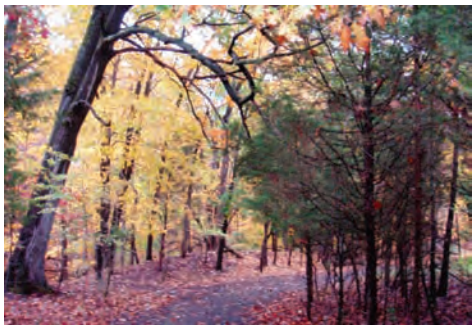
February 2012



Environmental Resource Inventory

for

The Borough of Highland Park

Middlesex County, NJ

This plan was prepared with the assistance of a Smart Growth Planning Grant from the Association of New Jersey Environmental Commissions ANJEC

Prepared for:

Highland Park

Environmental Commission

Written by:

Deborah J. Kratzer

Kratzer Environmental Services

ENVIRONMENTAL RESOURCE INVENTORY

The Borough of Highland Park

Middlesex County

New Jersey

Prepared By

Deborah J. Kratzer, Kratzer Environmental Services

For

The Borough of Highland Park Environmental Commission

February 2012

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Kratzer Environmental Services

Deborah J. Kratzer
19 Hill Road
Frenchtown, NJ 08825
908-996-2576
dkratzer@embarqmail.com

"We should act like this is the only planet we have because it is." (Honachevsky, 2000)

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PREFACE

A Natural Resources Inventory (NRI) was commissioned by the Highland Park Environmental Commission in 1992[1] with a grant from the New Jersey Department of Environmental Protection and Energy, Office of Environmental Services. In 2010 the Environmental Commission again won a grant from ANJEC to generate an Environmental Resource Inventory (ERI), which is equivalent to a NRI. An ERI is an objective set of data and maps, which documents a town's natural resources, biological resources, cultural resources, and more. Thus, the ERI provides a "snapshot" of Highland Park in 2011 and provides us the opportunity to identify changes which have occurred over this eighteen-year period.

The technology to generate an ERI has also changed remarkably in these 18 years. Geographic Information Systems (GIS) are now the state of the art for producing maps for ERIs in which multiple types of information can be displayed on a single map. Large amounts of data are available from county, state, and the federal government agencies and are included in the ERI and maps. Internet references and literature references for data sources are provided. This ERI has many digital photographs to document the town and some of its historical resources. The Internet application "Google Earth" has also provided additional images to make the ERI accurate to December 2011.

The primary purpose of the ERI is to provide an objective data set (in one volume) to borough elected officials, borough officials, and commissions and boards so that they can make better, well-informed decisions on land use and the environment. The ERI also will provide the Highland Park resident with a great deal of information about the natural environment, biological resources, historical resources, and the recreational opportunities of Highland Park. The ERI also incorporates data from two historical studies commissioned by the Environmental Commission: "Stage 1A Reconnaissance Survey, Borough of Highland Park", 1993 and "Evaluation of Historical Significance – Livingston Manor District", 1997, which enhance the Historical Resources Section of the ERI.

The project team would like to thank ANJEC for awarding us the 1:1 matching grant and the Borough Council for supporting the grant application and for providing matching funds (25%) for the grant. The Project Team has provided the remaining match with in-kind labor (25%).

We would like to acknowledge Joan Hullings, Borough Clerk; Don Rish, Superintendent of Department of Public Works; and Scott Luthman, Director of Code Enforcement, for providing assistance and data.

The ERI has been generated by Kratzer Environmental Services with input on the contents from the Project Team. The Environmental Commission has generated a significant amount of GIS data using GPS devices. The process has been very interactive between the project team and our professional consultant. The Project Team has gone to great lengths to make certain that the data from government agencies is accurate and current. We have found that there were significant

[1] A digital version is available at the link www.leoraw.com/hpenv/info/HP_NRI_1992_Final.pdf and a hard copy is available at the Highland Park Public Library.

errors in government databases, which have been corrected in the ERI. Google Earth has allowed the Environmental Commission to assure that our GIS data was accurate.

Reference copies of the ERI are available in the Office of the Borough Clerk and the Public Library. The ERI is available on the Borough's website www.hpboro.com and the Environmental Commission's website www.leoraw.com/hpenv/.

The Project Team hopes that the ERI will be found useful to our elected officials, borough officials, boards and commissions, and educational for the residents of Highland Park

Allan Williams
Project Team Leader
Environmental Commission

On February 16, 2012 the Highland Park Planning Board voted affirmatively to add the Environmental Resource Inventory to the Master Plan.

ACKNOWLEDGEMENTS

This report was authored by Deborah J. Kratzer of Kratzer Environmental Services. Funding for this report was provided by a grant from the Association of New Jersey Environmental Commissions and the Borough of Highland Park.

2011 Highland Park Borough Council	2011 Highland Park Planning Board
Stephen B. Nolan - Mayor Elsie Foster-Dublin - President Jon Erickson - Councilman Padraic Millet - Councilman Gary Minkoff - Councilman Gayle Brill Mittler - Councilman Jeffrey Morris - Councilman	Jon Carnegie, Chair Lita Greenberg Kim Hammond Rebecca Hersh Paul Lanaris Teri Jover Nathan Siegel Heather Wilkinson Allan Williams Padraic Millet – Borough Council Liaison to Planning Board
2011 Highland Park Environmental Commission	**Project Team for ERI**
Michael Rosenberg - Chair Allan Williams - Vice Chair and Liaison to Planning Board Jon Erickson - Borough Council Liaison to Environmental Commission Jonathan Abrahams Steve Barnes Gabor Grunstein Karen Swaine Joan Ehrenfeld* - alternate	Allan Williams - Project Team Leader, Environmental Commission, Planning Board Anne Barron - Sustainable Highland Park Steve Barnes - Environmental Commission Jon Erickson - Borough Council Michael Rosenberg - Chair, Environmental Commission Karen Swaine - Shade Tree Advisory Committee and Environmental Commission

Special Acknowledgements

Special thanks are extended to Allan Williams for reviewing and editing this document and extensive contributions of data and information specific to Highland Park, such as GPS points and the historical section.

Photo Credits

Photos by Deborah J. Kratzer unless otherwise noted.
Cover (clockwise from top left): The Meadows; Raritan River; Rutgers Ecological Preserve; Doughboy Statue (Allan Williams); snapping turtle and Egyptian geese in Donaldson Park (Arnold Clayton Henderson); Livingston House (Allan Williams); *Lobelia siphilitica*, great blue lobelia. **Page 143** - illustrations of plants as noted in Table 7.9. **Pages 148-152** - photos of invasive species as noted in Table 7.12. Allan Williams contributed the following photos: **Page 5** - Pulte property (formerly Cenacle); **Page 161** - Johnson Park; and **Pages 170-189** - photos of historical structures.

* Deceased June 25, 2011.

1: INTRODUCTION

A. About This Report

Ecologically Based Planning

Ecology is defined as the science of the relationships between organisms and their environments. The relationships between and among the physical factors of the environment, including the air, geology, topography, soils, and water, and the biotic environment, including plants, animals and decomposers, are a complex web. Humans are a significant part of the ecosystem of the Borough of Highland Park, both affecting and being affected by many physical and biological factors. With Highland Park's population of 13,982, or 7,767 persons/mi^2 [2] (US Census, 2010), the cumulative effects of many individual decisions have altered and have the potential to impact the environment in ways that cause harm directly to the environment and human health, and indirectly through complex environmental functions.

> "The scientific community needs to articulate more clearly for local decision makers the underlying ecological processes and the consequences resulting from interference or truncation of those processes." (Honachefsky, 2000, p. 32)

Assembling an inventory of the Borough's environmental and biological infrastructure is the first step in a proactive and ecological approach to protecting and preserving human and ecological health. Analyzing the data, gaining an understanding of the ecological processes involved, and considering the consequences of ignoring them, will help local land planners create and maintain an ecologically healthy community.

Goal of the Environmental Resource Inventory

The goal of the *Environmental Resource Inventory (ERI)* is to provide objective, reliable environmental data in one document so that borough officials (the Mayor, Borough Council, Planning Board, Board of Adjustment, Environmental Commission, Shade Tree Advisory Committee and the Construction Office) can make more informed decisions by taking numerous variables into consideration in order to better protect the borough's natural resources and the overall health and welfare of the community. Similarly, it is a tool for the public to use.

The Municipal Land Use Law requires municipalities' Master Plans to have a land use plan including, but not necessarily limited to, topography, soil conditions, water supply, flood plains, wetlands, and woodlands (Municipal Land Use Law, 2002).

The Environmental Commission Enabling Legislation gives environmental commissions the authority to conduct research for inclusion in the Master Plan, and then to use this information to help evaluate development applications.

The Association of New Jersey Environmental Commissions (ANJEC) defines "Environmental Resource Inventory" in its Resource Paper, The Environmental Resource Inventory: ERI, as follows:

> "The Environmental Resource Inventory (ERI), also called Natural Resource Inventory (NRI), or Index of Natural Resources, is a compilation of text and visual information about the natural resource characteristics and environmental features of an area. An ERI

[2] The population of Middlesex County as a whole is 809,858 persons (2,507 persons/mi^2) and for the entire State of New Jersey, the population is 8,791,894 (1,008 persons/mi^2) (US Census, 2010).

is an unbiased report of integrated data. It provides baseline documentation for measuring and evaluating resource protection issues. The ERI is an objective listing, rather than an interpretation or recommendation. Identifying significant environmental resources is the first step in their protection and preservation." (ANJEC, no date).

The ERI will provide valuable information to anyone interested in the natural resources of the Borough of Highland Park. This objective information may facilitate resource-sensitive development decisions. In addition, familiarity with environmental concerns enables residents to appreciate and to learn how to maintain our valuable natural resources. Areas of specific concern may emerge which require additional protection strategies, such as further research and monitoring, public outreach and education, habitat restoration, easements, volunteer projects, and/or revised or new ordinances.

Methods

Funding for this project was obtained through a grant from the Association of New Jersey Environmental Commissions (ANJEC), with 50% cost share provided by the Borough of Highland Park.

An inventory of what is currently known about the physical and biological environment and the human influence on the environment of Highland Park has been compiled for this document. Information sources include the 2003 Master Plan (Orth-Rodgers & Associates, Inc., 2003), the 2010 Reexamination of the Master Plan (Schectel Planners, LLC, 2010), the 1992 Natural Resource Inventory (Townplan Associates, 1992) and others. The most current GIS data have been obtained from the New Jersey Department of Environmental Protection GIS Data Web Site and other sources (see **Appendix A** and **Appendix B)**. Members of the Environmental Commission used Geographic Positioning Systems (GPS) to map a number of features, such as gardens and historic structures. A total of 91 GIS data layers from 22 sources were used for this report's 56 GIS maps.

What is GIS?

"A geographic information system (GIS) integrates hardware, software, and data for capturing, managing, analyzing, and displaying all forms of geographically referenced information.

GIS allows us to view, understand, question, interpret, and visualize data in many ways that reveal relationships, patterns, and trends in the form of maps, globes, reports, and charts." (GIS.com, 2011)

Further sources include the internet, and federal, state, county and local databases and contacts. All digital inventory data used in this report will be provided to the Highland Park Environmental Commission. The public can also use GIS data by using either the New Jersey Department of Environmental Protection's NJ-GeoWeb website or obtain relevant data layers (most are free on the internet), and download the free software, ArcExplorer to view the data (see **Internet Resources**, at the end of this section).

When viewing the digital document (as opposed to a printed copy) maps in PDF[3], clicking on the tab "Layers" at the left side of the screen will allow users to turn on or off the various data layers. Viewing the separate layers in this way is often helpful, especially for complex maps[4].

[3] PDF stands for "Portable Document Format," a digital format which allows the document to appear the same to everyone, requiring only the download of the free Adobe® Reader® at http://www.adobe.com/products/acrobat/readstep2.html.

[4] A few maps are so large in this format that they are included as a simple graphic in the report, but are available separately in PDF.

References and related Internet resources (with links) are listed at the end of each section, so that readers may find more information and updates. Please note that Internet sites may change or be temporarily out of service. If an Internet link doesn't work, try using an Internet search engine.

The following chapters present objective information about the Borough of Highland Park's natural resources, including climate, geology, soils, water, floodplains, wetlands, and forests, and cultural resources such as infrastructure, open space and historic and architecturally interesting structures. Environmental concerns in Highland Park include air and water pollution, rare, threatened and endangered species, invasive species, potential loss of remaining wetlands and forests.

Limitations of the ERI

It should be noted that the ERI is not meant to replace the primary data sources upon which it is based. Some new data was created for this project. Details about each data layer, including the date, scale and methods of developing the data, are provided in **Appendix B**. The ERI is intended for preliminary assessments of proposed projects, proposed regulatory changes or actions, and assessment of analysis of on-going activities and *cannot substitute for on-site testing and evaluations*. Most maps are presented at a scale of 1:18,000 in order to fit on 8.5 x 11 inch paper. "Zooming in" to better view individual lots is possible, but should not exceed the scale at which the data was created. Most data layers used for this report were created at 1:24,000 scale (with an accuracy of $\pm$ 40 feet). Data mapped at 1:100,000, such as the geology data layer, have an accuracy of $\pm$ 166.7 feet (Garie, 1998).

Sometimes mapped features don't line up exactly, since different data producers may have used different methods of acquiring and analyzing the data, used different scales or coordinate systems, and because of differences or errors in the base data.

GIS data from NJDEP and Middlesex County are used with permission (see the Terms of Agreement in **Appendix A**), with the required "disclaimer" printed on each map which uses their data.

Some components of the environment may have been studied or presented in detail, while other important factors may have been minimally addressed. When new or updated information becomes available, or new issues emerge, *updates should be appended to the ERI*.

Following the guidelines provided by ANJEC, management recommendations are not included in the ERI.

B. General Description of the Borough of Highland Park

Highland Park is located in Middlesex County, NJ (see **Figure 1a**) and is bordered by Piscataway Township to the northwest, Edison Township to the northeast and east and the city of New Brunswick to the south, separated from Highland Park by the Raritan River, which

Route 1 Bridges over Raritan from Donaldson Park

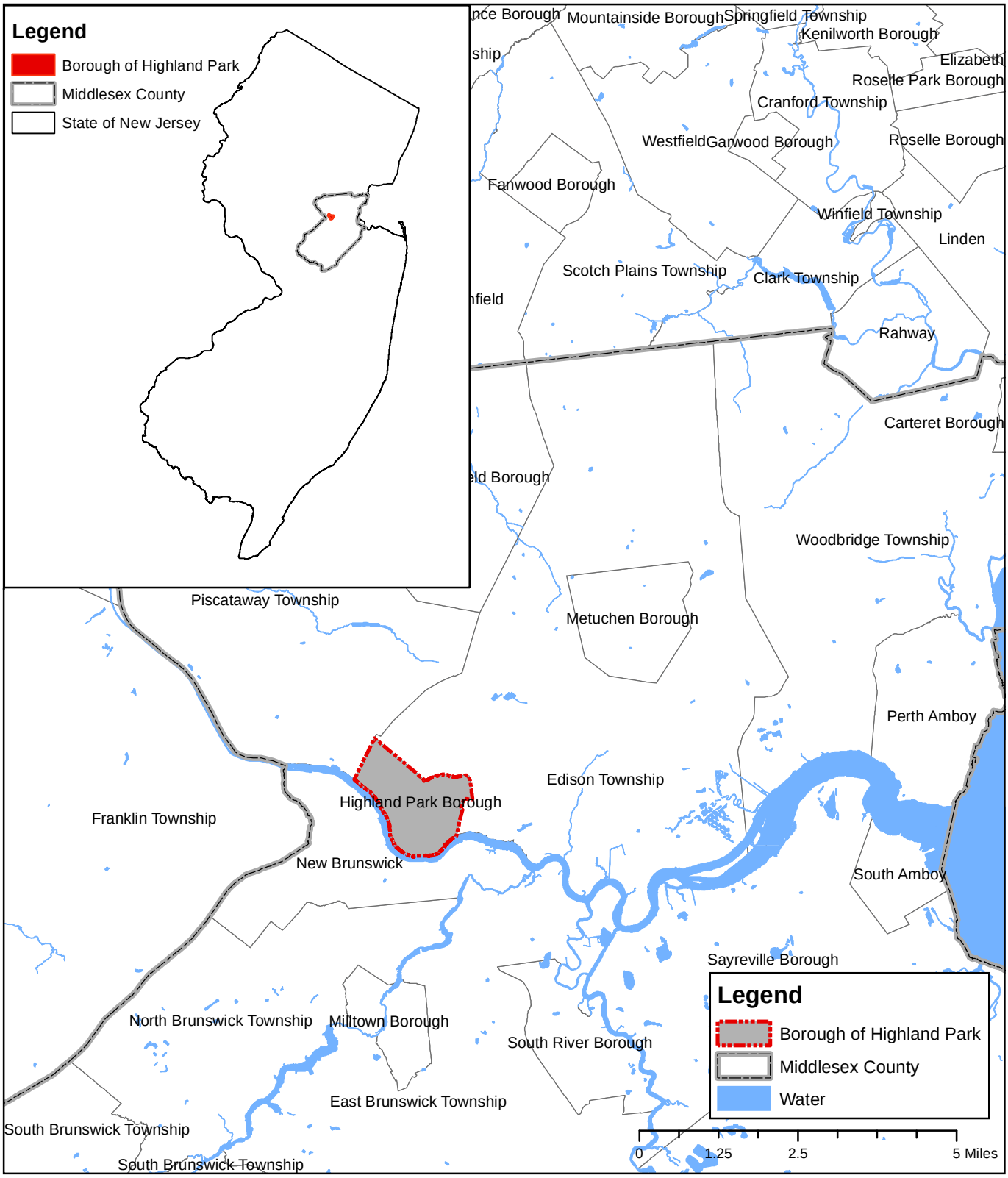

Figure 1a: Location of The Borough of Highland Park, NJ

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Borough of Highland Park ERI 2012
Prepared by Kratzer Environmental Services

Data Sources: See Appendix B.
Note: Map accuracy is limited to the accuracy and scale of the original data sets; see Appendix B.
Disclaimer: This map was developed using NJDEP GIS digital data, but this secondary product has not been verified by NJDEP and is not NJDEP authorized.

forms the southern boundary of the Borough. The Borough was formed in 1905, when it broke away from Raritan Township (now Edison Township) (Highland Park website, 2011). Highland Park encompasses 1.8 square miles (1,152 acres) with a population of 13,982 living in 6,203 housing units (US Census, 2010).

