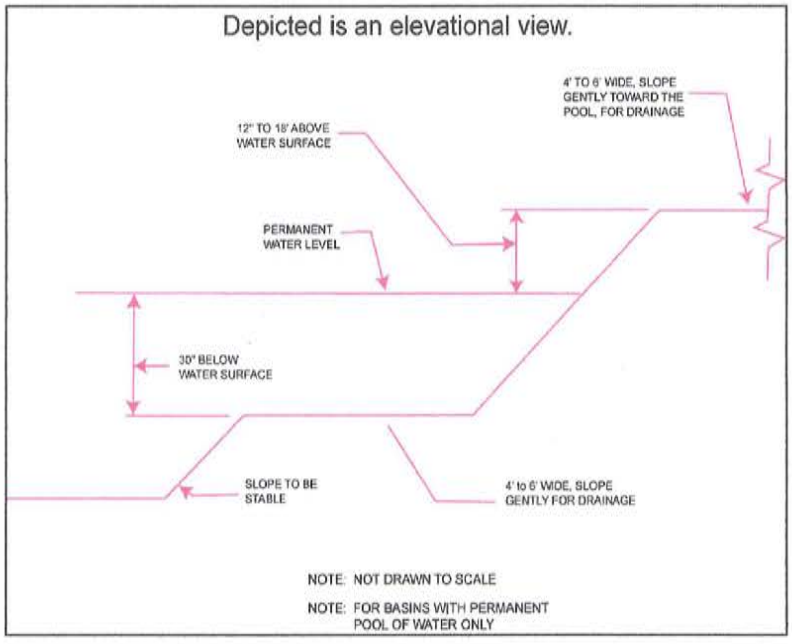
b. Safety ledges shall be constructed on the slopes of all new stormwater management basins having a permanent pool of water deeper than two and one-half feet. Such safety ledges shall be comprised of two steps. Each step shall be four to six feet in width. One step shall be located approximately two 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. See Section 8.D for an illustration of safety ledges in a stormwater management basin.

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.

C. 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) that the variance or exemption will not constitute a threat to public safety.

D. Illustration of Safety Ledges in a New Stormwater Management Basin



Section 9: Requirements for a Site Development Stormwater Plan

A. Submission of Site Development Stormwater Plan

1. Whenever an applicant seeks municipal approval of a development subject to this ordinance, the applicant shall submit all of the required components of the Checklist for the Site Development Stormwater Plan at Section 9.C below as part of the submission of the applicant's application for subdivision or site plan approval.

2. The applicant shall demonstrate that the project meets the standards set forth in this ordinance.

3. The applicant shall submit four copies of the materials listed in the checklist for site development stormwater plans in accordance with Section 9.C of this ordinance.

B. Site Development Stormwater Plan Approval

The applicant's Site Development project shall be reviewed as a part of the subdivision or site plan review process by the municipal board or official from which municipal approval is sought. That municipal board or official shall consult the engineer retained by the Planning and/or Zoning Board (as appropriate) to determine if all of the checklist requirements have been satisfied and to determine if the project meets the standards set forth in this ordinance.

C. Checklist Requirements

The following information shall be required:

1. Topographic Base Map

The reviewing engineer may require upstream tributary drainage system information as necessary. It is recommended that the topographic base map of the site be submitted which extends a minimum of 200 feet beyond the limits of the proposed development, at a scale of 1"=200' or greater, showing 2-foot contour intervals. The map as appropriate may indicate the following: existing surface water drainage, shorelines, steep slopes, soils, erodible soils, perennial or intermittent streams that drain into or upstream of the Category One waters, wetlands and flood plains along with their appropriate buffer strips, marshlands and other wetlands, pervious or vegetative surfaces, existing man-made structures, roads, bearing and distances of property lines, and significant natural and manmade features not otherwise shown.

2. Environmental Site Analysis

A written and graphic description of the natural and man-made features of the site and its environs. This description should include a discussion of soil conditions, slopes, wetlands, waterways and

vegetation on the site. Particular attention should be given to unique, unusual, or environmentally sensitive features and to those that provide particular opportunities or constraints for development.

3. Project Description and Site Plan(s)

   A map (or maps) at the scale of the topographical base map indicating the location of existing and proposed buildings, roads, parking areas, utilities, structural facilities for stormwater management and sediment control, and other permanent structures. The map(s) shall also clearly show areas where alterations occur in the natural terrain and cover, including lawns and other landscaping, and seasonal high ground water elevations. A written description of the site plan and justification of proposed changes in natural conditions may also be provided.

4. Land Use Planning and Source Control Plan

   This plan shall provide a demonstration of how the goals and standards of Sections 3 through 6 are being met. The focus of this plan shall be to describe how the site is being developed to meet the objective of controlling groundwater recharge, stormwater quality and stormwater quantity problems at the source by land management and source controls whenever possible.