C. Land Use and Land Use Change

Figures 1b through **1e** show aerial photographs of Highland Park and the surrounding areas. In **Figure 1b**, aerial photography taken in 1930, although not very high resolution and not georeferenced,[5] illustrates the existence of many acres of agricultural land within Highland Park at the time. In 1963 (see **Figure 1c)**, also not georeferenced, the absence of development northeast of the railroad line is notable, while the agricultural fields are dotted with trees, evidence of forest succession. Aerial photography taken in 2002 and 2007 are shown in **Figure 1d and Figure 1e**[6] respectively. While the 2007 aerial photographs are the newest available georeferenced aerial photos of the state, an additional aerial photo map, **Figure 1f**, uses a 2010 (non-georeferenced) Google Earth (see **Internet Resources**) map image to more accurately depict the current view of Donaldson Park. In particular, this shows the current configuration of Donaldson Park. The picture to the right shows the property at the corner of River Road and Cedar Lane (now urban), a land use change that is too recent to show on currently available aerial photography.

The largest recent change in land use in Highland Park is the Pulte Property (formerly Cenacle) approved development, formerly mostly forested with a historic structure changing to residential high density (picture scanned from Pulte brochure, with Cenacle House removed and one acre public park added. Picture may vary somewhat from the approved plan).

Users of Google Earth may also view several years of historic imagery of Highland Park from 1995 through 2010 (on the menu bar, click View, then click Historical Imagery and use the slider bar to choose the year). Another website, HistoricAerials.com (see **Internet Resources**), allows viewing of historic aerial photography between 1931 through 2007.

[5] Georeferencing involves defining the location of something in physical space using map coordinates and assigning a coordinate system. This is the strength of GIS, because features can be defined in relation to other features.

[6] The 2002 and 2007 aerial photography data are high resolution, with pixels of 1 square foot. This is much more detail than can be shown in this report. See NJ-GeoWeb in internet resources, below .

The New Jersey Department of Environmental Protection (NJDEP) used aerial photography taken in 1986, 1995, 2002 and 2007 to determine land use and land use change. The Land Use Type is the generalized category of six land uses: agriculture, barren, forest, urban, water and wetlands. Definitions are as follows (USGS, 2010):

Agriculture includes all lands used primarily for the production of food and fiber and associated farm structures (there is no agricultural land in Highland Park).

Forest land is covered by woody vegetation (excluding wooded wetlands, which are included in the wetlands category). These areas are capable of producing timber and other wood products, and of supporting many kinds of outdoor recreation. Forests are important environmentally, because they affect air quality, water quality, wildlife habitat and climate.

Any areas periodically covered with water are included in the *water* land use type.

Wetlands are those areas that are inundated or saturated by surface or ground waters at a frequency and duration sufficient to support vegetation adapted for life in saturated soil conditions. Included in this category are naturally vegetated swamps, marshes, bogs, etc., as well as formerly natural wetlands that have been altered (sometimes filled) and are now part of a managed recreational area, but which still show signs of soil saturation on the aerial imagery. These areas do not currently support typical wetland vegetation, but are vegetated primarily by grasses and other planted vegetation that may be routinely mowed. Wetlands are further discussed in **Section 6C** of this report.

Barren Land includes areas being developed or cleared at the time the photos were taken.

The *Urban Land* type is characterized by intensive land use where the landscape has been altered by human activities. It encompasses various categories of residential, commercial, educational and industrial land.

Figure 1g illustrates the land use types within the Borough of Highland Park in 2007, the most recent data available. Detailed categories of land use/land cover are shown in **Section 7 (Figures 7a, 7b and 7c)** of this report. Captions on the map highlight some changes that have occurred since the aerial photos were taken in 2007. **Table 1** shows the proportions and acres of land use types within Highland Park in 1986, 1995, 2007 and 2011.

Table 1: 1986, 1995, 2007 and 2011[7] Land Use Type in Highland Park

Land Use Type	1986 Acres	1986 %	1995 Acres	1995 %	% Change '86-'95	2007 Acres	2007 %	% Change '95-'07	2011 Acres	2011 %	% Change '07-'11	% Change '86-'11
Agriculture	0	0%	0	0.0%	←→	0	0%	←→	0	0%	←→	←→
Barren	0	0%	0	0.0%	←→	4.4	0.4%	↑0.4%	12.3	1.0%	↑0.6%	↑1.0%
Forest	131.1	11.2%	149.9	12.8%	↑1.6%	140.3	12.0%	↓0.8%	137.8	11.8%	↓0.2%	↑0.4%
Urban	918.7	78.5%	898.8	76.8%	↓1.7%	901.1	77.0%	↑0.2%	895.7	76.6%	↓0.5%	↓1.8%
Water	5.9	0.5%	7.2	0.6%	↑0.1%	6.8	0.6%	↓0.01%	6.8	0.6%	←→	↑0.1%
Wetlands	114.3	9.8%	114.1	9.8%	←→	117.5	10.0%	↑0.2%	117.5	10.0%	←→	↑0.2%

Note: Acres in the GIS data differs somewhat from deed acres.

*2011 Land Use is based on major changes observed by the Environmental Commission. Other changes may exist.

Sources: NJDEP, 2000; NJDEP, 2007; NJDEP, 2010; Highland Park Environmental Commission, 2011

[7] Changes 2007-2011: On the Cenacle property, approximately 4.9 acres of Forest were clear-cut, and use changed to Urban. Approximately 7.4 acres on the Midland Ross Property on Cleveland Avenue changed from Urban to Barren; Approximately 3.2 acres on the YMHA (Myer-Rice Estate) property on Route 27 changed from Urban to Barren. Two areas categorized as barren in 2007 (approximately 1.1 and 1.6 acres), are now Urban. About 0.9 acres on Skyview Terrace changed from Urban to Forest (acquired by Middlesex County as open space). A portion of The Meadows, borough open space, was incorrectly named Urban in 2007, and 1.5 acres was reassigned to Forest in the 2011 acreage.

Legend

Borough of Highland Park

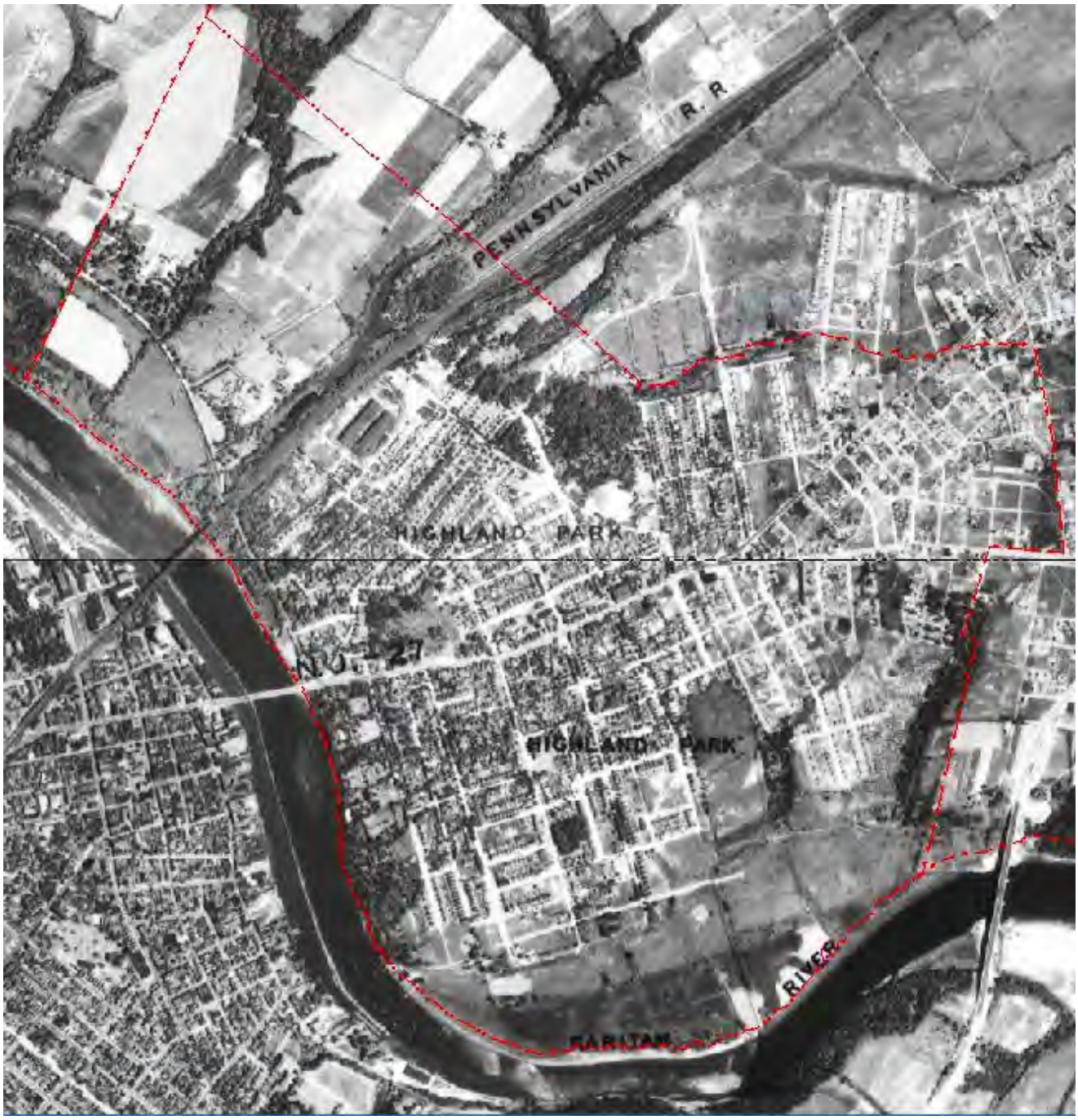

Figure 1b: 1930 Aerial Photography

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0 0.125 0.25 0.5 Miles
0 500 1,000 2,000 Feet

Borough of Highland Park ERI 2012
Prepared by Kratzer Environmental Services

Data Sources: See Appendix B. Image Source: http://njstateatlas.com/1930/
Note: Map accuracy is limited to the accuracy and scale of the original data sets; see Appendix B.
Disclaimer: This map was developed using NJDEP GIS digital data, but this secondary product has not been verified by NJDEP and is not NJDEP authorized.

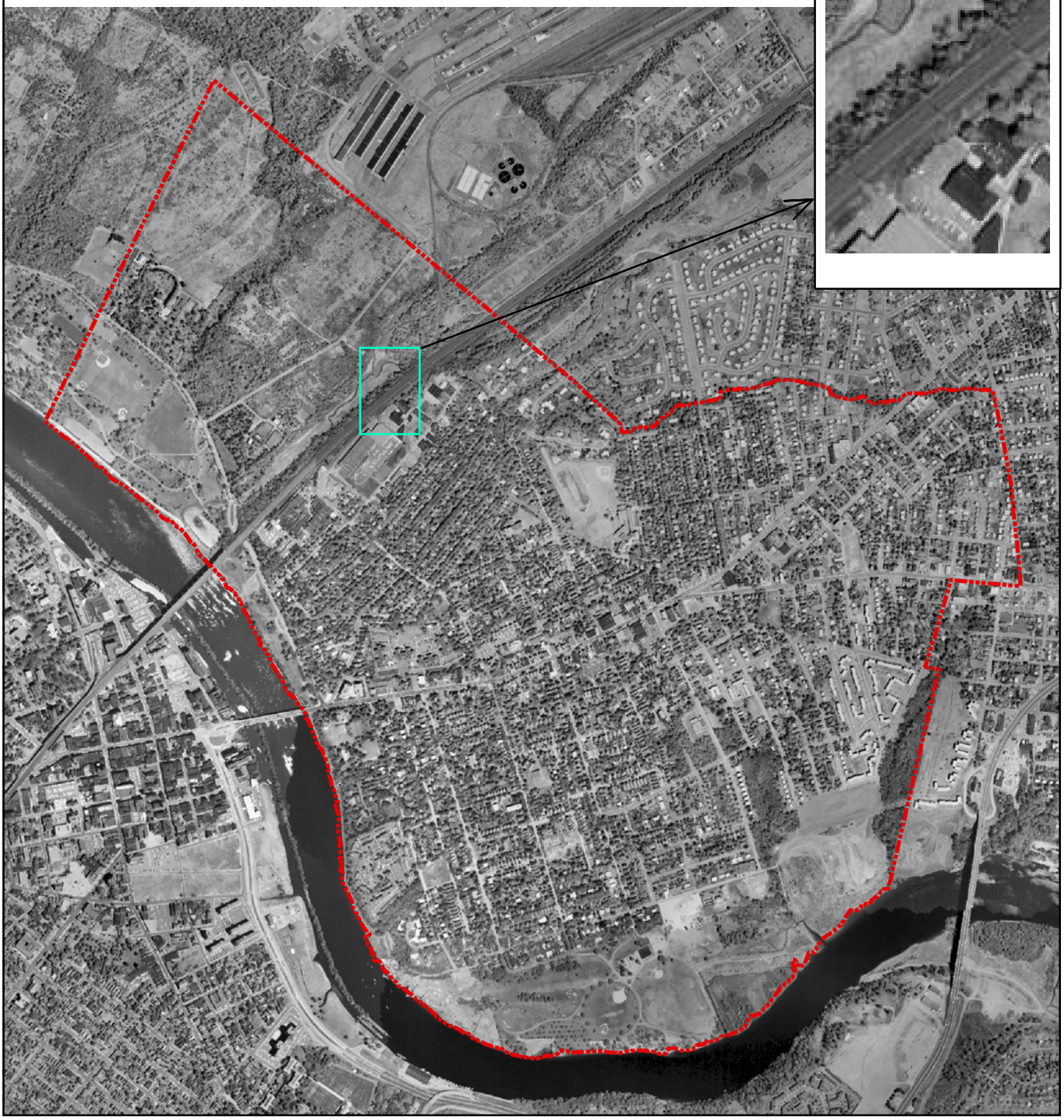

Figure 1c: 1963 Aerial Photography

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0 0.125 0.25 0.5 Miles
0 500 1,000 2,000 Feet

Borough of Highland Park ERI 2012
Prepared by Kratzer Environmental Services

Data Sources: See Appendix B. Image Source: HistoricAerials.com
Note: Map accuracy is limited to the accuracy and scale of the original data sets; see Appendix B.
Disclaimer: This map was developed using NJDEP GIS digital data, but this secondary product has not been verified by NJDEP and is not NJDEP authorized.

Figure 1d: 2002 Aerial Photography

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0 0.125 0.25 0.5 Miles
0 500 1,000 2,000 Feet

Borough of Highland Park ERI 2012
Prepared by Kratzer Environmental Services

Data Sources: See Appendix B.
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Figure 1e: 2007 Aerial Photography

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0 0.125 0.25 0.5 Miles
0 500 1,000 2,000 Feet

Borough of Highland Park ERI 2012
Prepared by Kratzer Environmental Services

Data Sources: See Appendix B.
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Disclaimer: This map was developed using NJDEP GIS digital data, but this secondary product has not been verified by NJDEP and is not NJDEP authorized.

Figure 1f: Donaldson Park

Top: 2007 Aerial Photograph from NJDEP
Bottom: 2010 Aerial Photograph from Google Maps

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0 0.05 0.1 0.2 Miles
0 200 400 800 Feet

Borough of Highland Park ERI 2012
Prepared by Kratzer Environmental Services

Data Sources: See Appendix B.
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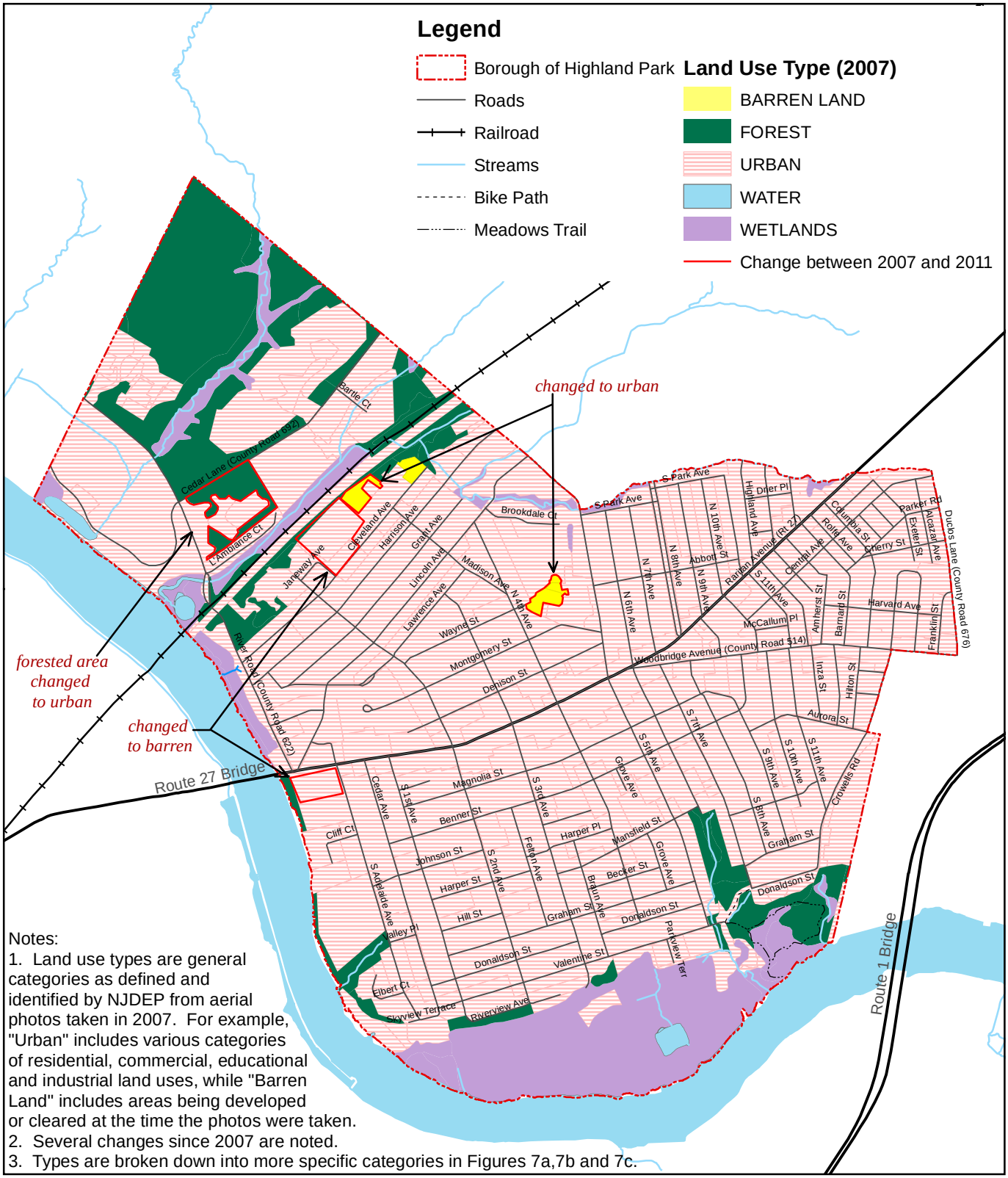

Figure 1g: Land Use Type from 2007 Aerial Photos

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0 0.125 0.25 0.5 Miles
0 500 1,000 2,000 Feet

Borough of Highland Park ERI 2012
Prepared by Kratzer Environmental Services

Data Sources: See Appendix B.
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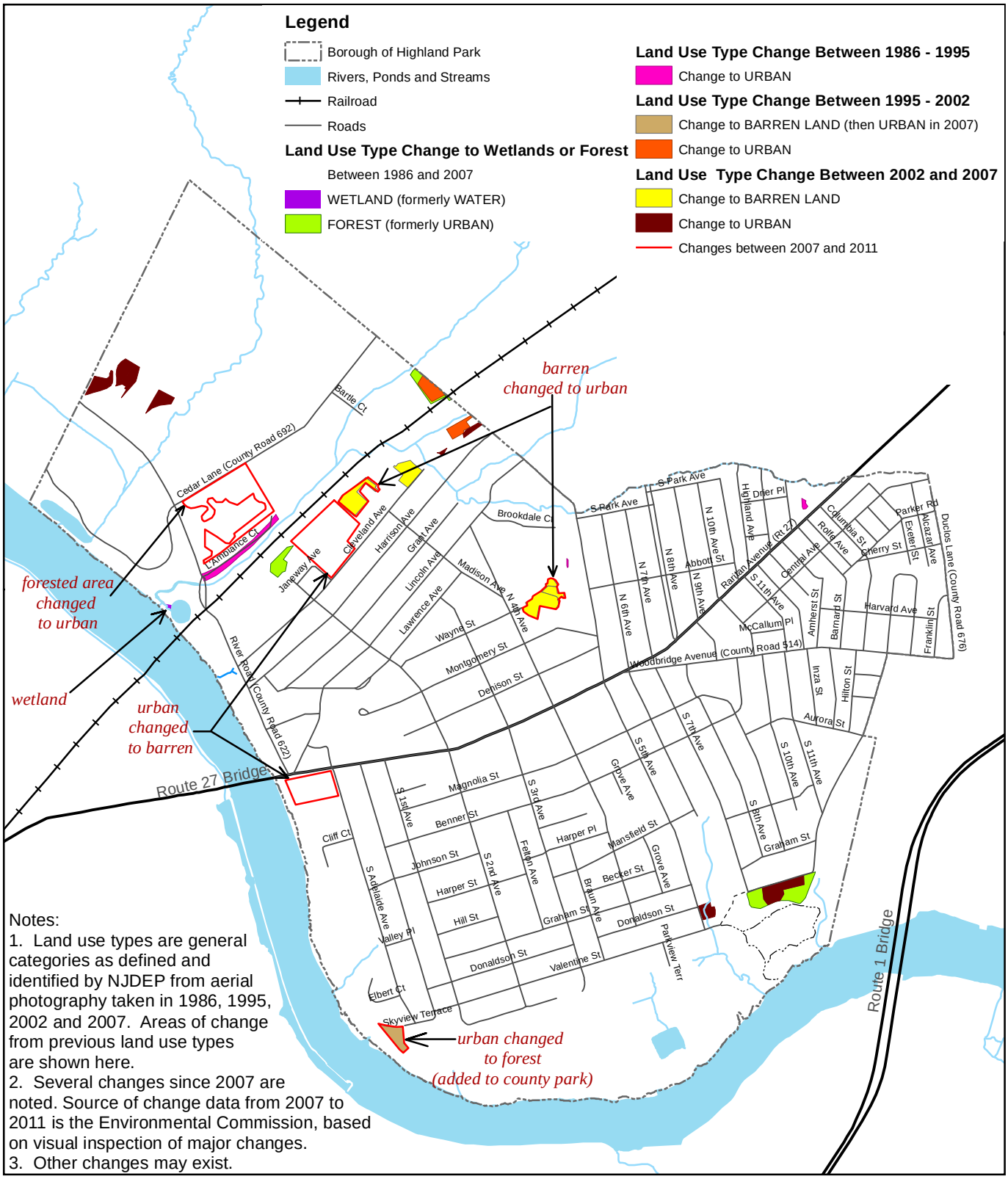

Figure 1h: Land Use Type Change between 1986 and 2011

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0 0.125 0.25 0.5 Miles
0 500 1,000 2,000 Feet

Borough of Highland Park ERI 2012
Prepared by Kratzer Environmental Services

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Figure 1h and **Table 1** show that Highland Park has not experienced a major net change in land use types in the past 25 years. Between 1986 and 2011, a 1.8% decrease in urban land uses have resulted in slight increases of 0.4% in forests and 1.0% in barren land (land that is currently being cleared, usually for development). Although a small area in Johnson Park changed from water to wetlands, the other changes in wetlands and water could not be identified, and are apparently an artifact of the GIS methods or calculations.

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Internet Resources: Introduction

Aerial photography and online mapping:

- Google Earth: http://www.google.com/earth/index.html (free download)
- HistoricAerials.com: http://historicaerials.com (free to use, but maps have watermark unless purchased)
- NJ-GeoWeb (NJDEP): http://www.state.nj.us/dep/gis/geowebsplash.htm (free to use, many data layers available)
- New Jersey State Atlas: http://njstateatlas.com/

Environmental Education

- NJDEP SEEDS: The State Environmental Education Directory Website: http://www.state.nj.us/dep/seeds/index.html

Free GIS Software

- ArcExplorer (free GIS software): http://www.esri.com/software/arcexplorer/explorer.html

GIS Data from New Jersey Department of Environmental Protection
(For a complete list of data sources used in this report, see Appendix B.)

- NJ GIS Home Page: http://www.state.nj.us/dep/gis/index.html
- Download GIS data: http://www.state.nj.us/dep/gis/downloadintra.html
- NJ Geographic Information Network: https://njgin.state.nj.us/NJ_NJGINExplorer/index.jsp

Highland Park's Official Home Page: http://www.hpboro.com/

Highland Park Environmental Commission: http://www.leoraw.com/hpenv/

Middlesex County's Official Home Page: http://www.co.middlesex.nj.us/

2: LOCAL & REGIONAL CONDITIONS

A. Climate & Meteorology

Climate

Climate is a major factor in determining the kinds of plants and animals found in an ecosystem. New Jersey has a temperate climate because it has mild average temperatures, four seasons, and rainfall distributed throughout the year. The dominant atmospheric circulation is the prevailing westerlies, the broad, undulating flow of air from west to east across the middle latitudes of North America. Prevailing winds are from the southwest in summer and from the northwest in winter (ONJSC, No Date).

According to the NJ State Climatologist,

> "Amidst growing evidence that our global climate is changing as a result of human activities, are specific concerns regarding the local and regional impacts such changes may be having or may eventually have on nature and society.... Changes in our State's climate are likely to impact natural flora and fauna, human health and safety, agricultural productivity, fresh-water resources, tourism, transportation, and business and commerce in general. It is imperative that we better understand the nature of the climate of New Jersey in order to recognize the significance of its possible ongoing or future behavior." (Robinson, 2010)

The NJ State Climatologist evaluated data from 19 stations for the NJ Climate Report Card in order to begin to document and understand climate change within NJ. While statistical trends were not developed for this study, over 600 time-series graphs were created that chart weather variables over the past century (e.g. min. and max. temperature, precipitation). The weather station nearest to Highland Park that was evaluated for this climate study was New Brunswick, which has been monitored since 1847 (Robinson, 2010; Hartman, 2002).

According to the National Oceanic and Atmospheric Administration (NOAA) National Climatic Data Center, the temperature trend in New Jersey is +0.2 °F per decade, and the precipitation trend is +0.05 inches per decade (for the period of record (1895 to present) (NOAA, May 3, 2011).

State and Federal laws regulate greenhouse gases emissions that cause climate change (see **Internet Resources**).

Precipitation and Temperature

As the prevailing westerlies shift north and south and vary in strength, they bring wet, dry, hot, and cold airstreams. These influence the weather throughout New Jersey, resulting in highly variable daily weather. The Office of the New Jersey State Climatologist (ONJSC) divides New Jersey into five distinct climate regions. Highland Park is included in the Central Zone, which extends diagonally from Bergen to Mercer Counties (ONJSC, No Date).

This region has many urban areas and the intensity of buildings and paved surfaces serve to retain more heat. Local nighttime temperatures in heavily developed parts of the zone are regularly warmer than surrounding suburban and rural areas, a phenomenon known as an urban heat island. The difference between freezing and non-freezing precipitation during the winter often occurs at the northern edge of the Central Zone. In the summer, the Central Zone usually

has 15-20 days with temperatures above 90 °F, half as many as areas to the south (ONJSC, No Date).

The ONJSC's New Jersey Weather and Climate Network maintains weather stations which transmit real-time data and weather forecasts on the Internet. Of these stations, New Brunswick is nearest to Highland Park. **Table 2.1** displays monthly average highs and lows and mean temperature, average monthly precipitation, and record highs and lows (and the year it occurred in parentheses).

Measurable precipitation falls in this area on approximately 120 days per year (ONJSC, No Date). In New Brunswick, annual precipitation has averaged 49.00 inches (for the period 1893-2011), (see **Table 2.1**).

Rainfall is distributed fairly evenly throughout the year, with February being the driest month. On average, June and July have the most precipitation, but appear drier because evapotranspiration exceeds precipitation (ONJSC, 2011). Record rainfalls are more likely to occur between June and November, due to tropical storms (see **Table 2.2**).

An average of 26.7 inches of snow falls annually measured at the New Brunswick station (about 10" of snow equals 1" of rain). Each winter, about 9 to 10 days receive snowfall greater than or equal to 0.5" in Highland Park. Days with snowfall greater than 4" occur only about twice per winter in this area (ONJSC, 1971-2000). Measured in New Brunswick, the earliest snow on record was on October 19 (in 1986, with 0.6"), and the latest was April 23 (in 1986, with 1.2") (ONJSC, 1893-2006).

According to a study by the National Atmospheric (NOAA), Plainfield (the site nearest to Highland Park in the study) has an average of 179 frost-free days. The average date for the last spring frost (32^{o}F) is April 20th (although there is a 10% probability that the last freeze may be May 6th or later). The first frost in fall is usually around October 17th (although there is a 10% probability that the first frost may be October 4th or earlier). The exact dates vary within the county as well as from one year to another (Koss, 1988).

During the winter, temperatures are not generally cold enough to keep the soil frozen for the whole winter. Winter rains are frequently warm enough to thaw the soil. Heavy rain on partly thawed soils is very erosive.

Table 2.1: Temperature & Precipitation at New Brunswick, NJ

Month	*Based on data from 1971-2000*		*Based on data from 1893-2011*	*Based on data from 1893-2006*		*Based on data from 1893-2011*
	Temperature					Mean Precipitation
	Avg. High	Avg. Low	Mean	Record High	Record Low	
January	38.2 °F	21.1 °F	29.9 °F	73 °F (1916)	-15 °F (1904)	3.75 in.
February	41.0 °F	22.9 °F	32.1 °F	76 °F (1930)	-16 °F (1934)	2.93 in.
March	50.1 °F	31.0 °F	40.5 °F	88 °F (1998)	1 °F (1900)	4.20 in.
April	60.8 °F	39.7 °F	50.8 °F	95 °F (2002)	11 °F (1923)	4.11 in.
May	71.5 °F	49.6 °F	60.6 °F	99 °F (1895)	29 °F (1907)	4.26 in.
June	80.3 °F	58.8 °F	69.8 °F	102 °F (1895)	38 °F (1938)	4.30 in.
July	85.4 °F	64.2 °F	74.8 °F	105 °F (1901&36)	45 °F (1982)	4.97 in.
August	83.6 °F	62.7 °F	73.5 °F	106 °F (1918)	40 °F (1982)	4.29 in.
September	76.6 °F	54.8 °F	66.2 °F	103 °F (1895)	31 °F (1904)	4.39 in.
October	65.3 °F	42.8 °F	54.4 °F	94 °F (1941)	22°F (1936)	3.74 in.
November	54.2 °F	35.1 °F	45.2 °F	82 °F (1950)	6 °F (1938)	3.89 in.
December	43.3 °F	26.6 °F	35.0 °F	76 °F (1998)	-15 °F (1917)	4.10 in.
Average Annual Precipitation:						49.00 in.
Sources: Averages: ONJSC, April 2011. http://climate.rutgers.edu/stateclim_v1/monthlydata/index.html Extremes: ONJSC, 1893-2006. http://climate.rutgers.edu/stateclim_v1/dailynormalsextremes.html						

Extreme Weather

Most areas of New Jersey receive 25 to 30 thunderstorms per year, with fewer storms near the coast than farther inland. In addition, each year between 1 and 10 nor'easters bring strong winds and heavy rains to the state. Approximately five tornadoes appear each year in New Jersey (usually relatively weak ones) (ONJSC, No Date). From 1950 to the present, a total of seven tornadoes have been documented in Middlesex County, two F1 and five F0 on the Fujita Scale. One of these is reported to have occurred in Highland Park on October 27, 2003, but caused little damage. During the same period, 26 hail events were recorded in Middlesex County. Hail which fell specifically in Highland Park occurred on May 24, 2000, May 28, 2003 and June 29, 2008, all about 0.75" diameter (NOAA, 2011).