5. Stormwater Management Facilities Map

   The following information, illustrated on a map of the same scale as the topographic base map, shall be included:

   a. Total area to be paved or built upon, proposed surface contours, land area to be occupied by the stormwater management facilities and the type of vegetation thereon, and details of the proposed plan to control and dispose of stormwater.

   b. Details of all stormwater management facility designs, during and after construction, including discharge provisions, discharge capacity for each outlet at different levels of detention and emergency spillway provisions with maximum discharge capacity of each spillway.

6. Calculations

   a. Comprehensive hydrologic and hydraulic design calculations for the pre-development and post-development conditions for the design storms specified in Section 4 of this ordinance.

   b. When the proposed stormwater management control measures (e.g., infiltration basins) depends on the hydrologic properties of soils, then a soils report shall be submitted. The soils report shall be based on onsite boring logs or soil pit profiles. The number and location of required soil borings or soil pits shall be determined

based on what is needed to determine the suitability and distribution of soils present at the location of the control measure.

7. Maintenance and Repair Plan
   The design and planning of the stormwater management facility shall meet the maintenance requirements of Section 10.

8. Waiver from Submission Requirements

   The municipal official or board reviewing an application under this ordinance may, in consultation with the municipal engineer, waive submission of any of the requirements in Sections 9.C.1 through 9.C.6 of this ordinance when it can be demonstrated that the information requested is impossible to obtain or it would create a hardship on the applicant to obtain and its absence will not materially affect the review process.

Section 10: Maintenance and Repair

A. Applicability

1. Projects subject to review as in Section 1.C of this ordinance shall comply with the requirements of Sections 10.B and 10.C.

B. General Maintenance

1. The design engineer shall prepare a maintenance plan for the stormwater management measures incorporated into the design of a major development.

2. The maintenance plan shall contain specific preventative maintenance tasks and schedules; cost estimates, including estimated cost of sediment, debris, or trash removal; and the name, address, and telephone number of the person or persons responsible for preventative and corrective maintenance (including replacement). Maintenance guidelines for stormwater management measures are available in the New Jersey Stormwater Best Management Practices Manual. If the maintenance plan identifies a person other than the developer (for example, a public agency or homeowners' association) as having the responsibility for maintenance, the plan shall include documentation of such person's agreement to assume this responsibility, or of the developer's obligation to dedicate a stormwater management facility to such person under an applicable ordinance or regulation.

3. Responsibility for maintenance shall not be assigned or transferred to the owner or tenant of an individual property in a residential development or project, unless such owner or tenant owns or leases the entire residential development or project.

4. If the person responsible for maintenance identified under Section 10.B.2 above is not a public agency, the maintenance plan and any future revisions based on Section 10.B.7 below shall be recorded upon the deed of record for each property on which the maintenance described in the maintenance plan must be undertaken.

5. Preventative and corrective maintenance shall be performed to maintain the function of the stormwater management measure, including repairs or replacement to the structure; removal of sediment, debris, or trash; restoration of eroded areas; snow and ice removal; fence repair or replacement; restoration of vegetation; and repair or replacement of nonvegetated linings.

6. The person responsible for maintenance identified under Section 10.B.2 above shall maintain a detailed log of all preventative and corrective maintenance for the structural stormwater management measures incorporated into the design of the development, including a record of all inspections and copies of all maintenance-related work orders.

7. The person responsible for maintenance identified under Section 10.B.2 above shall evaluate the effectiveness of the maintenance plan at least once per year and adjust the plan and the deed as needed.

8. The person responsible for maintenance identified under Section 10.B.2 above shall retain and make available, upon request by any public entity with administrative, health, environmental, or safety authority over the site, the maintenance plan and the documentation required by Sections 10.B.6 and 10.B.7 above.

9. The requirements of Sections 10.B.3 and 10.B.4 do not apply to stormwater management facilities that are dedicated to and accepted by the municipality or another governmental agency.

10. 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 or repair, the municipality shall so notify the responsible person in writing. Upon receipt of that notice, the responsible person shall have fourteen (14) days to effect maintenance and repair of the facility in a manner that is approved by the municipal engineer or his designee. The municipality, in its discretion, may extend the time allowed for effecting maintenance and repair for good cause. If the responsible person fails or refuses to perform such maintenance and repair, the municipality or County may immediately proceed to do so and shall bill the cost thereof to the responsible person.

C. Nothing in this section shall preclude the municipality in which the major development is located from requiring the posting of a performance or maintenance guarantee in accordance with N.J.S.A. 40:55D-53.

Section 11: Penalties

1. Any person who erects, constructs, alters, repairs, converts, maintains, or uses any building, structure or land in violation of this ordinance shall be subject to the following penalties: [*Municipality to specify*].

Section 12: Effective Date

This ordinance shall take effect immediately upon the approval by the county review agency, or sixty (60) days from the receipt of the ordinance by the county review agency if the county review agency should fail to act.

Section 13: Severability

If the provisions of any section, subsection, paragraph, subdivision, or clause of this ordinance shall be judged invalid by a court of competent jurisdiction, such order of judgment shall not affect or invalidate the remainder of any section, subsection, paragraph, subdivision, or clause of this ordinance.