Table 2.2 lists some of the highest snow and rainfall received in one day at New Brunswick (although multiple day storms can have higher totals), for the period 1893 to 2006 (the most recent data available on the Internet).

Table 2.2: Highest Daily Precipitation Measured at New Brunswick

Rank	Greatest one-day snowfall		Greatest one-day rainfall	
	Amount	Date	Amount	Date
1st	19.5	1/7/1996	7.66	8/28/1971
2nd	19.0	2/4/1961	6.70	8/31/1911
3rd	17.9	2/12/1983	6.24	7/25/1997
4th	15.0	12/12/1960	6.15	8/16/1909
5th	13.8	1/23/2005	5.78	9/17/1999
Source: ONJSC, 1893-2006				

Tropical storms and hurricanes can contribute significant rainfall and can cause flooding. Some storms which have affected Highland Park are described here. Hurricane Floyd battered New Jersey on September 16, 1999 and brought with it record breaking amounts of rain and damaging winds. Storm totals of 7.04 inches of rain were recorded in New Brunswick (higher in some areas), resulting in the worst flooding of the Raritan basin on record, exceeding previous records set during Tropical Storm Doria on August 28, 1971. An intense nor'easter that brought 3 to 6 inches of rain caused widespread flooding on April 15-16, 2007. Nearly every municipality in Middlesex County suffered flood damage or had roads closed due to flooding. It produced the worst flooding in the Raritan Basin since Floyd, and, combined with high winds, was the second-worst rainstorm (not related to a hurricane) in the state's history. Four days of rain culminated in major flooding on the Raritan River March 13-14, 2010, producing the worst flooding in the Raritan Basin since April of 2007 (NOAA, 2011).

Flood forecasts and gage height of the Raritan River at Bound Brook are available in real-time on the internet from USGS and NOAA (see **Internet Resources**).

At the other extreme, extended periods of time with less than normal amounts of precipitation result in drought; agriculture suffers, wells can fail, reservoir levels fall and water supplies can be threatened.

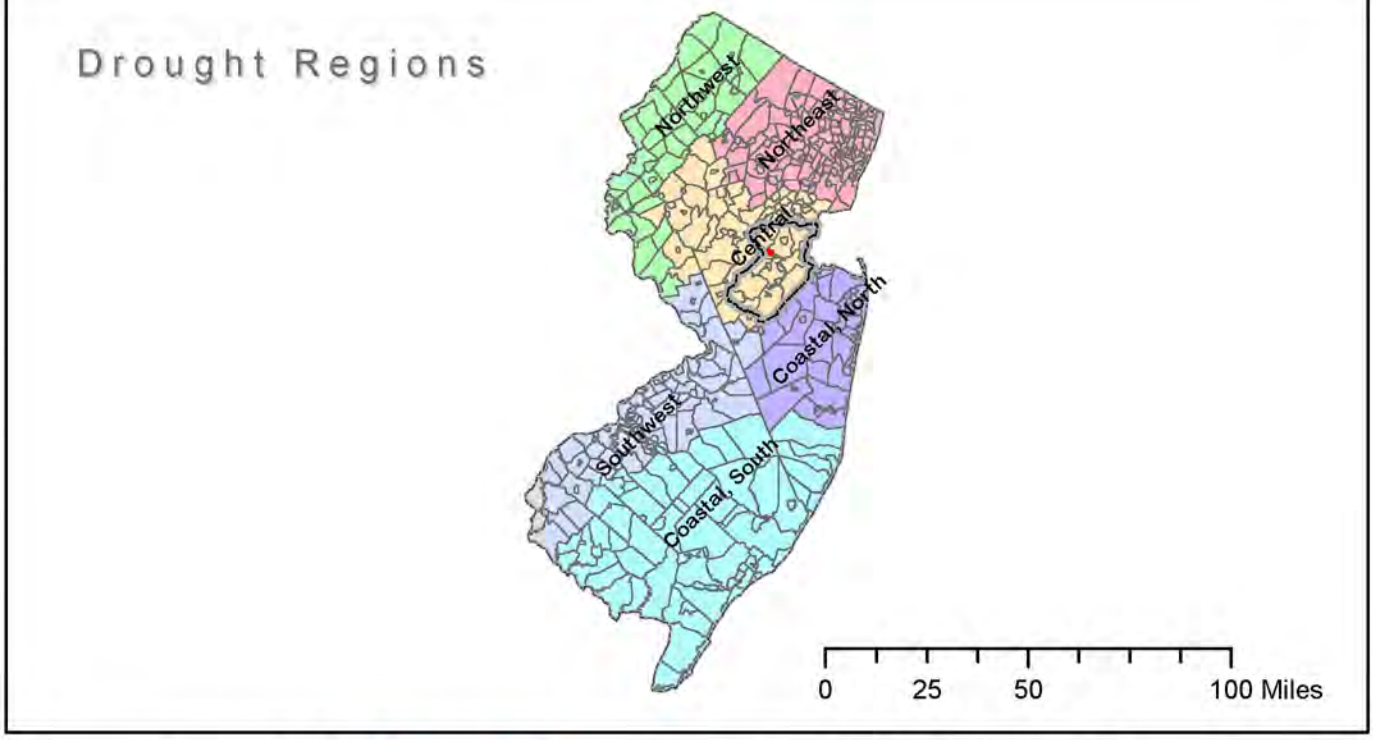
NJDEP provides information about droughts according to Drought Region, using indicators of 90-day precipitation, 90-day stream flow, reservoir levels and ground water levels for each region. Highland Park lies within the Central Drought Region (see **Figure 2a**).

Table 2.3: Lowest Annual Precipitation*

Rank	Year	Amount (inches)	Deviation from Mean
1st	1965	28.40	-17.60
2nd	1957	33.98	-12.02
3rd	1930	33.85	-12.15
4th	1918	35.01	-10.99
5th	2001	35.39	-10.61
*Average of 10 stations in southern NJ from 1895-2011; with a mean of 44.6 inches annually.			
ONJSC, April 6, 2011			

During a *drought watch*, voluntary water conservation measures are encouraged. During a *drought warning*, measures are taken to manage water supplies in order to avert a *drought emergency*. A water supply emergency results in mandatory restrictions on water use in order to curtail water demand.

Significant droughts in recent years



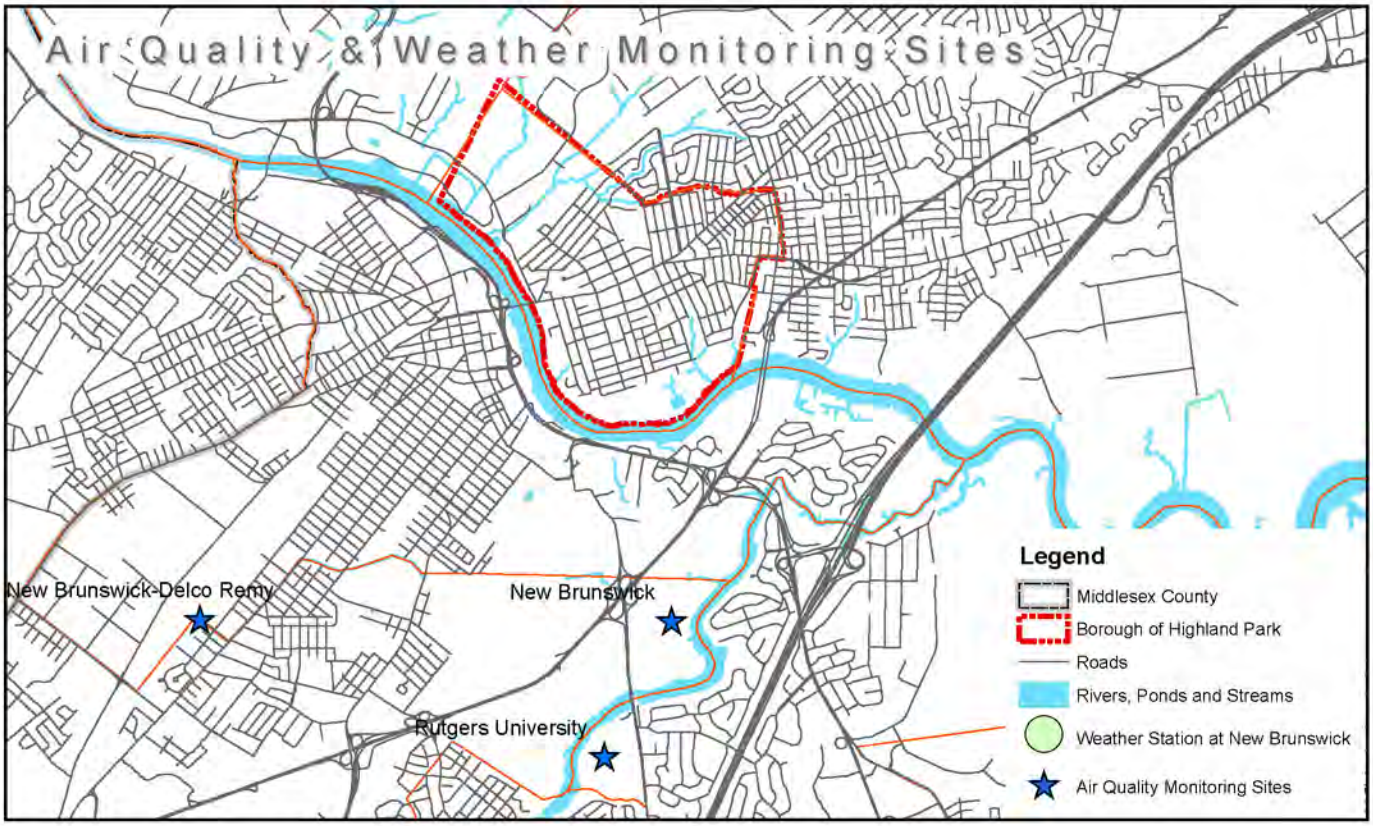


Figure 2a: Drought Regions & Air Quality Monitoring Sites

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Borough of Highland Park ERI 2012
Prepared by Kratzer Environmental Services

Data Sources: See Appendix B.
Note: Map accuracy is limited to the accuracy and scale of the original data sets; see Appendix B.
Disclaimer: This map was developed using NJDEP GIS digital data, but this secondary product has not been verified by NJDEP and is not NJDEP authorized.

included 1997-1999 and 2001-2002. A drought spanning September 1997 through September 1999 included a "snow drought" – one of the least snowy seasons on record. This drought was ended by Tropical Storm Floyd. Another year-long drought occurred between October 2001 and November 2002, when the drought was ended by a series of nor'easters that resulted in a wetter than normal November. The drought of record for the region, however, is considered 1963-1965, when three consecutive years included 3 of the 4 driest years since record-keeping began in 1895 (NOAA, 2011).

B. Air Quality

The New Jersey Comparative Risk Project (March 2003), funded by the United States Environmental Protection Agency (USEPA) and the NJDEP, combined the efforts of 73 experts to analyze and rank 88 chemical, physical and biological factors ("stressors") according to their relative negative impacts on human health, ecological quality, and socioeconomic conditions (monetary cost). The study ranked several air pollutants among the highest risks to human health, including ground-level ozone, particulate matter, radon, secondhand tobacco smoke, and volatile organic compounds (VOCs). Air pollution is estimated to have medium to medium-high socioeconomic impact, and lesser impacts to ecological quality (Steering Committee of the NJ Comparative Risk Project, 2003).

Exposure to air pollution is a widespread problem that occurs throughout the entire state. Airborne pollutants come from a wide variety of sources, including industry, utilities, manufacturing and commercial sources, vehicles and residential activities (such as oil burning for home heating, and painting houses). On hot summer days, when pollutant levels are worst, winds in New Jersey are usually blowing from the southwest, carrying air pollution from the Washington, Baltimore and Philadelphia metropolitan areas to New Jersey. In turn, these winds carry the pollution created here to New York, Connecticut and further to the northeast.

After the passage of the Clean Air Act in 1970, the USEPA set National Ambient Air Quality Standards (NAAQS) for six pollutants, known as the *Criteria Pollutants*, (ozone, sulfur dioxide, carbon monoxide, nitrogen dioxide, particulate matter, and lead). These pollutants are addressed throughout the country through a planning process and the concentrations of these pollutants in air have been monitored for compliance with the air quality standards. Since 1970, concentrations of these six pollutants have been significantly reduced in New Jersey. The state is now in compliance with all NAAQS, except for ozone.

The USEPA requires New Jersey to report the emissions from major sources annually. To accomplish this, the Emission Statement Rule (N.J.A.C. 7:27-21) requires the annual reporting of emissions from stationary sources for the following air contaminants; carbon monoxide (CO), sulfur dioxide (SO_2), ammonia (NH_3), total suspended particulate matter (TSP), respirable particulate[8] matter (PM_{10} and $PM_{2.5}$), lead (Pb), volatile organic compounds (VOC), oxides of nitrogen (NO_x), carbon dioxide (CO_2), methane (CH_4) and the 36 toxic air pollutants (TAPs).

NJDEP developed the Air Quality Index (AQI) to provide a descriptive rating and a color code (e.g. green=good) in real-time on the internet for many sites. The state is divided into 9 Air Quality Regions. Highland Park is located in the air monitoring *Suburban Region*, which includes Middlesex, Morris and Somerset Counties. $PM_{2.5}$ is monitored continuously at the New Brunswick (Cook College, Log Cabin Road in North Brunswick Township) monitoring site, and nitrogen dioxide (NO_2), ozone (O_3) are monitored continuously at Rutgers University (Ryders Lane, East Brunswick Township). The manual air quality monitoring network includes

[8] See Particulates, below in this section, for more information.

$PM_{2.5}$, $PM_{2.5}$ speciation, Volatile Organic Compounds (VOCs) and Carbonyls, measured at the New Brunswick station, lead and Total Suspended Particulates (TSP) measured at the New Brunswick-Delco Remy station (at the end of 12th Street), and a Photochemical Assessment Monitoring Station (Ozone Precursors, known as PAMS) at Rutgers University (Ryders Lane) (see **Figure 2a**).

The following summaries for ground-level ozone, particulates, air toxics and atmospheric deposition are summarized from either the 2008 Air Quality Report or the 2009 Air Quality Report (not all sections of the 2009 report are available at the time of this writing) published by the NJDEP Bureau of Air Monitoring (NJDEP Bureau of Air Monitoring web site).

Ground-level Ozone

Ground-level ozone (O_3) causes serious adverse health and environmental effects. It forms in the air from volatile organic compounds (VOCs) and nitrogen oxides (NO_x) under conditions of high temperature and bright sunlight. Sources include vehicles, power plants and factories. The hottest days of summer can yield unhealthy levels of ozone. Ozone is monitored at the Rutgers University station.

The 1-hour ozone standard is an average of 0.12 parts per million (ppm), and the 8-hour ozone standard (that became effective in 1997) is an average of 0.08 parts per million (ppm). The National Ambient Air Quality Standards (NAAQS) for ozone were revised in 2008 because the USEPA determined that the 1997 standard was inadequate to protect public health. A maximum daily 8-hour average of 0.075 ppm was established on March 12, 2008 (NJDEP Bureau of Air Monitoring, 2008). The graph below presents a summary of the number of days the ozone standards were exceeded per year at the New Brunswick Station (from 1980-1997) and Rutgers University station (1998 to 2008).

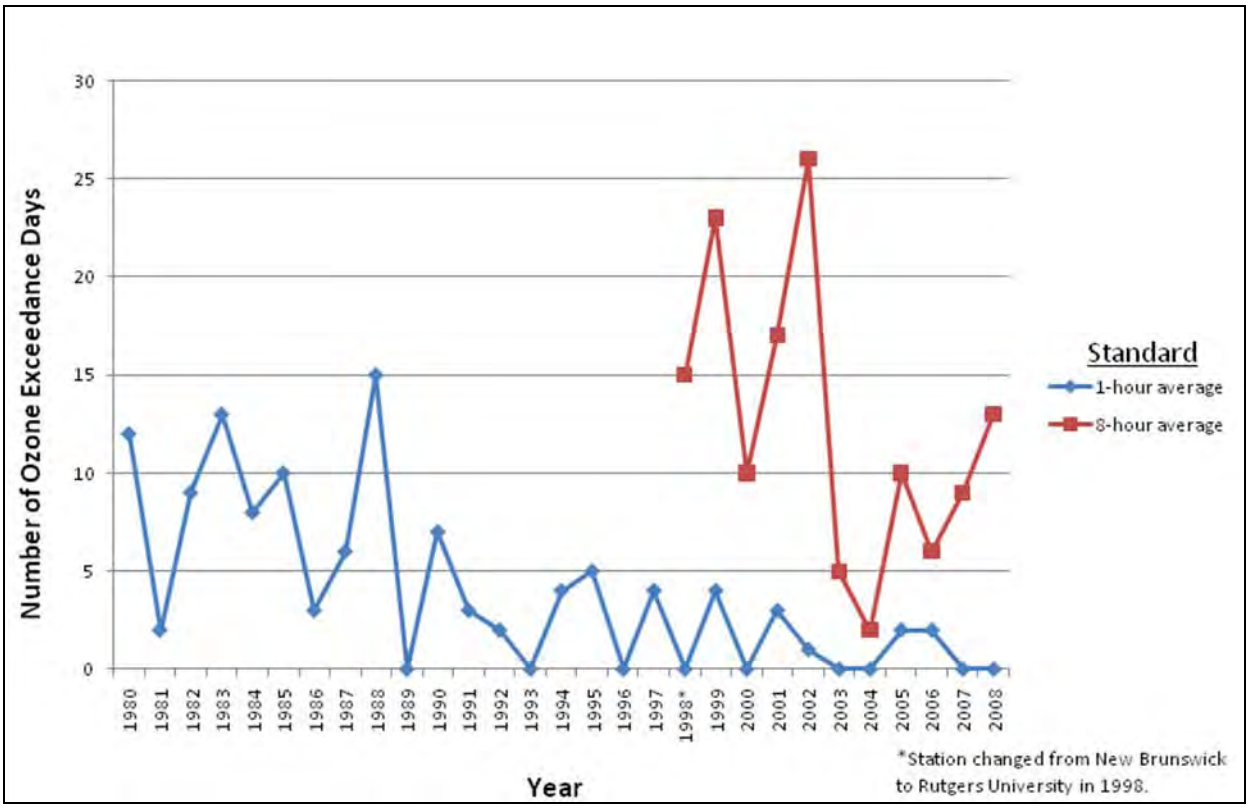


Figure 2b: Ozone Exceedance Days

According to data for 2008 (the most recent available), there were no exceedances of the 1-hour standard in 2008 at the Rutgers station. However, the new 8-hour ozone standard of 0.075 ppm was exceeded 13 times. The Clean Air Act requires that all areas of the country be evaluated and then classified as attainment or non-attainment areas for each of the National Ambient Air Quality Standards. Based on the 3-year period from January 2006 through December 2008, the USEPA has designated all of New Jersey as moderate non-attainment with respect to the 8-hour ozone standard. The 2008 Air Quality Report states that significant further improvements will require reductions in both VOCs and NOx, which will have to be achieved over a large region because levels in New Jersey are impacted by emissions from upwind sources (NJDEP Bureau of Air Monitoring, 2008).

Particulates

Particulate air pollution consists of both solid particles and liquid droplets suspended in the atmosphere, usually less than 70 microns in diameter. In addition to human health and environmental effects, particulate matter is a major cause of reduced visibility. Particulate matter smaller than 2.5µ (µ=microns, equal to 0.001 millimeter) diameter ($PM_{2.5}$) are considered *Fine Particulates*, while larger particles are considered *Coarse Particulates*. Coarse Particulates are made up of Total Suspended Particulates (TSP) and Inhalable Particulates (PM_{10}). All sizes are harmful to the environment, but coarse particles smaller than 10 microns (PM_{10}) are inhalable, therefore are considered harmful to human health, while fine particles less than 2.5 microns ($PM_{2.5}$) are even more detrimental to human health. Coarse particle sources include windblown dust and industrial sources, while fine particles come from combustion sources or are formed in the atmosphere from gaseous emissions.

The nearest monitoring site for fine particulates is in New Brunswick (Cook Campus), where $PM_{2.5}$ is monitored continuously (every minute) and $PM_{2.5}$ speciation is also measured. Total Suspended Particulates (TSP) are measured at the New Brunswick-Delco Remy station. The annual standard of 15.0µg/M^3 [9,10] was not exceeded at any monitoring site in the state, although 9 sites measured exceedances of the 24-hour standard of 35µg/M^3, but not the New Brunswick station. The annual mean at the New Brunswick station was 10.9µg/M^3, and the highest 24-hour concentration of 34.8µg/M^3. Results of the continuous monitoring a highest daily concentration of 2.5µg/M^3, slightly exceeding the 24-hour standard. Samples for $PM_{2.5}$ speciation are analyzed every third day for 55 analytes. Of these, organic carbon, sulfate, nitrate, sulfur and elemental carbon are the most common species (NJDEP Bureau of Air Monitoring, 2008).

PM_{10} is monitored at only 6 sites in the state, Jersey City-Firehouse being the closest to Highland Park. In 2008, the results at the Jersey City site did not exceed the PM_{10} 24-hour maximum standard of 150µg/M^3 or the annual average standard of 50µg/M^3. The 24-hour maximum was 93.4µg/M^3 and the annual average at this site was 29.0µg/M^3. In fact, the entire state is in attainment for the annual mean and maximum 24-hour average PM_{10} (NJDEP Bureau of Air Monitoring, 2008).

Air Toxics

In addition to ozone and particulates, there is increasing concern about a group of air pollutants termed *air toxics*. These include all other chemicals released into the air that have the

[9] M^3= cubic meters

[10] µg/M^3 = micrograms per cubic meter of air (a microgram is one millionth (10^{-6}) of a gram).

potential to cause adverse health impacts in humans. Toxic pollutants may also be deposited on soil and water, taken up by plants and consumed by animals.

The list of potential air toxics is very large and includes many different types of compounds from heavy metals to volatile organic compounds (VOCs) such as benzene. In 1979, NJDEP adopted a regulation that specifically addressed air toxics emissions. This rule (Control and Prohibition of Air Pollution by Toxic Substances, N.J.A.C. 7:27-17) listed 11 Toxic Volatile Organic Substances (TVOS) and required that sources emitting those TVOS to the air should register with the Department and demonstrate that they were using state-of-the-art controls to limit their emissions (NJDEP Air Toxics in NJ. 2011).

Under the Clean Air Act Amendments of 1990, USEPA is required to begin to address a list of 188 of these air toxics (known as *Hazardous Air Pollutants*, or HAPs). NJDEP works with USEPA to implement these various strategies to reduce air toxics throughout the state.

The USEPA prepared a comprehensive inventory of air toxics emissions for the entire country as part of the National-Scale Air Toxics Assessment (NATA) in 1996, which is updated on a three-year cycle. The 2002 study update determined that on-road mobile sources are responsible for 33% of the toxic emissions, off-road mobile sources (airplanes, trains, construction equipment, lawnmowers, boats, dirt bikes, etc.) account for 34%; area sources contribute 28% (residential, commercial, and small industrial sources), and major point sources account for the remaining 5%.

The NATA study also estimated levels of pollutants geographically. Benchmarks are developed based on health risks, and compared to predicted exposure to the chemicals, e.g. the risk of exposure to Acetaldehyde in the vicinity of Highland Park is 1 to 5 times the health benchmark. Highland Park falls within an area expected to have concentrations exceeding the health benchmark for a number of chemicals, particularly benzene, carbon tetrachloride, chromium, diesel particulate matter and formaldehyde (see **Table 2.4**) (NJDEP Air Toxics in NJ, 2005).

The NJDEP has established three comprehensive air toxics monitoring sites. They are located in Elizabeth, New Brunswick and Chester. Pollutant concentrations are trending downward, but many of them still exceed the NJDEP health benchmarks. At New Brunswick, these include acetaldehyde, acrolein, acrylonitrile, benzene, 1,3-Butadiene, carbon tetracholoride, chloroform, chloromethane and formaldehyde (NJDEP Bureau of Air Monitoring, 2009).

Atmospheric Deposition

Pollution that is deposited on land or water from the air is called *atmospheric deposition.* Wet deposition is washed from the air by precipitation, while dry deposition refers to particulates that settle out of the atmosphere during dry weather. Sources include motor vehicles, power plants, and incinerators. The major pollutants of concern are sulfur dioxide (SO_2), nitrogen oxides (NO_x), mercury (Hg), and volatile organic compounds (VOCs). In addition, the presence of these pollutants changes the pH of the precipitation which can harm plants and aquatic life (trout are particularly sensitive) and deplete nutrients from soils.

Of the 3 sites where atmospheric deposition is monitored in New Jersey, the one in Washington Crossing is closest to Highland Park. This site is also part of the National Atmospheric Deposition Program (NADP). Results for 2008 (the most recent available) show a mean pH value of 4.61 (normal rainfall has a pH of about 5.6). This is very acidic, but is a slight improvement from the 1980's and early 1990's, when pH averaged around 4.3 (NJDEP Bureau of Air Monitoring, 2008; Steering Committee of the New Jersey Comparative Risk Project, March 2003).

Mercury use in mining and manufacturing processes and emissions from power generation has resulted in increased concentrations of mercury in the environment. Mercury persists in the atmosphere up to two years and reaches the surface through atmospheric deposition, where it may persist as methyl mercury in the soil for decades. Health concerns include neurotoxicity (low-level exposure is linked to learning disabilities in children) and interference in reproduction, while both methyl mercury and mercuric chloride are listed by EPA as possible human carcinogens. Mercury is never removed from the environment, but accumulates in biological tissue (bioaccumulation) (see **Section 6.I for Fish Consumption**

Table 2.4: 2005 NATA Predicted Concentrations in Vicinity of Highland Park

Chemical Name	Health Benchmark	Risk in the Vicinity of Highland Park	Primary Source(s) of Pollutant in Middlesex County◈
Acetaldehyde	0.45 µg/M^3	1 to 5 times	Background & Secondary
Acrolein	0.02 µg/M^3	1 to 5 times	Background & Secondary
Arsenic Compounds	0.00023 µg/M^3	1 to 5 times	Background & Secondary
Benzene	0.13 µg/M^3	5 to 50 times	Background & Secondary On-road mobile sources
1,3 Butadiene	0.033 µg/M^3	1 to 5 times	On-road mobile sources Background & Secondary
Cadmium Compounds	0.00024 µg/M^3	<0.5 times	Background & Secondary
Carbon Tetrachloride	0.067 µg/M^3	5 to 10 times	Background & Secondary
Chloroform	0.043 µg/M^3	1 to 5 times	Non-point sources
Chromium VI	0.000083 µg/M^3	1 to 10 times	Background & Secondary
Cobalt Compounds	0.00011 µg/M^3	<0.5 times	Point Sources
1,4-Dichlorobenzene	0.091 µg/M^3	0.5 to 1 times	Non-point sources
1,3-Dichloropropene	0.25 µg/M^3	<0.5 to 1 times	Non-point sources
Diesel Particulate Matter	0.0033 µg/M^3	100 to 1,000 times	On-road mobile sources
Ethylbenzene	0.4 µg/M^3	0.5 to 1 times	On-road mobile sources
Ethylene Oxide	0.011 µg/M^3	0.5 to 1 times	Background & Secondary
Formaldehyde	0.077 µg/M^3	20 to 40 times	Background & Secondary
Methyl Chloride	0.56 µg/M^3	1 to 5 times	Background & Secondary
Naphthalene	0.029 µg/M^3	1 to 5 times	Non-point sources
Nickel Compounds	0.0021 µg/M^3	0.5 to 1 times	Background & Secondary Point Sources
PAH/POM *	0.0072 µg/M^3	0.5 to 5 times	Non-point sources
Perchloroethylene	0.17 µg/M^3	1 to 5 times	Background & Secondary
1,1,2-Trichloroethane	0.063 µg/M^3	<0.5 times	Point Sources

◈Primary Sources of Pollutant in Middlesex County:

Background concentrations can be attributed to long-range pollutant transport, unidentified emission sources and past emissions.

Secondary formation is a process by which air pollutants are transformed in the air into other chemicals.

Point Sources are stationary facilities or processes whose location could be identified with latitude and longitude coordinates, including manufacturing, power generation, heating, incineration, and other facilities that are required to report their emissions under the federal Toxic Release Inventory program and the state's Community Right-To-Know program.

Nonpoint/Area Sources : These are small stationary sources of air pollution which by themselves may not emit very much, but when their emissions are added together, they account for a significant portion of the total emissions of air toxics. They are also referred to as area sources and are generally too small or too numerous to be inventoried individually, including: Consumer products (personal care products, adhesives, sealants, automotive products, paints etc.); residential heating and fuel use; pesticide use; gas stations; dry cleaners; and institutional and commercial heating.

On-road mobile sources are vehicles found on roads and highways, including cars, trucks, buses & motorcycles.

Non-road mobile sources include aircraft, trains, lawnmowers, boats, dirt bikes, construction & farm vehicles, etc.

*PAH/POM is polycyclic aromatic hydrocarbons/polycyclic organic matter

Source: NJDEP Air Toxics in NJ, 2005

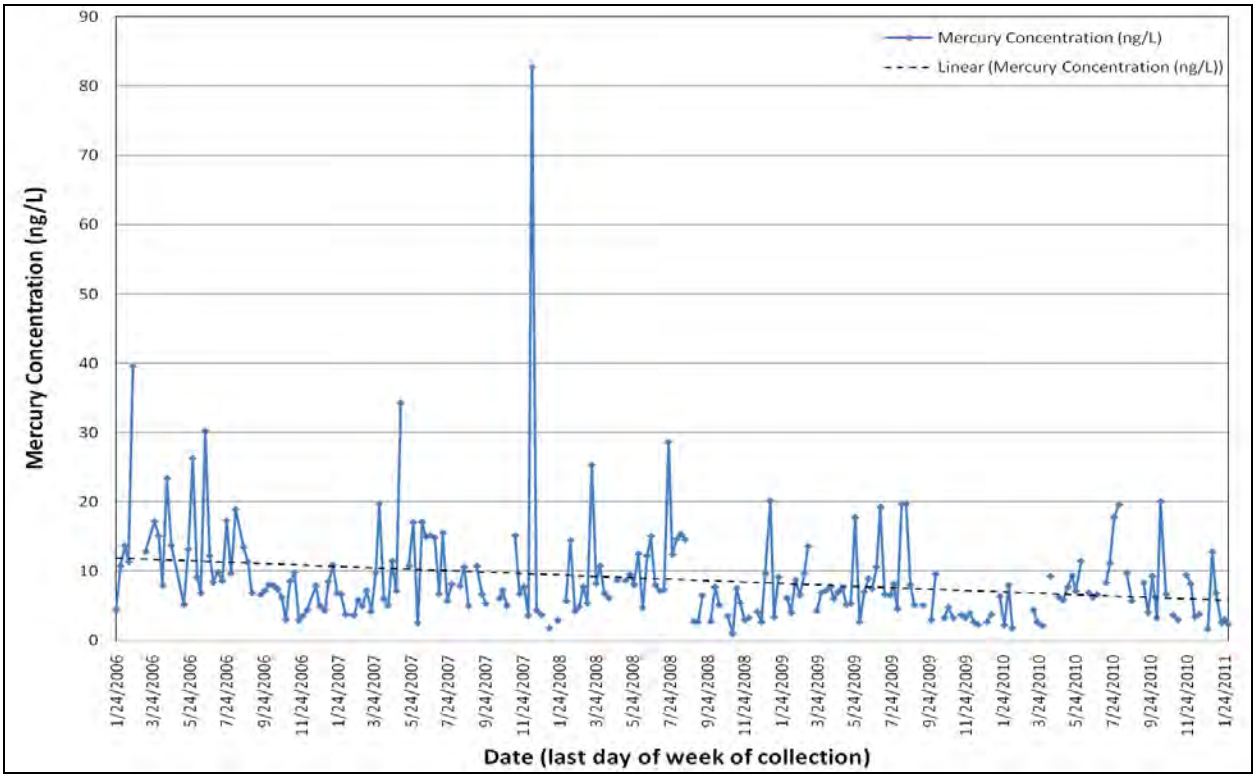


Figure 2c: Mercury Concentration in Wet Deposition at New Brunswick

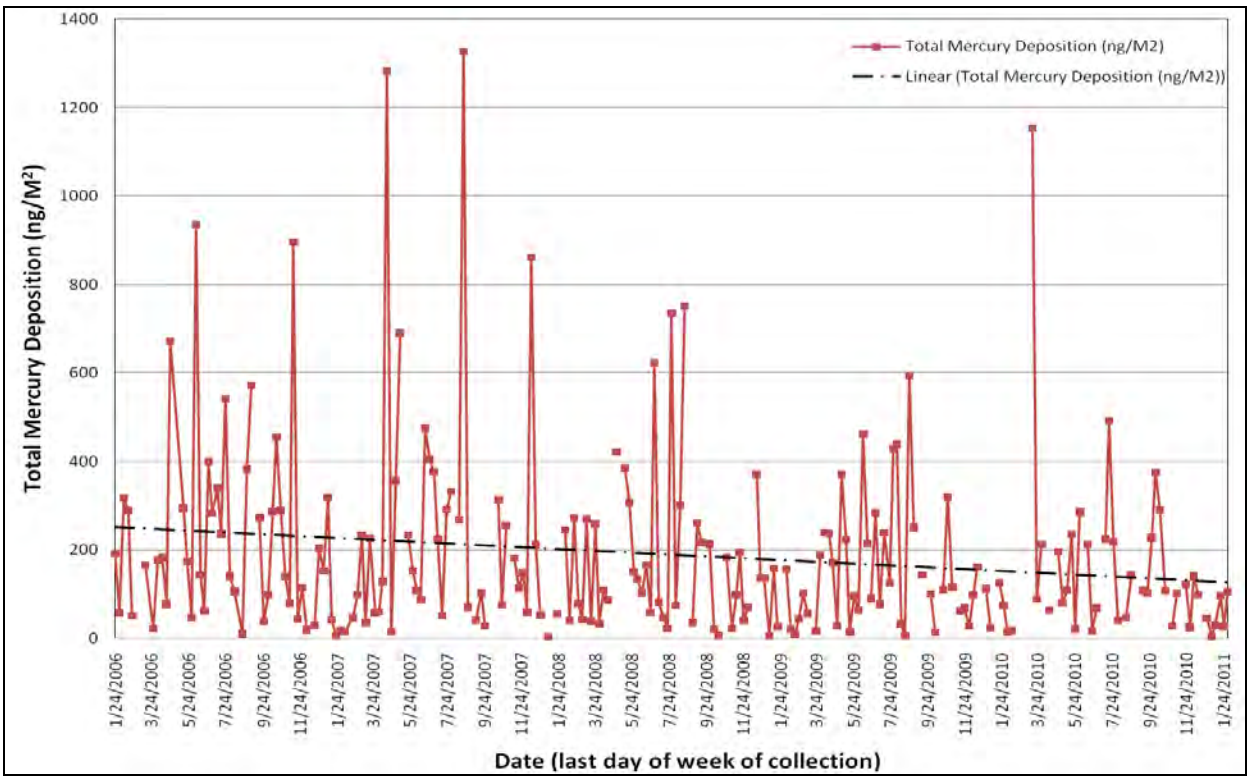


Figure 2d: Total Mercury Deposition in Wet Deposition at New Brunswick

Advisories) (National Atmospheric Deposition Network, 2011).

Mercury deposition has been monitored at New Brunswick from 2006 to the present as part of the NADP Mercury Deposition Network (MDN). **Figures 2c** and **2d** display the New Brunswick data for wet deposition, also presenting a linear regression line showing a downward trend in mercury concentration and total mercury deposition (National Atmospheric Deposition Network, 2011).

A separate study of mercury in lake sediment cores (which may be representative of atmospheric deposition over time) throughout New Jersey demonstrated that, while mercury levels have decreased, they are still present at levels far higher than natural levels. (Kroenke et al, 2003; Schuster et al, 2004).

Radon

Radon is a radioactive gas that is naturally occurring in New Jersey rocks, soil and ground water. Radon gas can become concentrated indoors, where it can increase risks of lung cancer. Because there is no known safe level of exposure to radon, the USEPA strongly recommends taking measures to reduce indoor radon if your radon test shows 4 pCi/L (picocuries per liter of air) or more, and to consider remediation if your test shows between 2 and 4 pCi/L (USEPA, 2011). The Borough of Highland Park is rated Tier 1, High Radon Potential. Tier 1 municipalities are designated where 25% or more of homes tested were 4 pCi/L or higher. New homes built in Tier 1 areas must include radon preventative features (N.J.A.C. 5:23-10.1 et seq.) (NJDEP Radon Section, 2011).

C. Existing Infrastructure

Public Water

Public water purveyors may be government agencies, private companies, or quasi-government groups. The water purveyor for Highland Park is the Borough of Highland Park Water Department, which purchases water from the Middlesex Water Company (see **Section 5C**). Water purveyors are regulated by the NJDEP Bureau of Safe Drinking Water, under the Safe Drinking Water Act. *Public Community Water Supply* (PCWS) wells are wells that supply potable water to public communities, and serve at least 15 connections used by year-round residents or which serve at least 25 year-round residents. There are no PCWS wells within the Borough of Highland Park (NJDEP Bureau of Environmental Assessment, 2004).

Sewer Service Areas

The NJDEP administers the Statewide *Water Quality Management (WQM)* Planning rules found in N.J.A.C. 7:15. The rules establish a mechanism for determining whether proposed projects or activities are consistent with the statewide WQM Plan (see **Internet Resources**). This process includes development and adoption of a *Wastewater Management Plan (WMP),* a document that provides 20 year planning for wastewater and certain other water quality concerns. Middlesex County, the responsible agency for the WMP within the county, must notify, seek comments from, and offer to confer with all government units that have regulatory or planning jurisdiction over wastewater or land use in the county, and all government units and public utilities that own, operate, or have contracts or NJDEP permits for sewerage facilities identified in the WMP. Statewide, counties are updating their WMP at the time of this writing (see **Internet Resources**). A WMP is valid only after submission to NJDEP and adoption by the Governor or his designee as a WQM plan amendment (NJDEP Division of Watershed Management, March 2011).

The WMP includes mapping the planned method of wastewater disposal for specific areas, shown in **Figure 2e**. The public *Sewer Service Areas* (SSA) mapped on **Figure 2e** show areas served by sewers. Areas not designated as SSAs are planned for service by individual subsurface disposal system (septic systems) discharging less than 2,000 gallons per day (gpd) (where the site conditions and existing regulations allow) (NJDEP BWR, 2008).

Highland Park is within the Sewer Service Area of the Middlesex County Utility Authority. **Figure 2e** illustrates the entire extent of the Middlesex County Utility Authority, which includes much of Middlesex County. **Figure 2e** also shows the sewer infrastructure within Highland Park, including the trunk interceptor lines.

Brownfields

The New Jersey Department of State Office for Planning Advocacy defines *brownfields* as any former or current commercial or industrial site, currently vacant or underutilized, on which there has been, or there is suspected to have been, a discharge of a contaminant. The purpose of the Brownfields and Contaminated Site Remediation Act (N.J.A.C. 58:10) is to develop strict remediation standards in order to protect public health and safety and the environment. In order to encourage clean-up of contaminated sites, NJDEP provides financial incentives, liability protection, cleanup procedures that are cost effective and regulatory action that is timely and efficient (NJDEP Site Remediation Program, 2010).

The Brownfields SiteMart was developed to highlight and denote locations of brownfield sites in order to promote the redevelopment of brownfields throughout the State. The 9 brownfield sites currently located within Highland Park are listed in **Table 2.5** and shown on **Figure 2f**.

Table 2.5: Brownfields

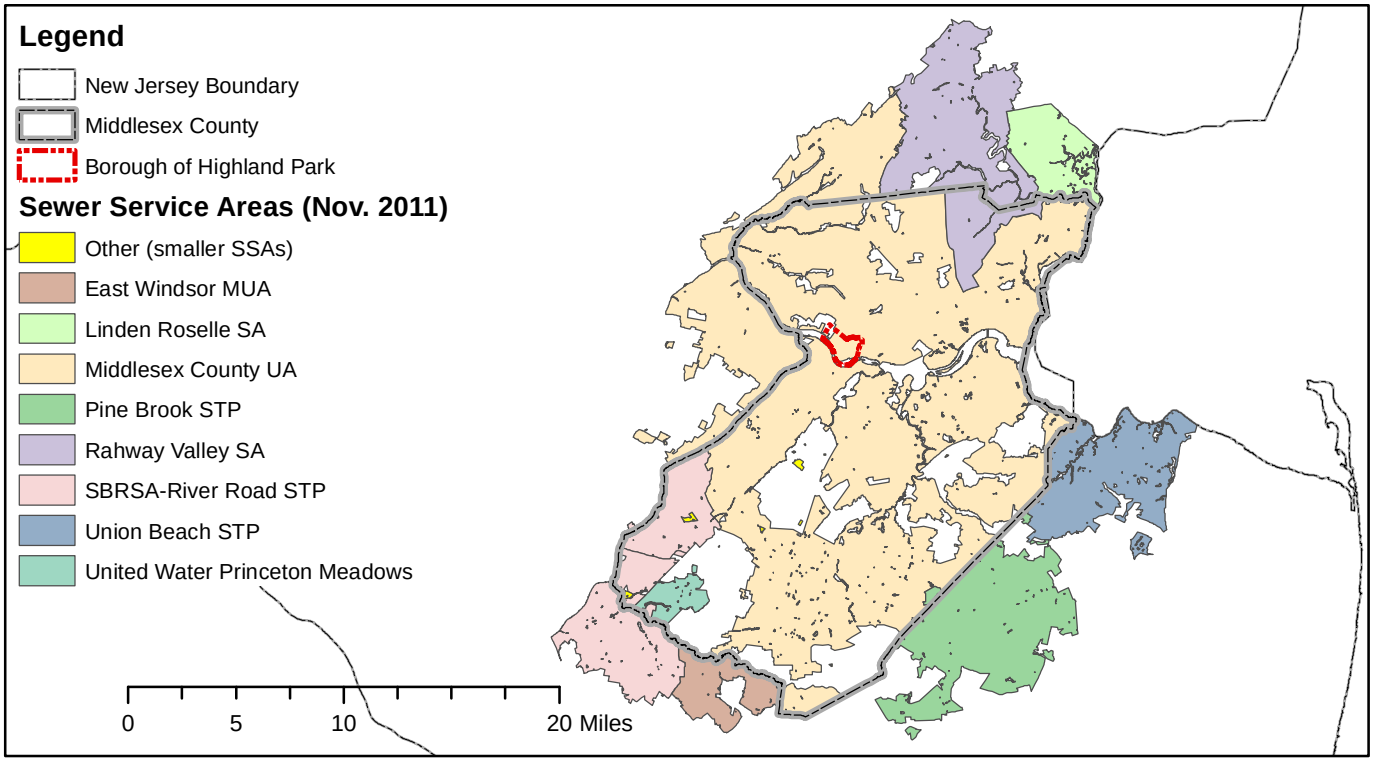
Site ID❖	PI Number*	Site Name	Address	Current Site Name/ Status
7866	004611	Astra Cleaners	705 Raritan Ave	Rainbow Cleaners
7867	032895	Highland Park Service Center Inc.	126 Raritan Ave	
7868	018773	Midland - Ross Corp	100 Cleveland Ave	
7869	004442	Ubry's Inc.	115 Raritan Ave	Highland Park One
7870	000923	Bergen's Car Care Center	101 Raritan Ave	
7871	010999	Highland Park Dept. Of Public Works	444 Valentine St	
7872	030258	Acme Motors Inc.	211 Woodbridge Ave	
7873	021277	Auto Spa	1010-1020 Raritan Ave	Lube It All
7876	194327	Red's Marina	Skyview Terrace	"Ayres Beach" Open Space/ Remediation has occurred, awaiting "No Further Action" letter from DEP

Notes: Three locations in the Brownfields GIS data are residential/developed properties, therefore not candidates for redevelopment, so they are not listed here or on Figure 2f.
❖Identification number used on NJ SiteMart.
*Program Interest ID used by NJDEP.

Sources: NJ Department of Community Affairs, Office of Smart Growth, December 2008; NJ Office for Planning Advocacy, June 2011; Highland Park Environmental Commission, June 6, 2011.

Cell Towers, Railroads and Stormwater Outfall Points

Figure 2g shows additional infrastructure within Highland Park. This includes 6 cell tower locations, the NJ Transit Northeast Corridor railroad and 39 stormwater outfall points.



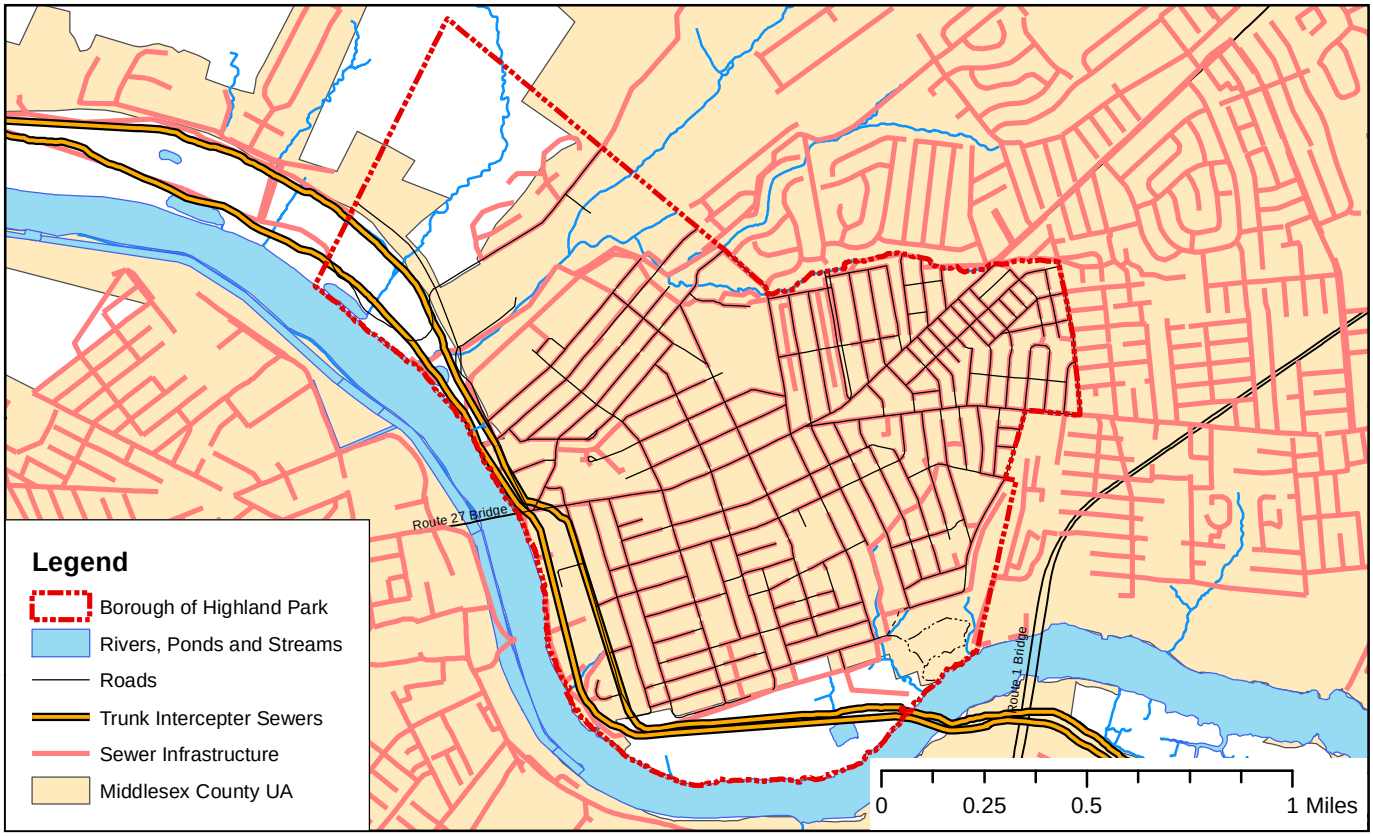


Figure 2e: Sewer Service Areas in Middlesex County (top) and Public Sewer System in Highland Park (bottom)

N
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S

Borough of Highland Park ERI 2012
Prepared by Kratzer Environmental Services

Data Sources: See Appendix B.
Note: Map accuracy is limited to the accuracy and scale of the original data sets; see Appendix B.
Disclaimer: This map was developed using NJDEP GIS digital data, but this secondary product has not been verified by NJDEP and is not NJDEP authorized.

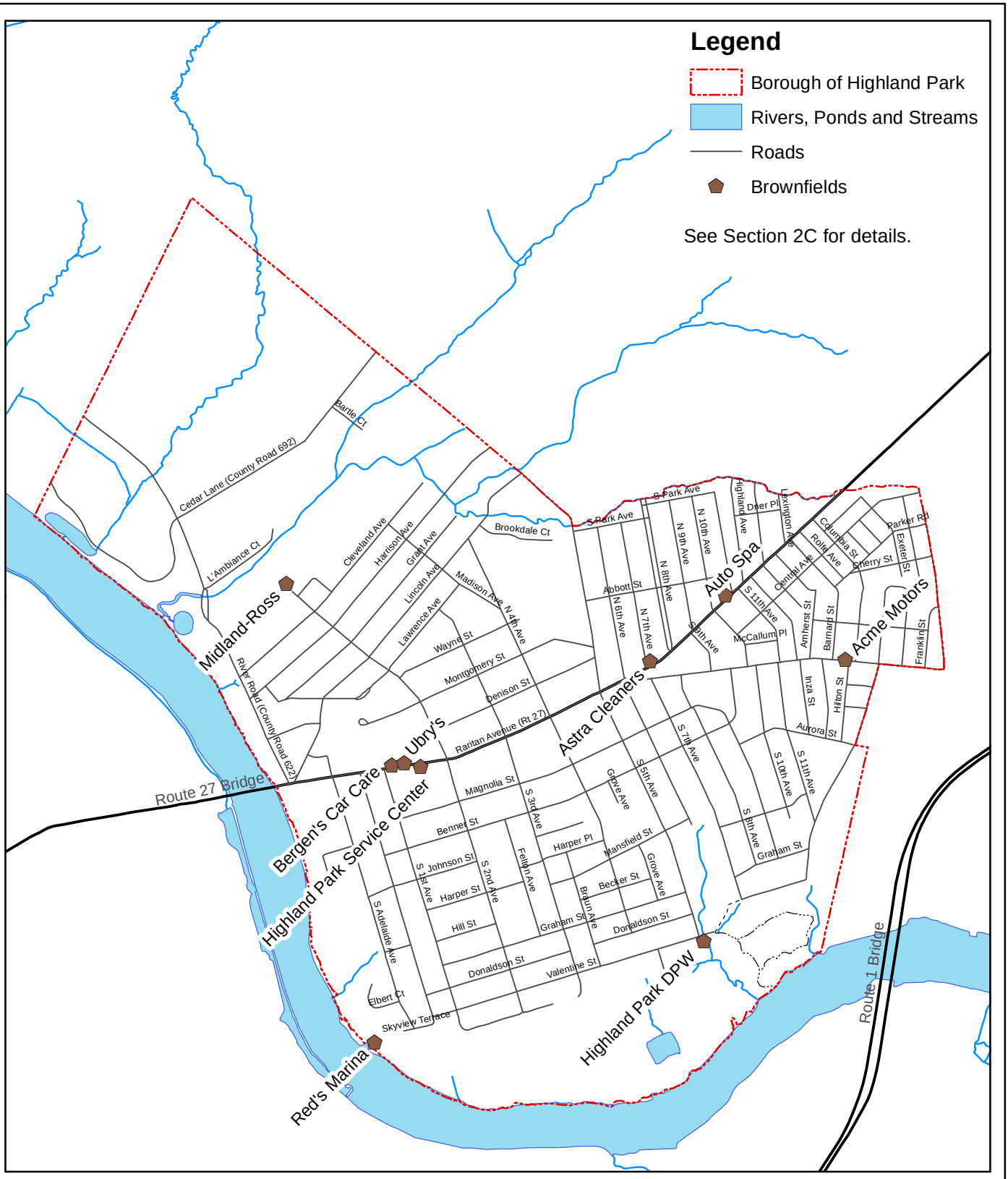

Figure 2f: Brownfields

Borough of Highland Park ERI 2012
Prepared by Kratzer Environmental Services

Data Sources: See Appendix B.
Note: Map accuracy is limited to the accuracy and scale of the original data sets; see Appendix B.
Disclaimer: This map was developed using NJDEP GIS digital data, but this secondary product has not been verified by NJDEP and is not NJDEP authorized.

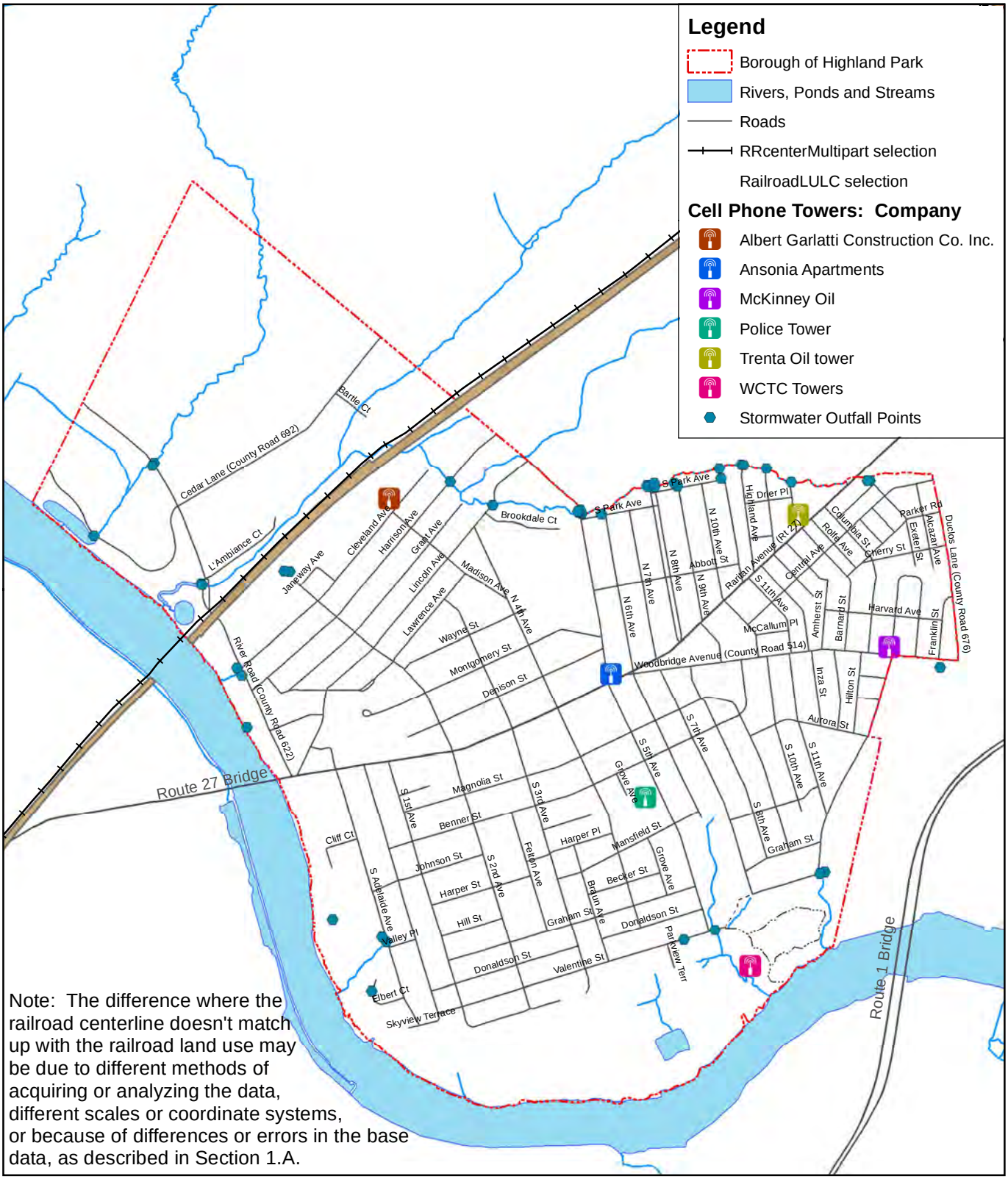

Figure 2g: Cell Towers, Railroads and Stormwater Outfall Aggregate

N
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0 0.125 0.25 0.5 Miles
0 500 1,000 2,000 Feet

Borough of Highland Park ERI 2012
Prepared by Kratzer Environmental Services

Data Sources: See Appendix B.
Note: Map accuracy is limited to the accuracy and scale of the original data sets; see Appendix B.
Disclaimer: This map was developed using NJDEP GIS digital data, but this secondary product has not been verified by NJDEP and is not NJDEP authorized.

D. Noise and Light Pollution

Light pollution is defined as excess or obtrusive light created by humans. Light pollution obstructs views of stars and planets, disrupts ecosystems and impacts human health and safety. Thousands of stars should be visible in the night sky, but as few as 10% of Americans live in areas where they can view them (Bower, 2000). Ecological impacts of light pollution range from contributing to algal blooms, disrupting feeding and mating of nocturnal animals such as frogs, bats, fireflies and moths, and killing migrating birds. Most migrating birds navigate at night by the moon and stars, and artificial lighting short-circuits their ability to navigate, causing millions of fatalities from collisions annually (Guynup, 2003; Bower, 2000).

At least 1/3 of our lighting is wasted because it shines upward or sideways, most of which was created by burning fossil fuels, thereby wasting energy and contributing to global warming and polluting air and water. Links between artificial light and human health, such as cancers, have also been documented. Finally, reduced and non-glaring lighting has been shown to decrease crime (Bower, 2000).

Highland Park is impacted by a number of sources of light pollution. First, the general glow from the New York and central New Jersey metropolitan areas is visible in the night sky. Local sources include light from housing developments, businesses, residences and street lights.

Noise pollution, defined as unwanted or excessive sound, is another undesirable by-product of modern life. It can be a nuisance, interfere with activities, and can cause physical damage. Transportation noise is among the most pervasive noise sources in our environment today, particularly for people who live within 500 feet of heavily traveled highways or within 100 to 200 feet of lightly traveled roads (Washington County Task Force, 2005).

Federal highway noise criteria (which apply only to federal highways) range from 57 to 72 decibels (depending on adjacent land use) (USDOT, FHA, 2006). New Jersey's Noise Control Act of 1971 authorized the NJDEP to develop regulations relating to the control and abatement of noise. While these regulations do not specify noise criteria, a sample municipal ordinance is provided with sound level standards of 50 decibels during nighttime (10:00 p.m. to 7:00 a.m.) and 65 decibels during daytime (NJDEP, 2008). The Middlesex County Public Health Department (MCPHD) is authorized by NJDEP to enforce noise pollution regulations in the State Noise Pollution Code (N.J.A.C. 7:29) (Middlesex County Public health Department, 2007).

Highland Park is subjected to noise pollution from cars and trucks on the state and interstate roads.

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Internet Resources: Local & Regional Conditions

Climate and Meteorology

Office of the New Jersey State Climatologist (ONJSC)

- ONJSC Home Page: http://climate.rutgers.edu/stateclim/
- NJ Drought Watch: http://www.njdrought.org/
- Drought Status of Central Region: http://www.njdrought.org/status.html#central
- Weather and Climate Network Index: http://climate.rutgers.edu/njwxnet
- Weather and Climate Network - New Brunswick: http://climate.rutgers.edu/njwxnet/station.php?s=1101

National Weather Service Advanced (NOAA) Hydrologic Prediction Service (flood predictions): http://water.weather.gov/ahps2/hydrograph.php?wfo=phi&gage=bdkn4&view=1,1,1,1,1,1,1,1"

National Weather Service Forecast Highland Park, NJ http://forecast.weather.gov/MapClick.php?CityName=Highland+Park&state=NJ&site=PHI&lat=40.5003&lon=-74.4284

State of New Jersey Global Warming Home Page: http://www.state.nj.us/globalwarming/index.shtml

US Environmental Protection Agency (USEPA) Climate Change: http://epa.gov/climatechange/index.html

USGS Real-Time Stream Flow Stations:

- 01403060 Raritan River below Calco Dam at Bound Brook NJ: http://waterdata.usgs.gov/nj/nwis/uv/?site_no=01403060&PARAmeter_cd=00065,00060

Index of NJ sites: http://waterdata.usgs.gov/nj/nwis/current/?type=flow

Air Quality

Current Air Quality: New Brunswick (Cook Campus).
http://www.njaqinow.net/StationInfo.aspx?ST_ID=21
http://www.njaqinow.net/Online.aspx?ST_ID=21;0
http://www.state.nj.us/dep/airmon/newb.htm

Current Air Quality: Rutgers University (Ryders Lane).
http://www.njaqinow.net/StationInfo.aspx?ST_ID=25
http://www.njaqinow.net/Online.aspx?ST_ID=25;0
http://www.state.nj.us/dep/airmon/rut.htm

NJDEP Bureau of Air Monitoring
Home Page: http://www.njaqinow.net/Default.htm
Air Toxics in New Jersey: http://www.state.nj.us/dep/airmon/airtoxics/overview.htm
What you can do to reduce air toxics? http://www.state.nj.us/dep/airmon/airtoxics/youcan.htm

NJDEP Radon Information: http://njradon.org or call 1-800-648-0394

United States Environmental Protection Agency Air Topics: http://www.epa.gov/ebtpages/air.html

Existing Infrastructure

Water:
Middlesex Water Company: http://www.middlesexwater.com/
NJ Statewide Water Supply Plan (1996): http://www.nj.gov/dep/watershedmgt/DOCS/SWSPlan/SWSP.pdf

Sewer:
Middlesex County Wastewater Mgmt Plan (2011): http://www.co.middlesex.nj.us/planningboard/wastewater_plan.asp
Middlesex County Utility Authority: http://www.mcua.com/authority.htm

Brownfields SiteMart Search:
http://www.njbrownfieldsproperties.com/Search.aspx

Light:
NJ Astronomical Society - Light Pollution: http://www.njaa.org/light.html
Simple Scale for Evaluating sky darkness: http://darkskyinitiative.org/links/how_dark_my_sky.html

Railroad:
NJ Transit Northeast Corridor: http://www.njtransit.com/pdf/rail/R0070.pdf

3: PHYSIOGRAPHY, TOPOGRAPHY & GEOLOGY

A. Physiography

New Jersey can be divided into four regions, known as *physiographic provinces*, which are areas with a common geologic history and similar sequences of rock types and geologic structures (see **Figure 3a**). The geologic history of New Jersey is summarized in **Table 3.1**.

During the Precambrian and Paleozoic Eras, the land that is now New Jersey was at the bottom of the sea, close to the equator. About 400 million years ago, the continents Europe and North America collided, forming the Appalachian Mountains, which at that time reached far higher and were more rugged than the Rocky Mountains are now (Gallagher, 1997).

The long, parallel ridges and valleys that characterize the northwestern section of New Jersey form the *Valley and Ridge Province*. The ridges are composed of erosion-resistant sandstone and siltstone bedrock while easily-eroded shale and limestone underlie the valleys (NJGS, 1999). No rocks of Precambrian or Paleozoic age exist within Middlesex County (Dombroski, 1980).

Bordering the Valley and Ridge Province to the southeast, the *Highlands Province* consists of metamorphic rocks of Precambrian age (the oldest rocks in the state). The granites and gneisses are resistant to erosion and create a hilly upland with deep, steep-sided valleys carved by streams.

The Highlands Province is separated from the *Piedmont Province* by a series of major faults. The Piedmont Province, covering roughly the northwest half of Middlesex County, is characterized by gently rolling hills. The rocks of the Piedmont are of Late Triassic and Early Jurassic age. As sediments eroded from adjacent uplands, and were deposited along rivers and lakes within the basin, they became compacted and cemented to form conglomerate, sandstone, siltstone and shale.

Roughly 200 million years ago, the supercontinent Pangaea broke apart, and the Atlantic Ocean was born. This was accompanied by volcanic activity, which resulted in magma flowing at or near the surface. When the diabase[11] intruded, the surrounding sedimentary rocks were hardened by heat and pressure, and are known as hornfels rocks, or traprock, some of which have been quarried commercially. These exist today as the erosion resistant outcrops and hills found in the Palisades, the Sourland Mountains, and, within Middlesex County, Sand Hills, Little Rocky Hill and Rocky Hill (Gallagher, 1997; Dombroski, 1980). Highland Park lies entirely within the Piedmont Physiographic Province (NJGS, 2007) (see **Figure 3a**).

Overlapping the Piedmont Province to the southeast, diagonally bisecting Middlesex County about a mile south of Highland Park, the relatively flat terrain of the *Coastal Plain Province* consists of unconsolidated sedimentary formations, such as sands, clays, and marls (NJGS, 1999).

Within the past two million years, the climate alternated between cool and warm. During periods of glaciation, the glaciers came as far south as Perth Amboy, NJ, while the area below that, including Highland Park, became a cold tundra. At times, the location of Highland Park was under the Atlantic Ocean, although at other times, the shore may have extended a hundred miles beyond the present shore (NJGS, 1999).

[11] *Diabase* is a rock formed by the cooling of magma at some depth in the crust (i.e. the magma did not erupt at the surface), while basalt formed when the magma was extruded onto the surface.

Table 3.1: Summary of New Jersey's Geologic History

Period	Million Years Ago	Description of Climate and Fossils Found in Corresponding Bedrock
Precambrian Era		
	Up to 544	**Climate:** New Jersey was under the sea. **Fossils:** stromatolites; most life forms were soft bodied and left no fossils
Paleozoic Era		
Cambrian Period	544 – 505	**Climate:** New Jersey was close to the equator, covered by warm tropical seas. **Fossils:** trilobites, brachiopods, stromatolites, worm burrows
Ordovician Period	505 – 440	**Climate:** New Jersey continued to be underwater, as the sea above deepened to oceanic depths. **Fossils:** trilobites, brachiopods, coral, nautiloids, clams, crinoids, and snails
Silurian Period	440 – 410	**Climate:** The sea level rose and fell, with New Jersey remaining at the sea floor. **Fossils:** coral, brachiopods, clams, brine shrimp, primitive fish, eurypterids (sea scorpions), arthrophycus (fossilized feeding burrow made by a worm-like animal)
Devonian Period	410 – 360	**Climate:** Europe collided with North America, forming the mountains which are now the Ridge and Valley and Highlands provinces of New Jersey. The fossils found continued to be aquatic life forms. **Fossils:** brachiopods, clams, trilobites, nautiloids, crinoids, coral, snails, stromatoporoids, ostracodes, bryozoa
Mississippian, Pennsylvanian & Permian Periods	360-248	**Climate:** No geologic record of these time periods is present in New Jersey. At some point, the sea subsided, and New Jersey became dry land, at least in part. **Fossils:** none
Mesozoic Era		
Triassic Period	248 – 200	**Climate:** New Jersey was next to Morocco, part of the supercontinent Pangaea. In the dry interior of the continent, the area experienced greater daily and seasonal fluctuations than the coasts. The rugged landscape consisted of high young mountains and deep valleys formed by faults. The brief rainy seasons' flashfloods dropped mud and silt in low areas, where playa lakes formed. In the end of the Triassic the climate became desert-like. The lakes began to dry up and became salty, resulting in an environment where brine shrimp flourished. When a lake went dry, some fish and other aquatic life became fossils. **Fossils:** dinosaur footprints, thecodonts, fish (including coelacanths), phytosaurs, amphibians, insects, plants
Jurassic Period	200 – 145	**Climate:** The breakup of Pangaea resulted in the beginning of the Atlantic Ocean. Igneous intrusions (molten rock forced into earlier rock formations) formed diabase and basalt bedrock. Because the terrain was mountainous, the net geologic action was erosion, not deposition. **Fossils:** There are no late Jurassic deposits in New Jersey; therefore no fossils exist from this period. However, the fauna probably consisted of the same dinosaurs as the American West, including sauropods, armored dinosaurs, ornithopods (forerunner of hadrosaurus), tenontosaurus (relative of the iguanadon). True flowering plants (angiosperms) appeared at this time.
Cretaceous Period	145 – 65	**Climate:** Northern New Jersey was above sea level, while southern New Jersey experienced flooding and ebbing. The sea level changed cyclically from deeper to shallower water in this tropical environment. During flooding, greensand marl (glauconite) was formed. During ebbing, clay and sand were deposited. **Fossils:** Fossil phytoplankton, clams, snails, crustaceans, ammonites, oysters, reptiles, sharks, burrows, worm tubes and vertebrates such as mosasaurs have been found in New Jersey's coastal plain. The fossil dinosaurs found include hadrosaurus (which probably washed downstream during a flood), ornithomimus, *Dryptosaurus aquilunguis* (a 17' predator with a great hand claw), *Hadrosaurus foulkii*, and *Hadrosaurus minor*.

Continued on next page

Cenozoic Era		
Tertiary Period	65 – 1.8	**Climate:** The climate was warm, and the sea level was higher, covering much of the Coastal Plain (see **Figure 3a**). **Fossils:** Fossils of land animals include birds, such as the diatryma (a giant flightless bird), tillodont (an extinct mammal the size of a bear, but with rodent-like teeth) and possibly others similar to those found in the South Dakota badlands, such as brontotherium, ancestral horses, entelodonts (resembled giant warthogs), diceratherium (semi-aquatic rhinoceros), peccary, prosynthetoceras (a camel), anchitherium (horse), and a primitive doglike carnivore. Fossils found in the Outer Coastal Plain include brachiopods, corals, sponges, clams, sharks, mollusks, crinoids, mammals (probably washed to the sea in floods), crocodiles, snakes, and early whales.
Quaternary Period	1.8 - present	**Climate:** The climate alternated between cool and warm, resulting in four intervals of glaciation. The glaciers covered northern New Jersey, reaching as far south as Belvidere on the Delaware River. South of the glacial ice, treeless, frozen tundra existed. When water was frozen in glaciers, the sea level was lower, resulting in a shoreline over a hundred miles east of the present coast. **Fossils:** Fossils of many familiar and some extinct animals have been found in nearby areas. There were insects, turtles, and snakes. Herbivores included squirrels, groundhogs, porcupines, beaver, muskrats, voles, mice, eastern cottontail rabbits, white-tailed deer, peccaries, tapirs, giant ground sloth, the elk-moose, giant beaver, American mastodon, and mammoth. Carnivores included otters, skunks, bobcats, foxes, black bears, coyotes, jaguars, jaguarundi, short-faced bear and a saber-toothed cat.
Sources: Gallagher, 1997; University of California Museum of Paleontology et al., 2003; USGS, 2002		

B. Topography

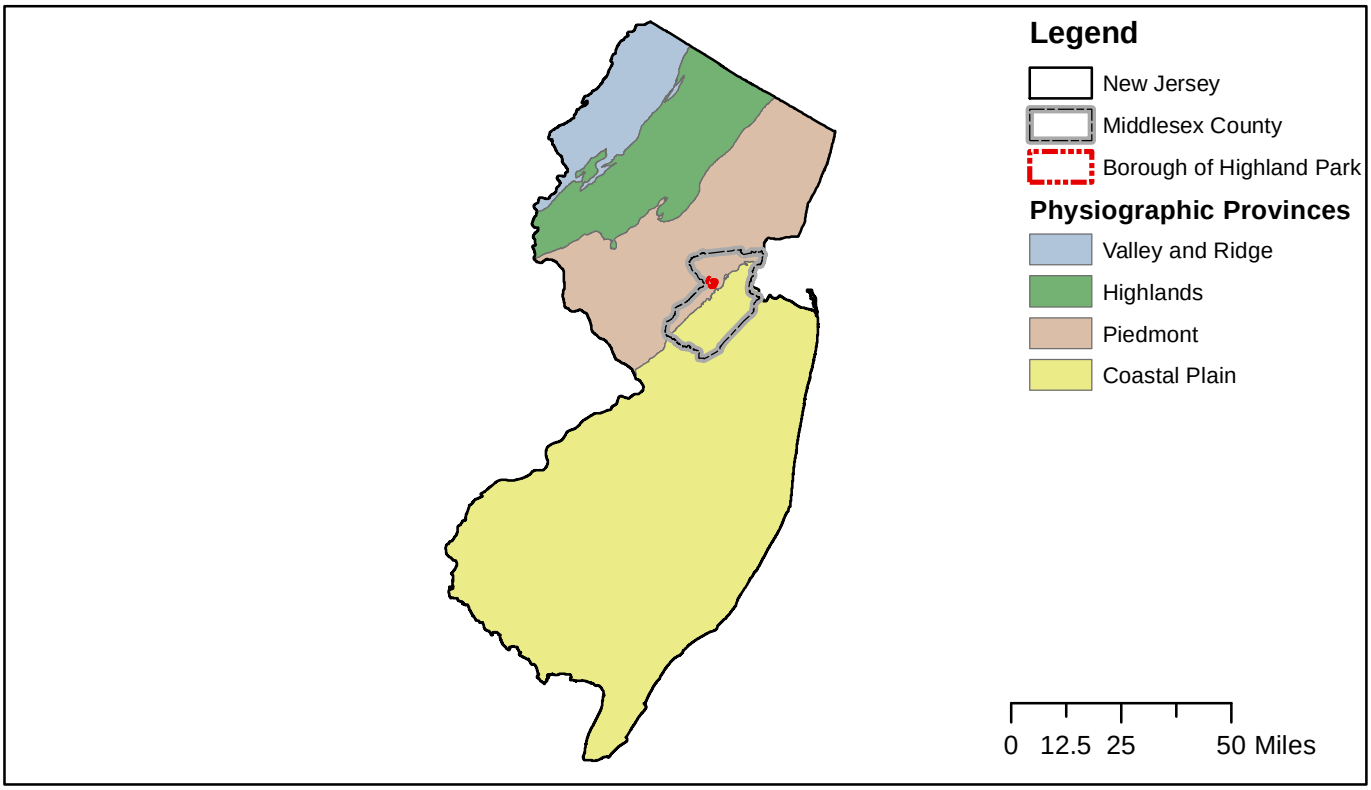
Topography depicts the relief features of an area. The elevation in Highland Park ranges from about 40 meters (131 feet) (at the north-central edge of the Borough, near Brookdale Court) to 0 meters (0 feet) above mean sea level (along the Raritan River)(see **Figure 3b**). In **Figure 3b**, each line represents 10 meters of elevation, and is drawn to follow the contour of the land. **Figure 3c** uses shaded colors to illustrate elevation in Highland Park.

Steep slopes present difficulties for driveway construction and for usable areas around a house. In addition, steeper slopes are more vulnerable to erosion. As the gradient or percent of slope increases, the velocity of runoff water increases, which increases its erosive power. A doubling of velocity of runoff water increases the erosive power fourfold and causes 32 times the amount of material of a given particle size that can be carried (Foth, 1978).

Erosion causes a number of harmful effects on the environment: loss of soil upon which plants and wildlife depend; loss of soil fertility, because the nutrients and organic material are more easily eroded; gully formation; loss of water that might have been useful for plant growth or ground water recharge; sedimentation of streams; and deposition of soil in navigable waters, creating the need for dredging to maintain navigability. Eroded sediment, and the nutrients, pesticides, and other chemicals carried with it, affects aquatic life in many ways. The sediments may bury fish eggs, reduce light available to aquatic plants, and reduce recreational quality and aesthetics.

Highland Park has a Steep Slope Ordinance (§230-122) (see **Internet Resources**).

Steep topography can be seen in **Figure 3c** where the color contrasts are the greatest. Slopes greater than 10 or 15% are generally considered "steep slopes." Available steep slope GIS data for Highland Park only depicts slopes greater than 30% (see **Figure 3d)**. Most areas of steep slopes are located along the Raritan River and along streams.



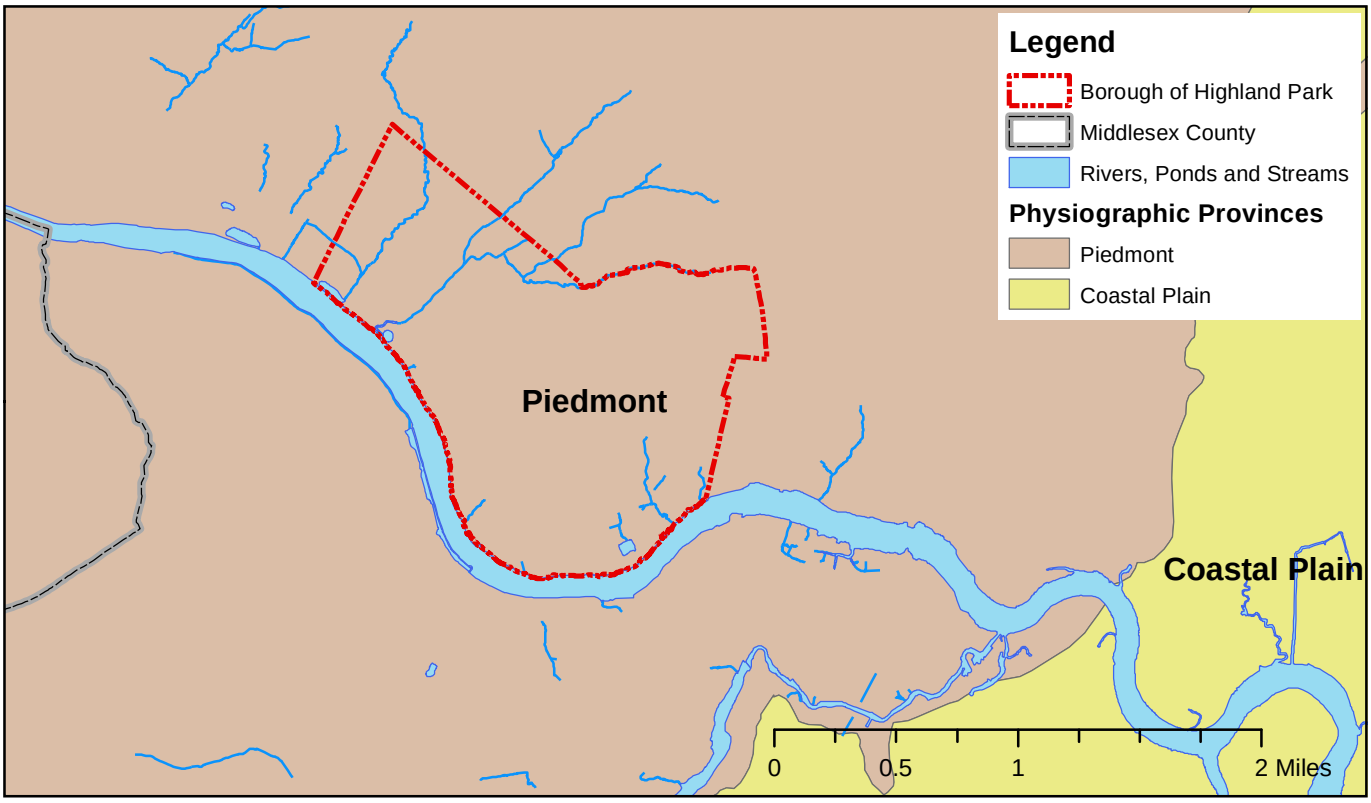


Figure 3a: Physiographic Provinces

N
W E
S

Borough of Highland Park ERI 2012
Prepared by Kratzer Environmental Services

Data Sources: See Appendix B.
Note: Map accuracy is limited to the accuracy and scale of the original data sets; see Appendix B.
Disclaimer: This map was developed using NJDEP GIS digital data, but this secondary product has not been verified by NJDEP and is not NJDEP authorized.

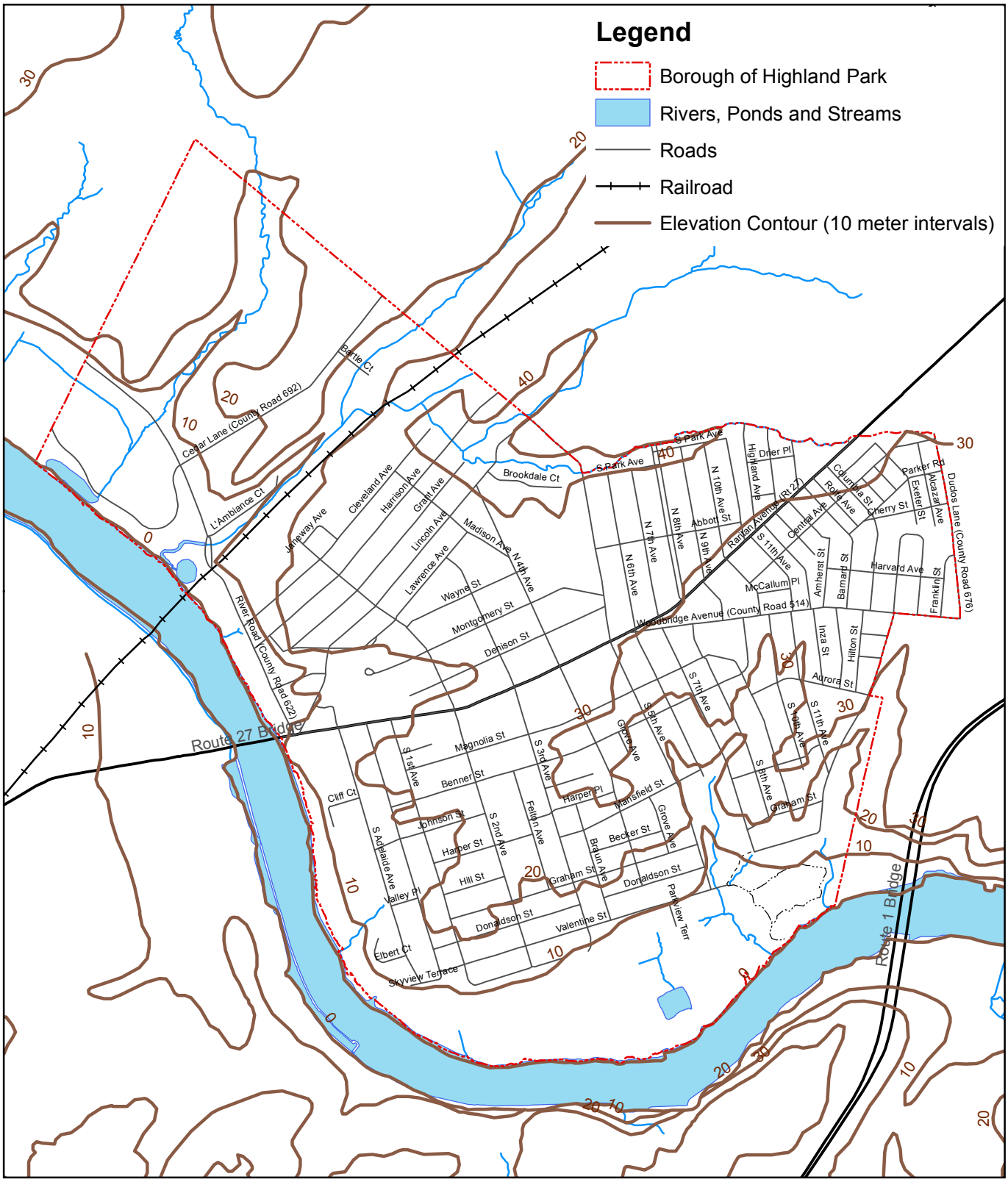


Figure 3b: Elevation (10 meter intervals)

N
W E
S

0 0.125 0.25 0.5 Miles
0 500 1,000 2,000 Feet

Borough of Highland Park ERI 2012
Prepared by Kratzer Environmental Services

Data Sources: See Appendix B.
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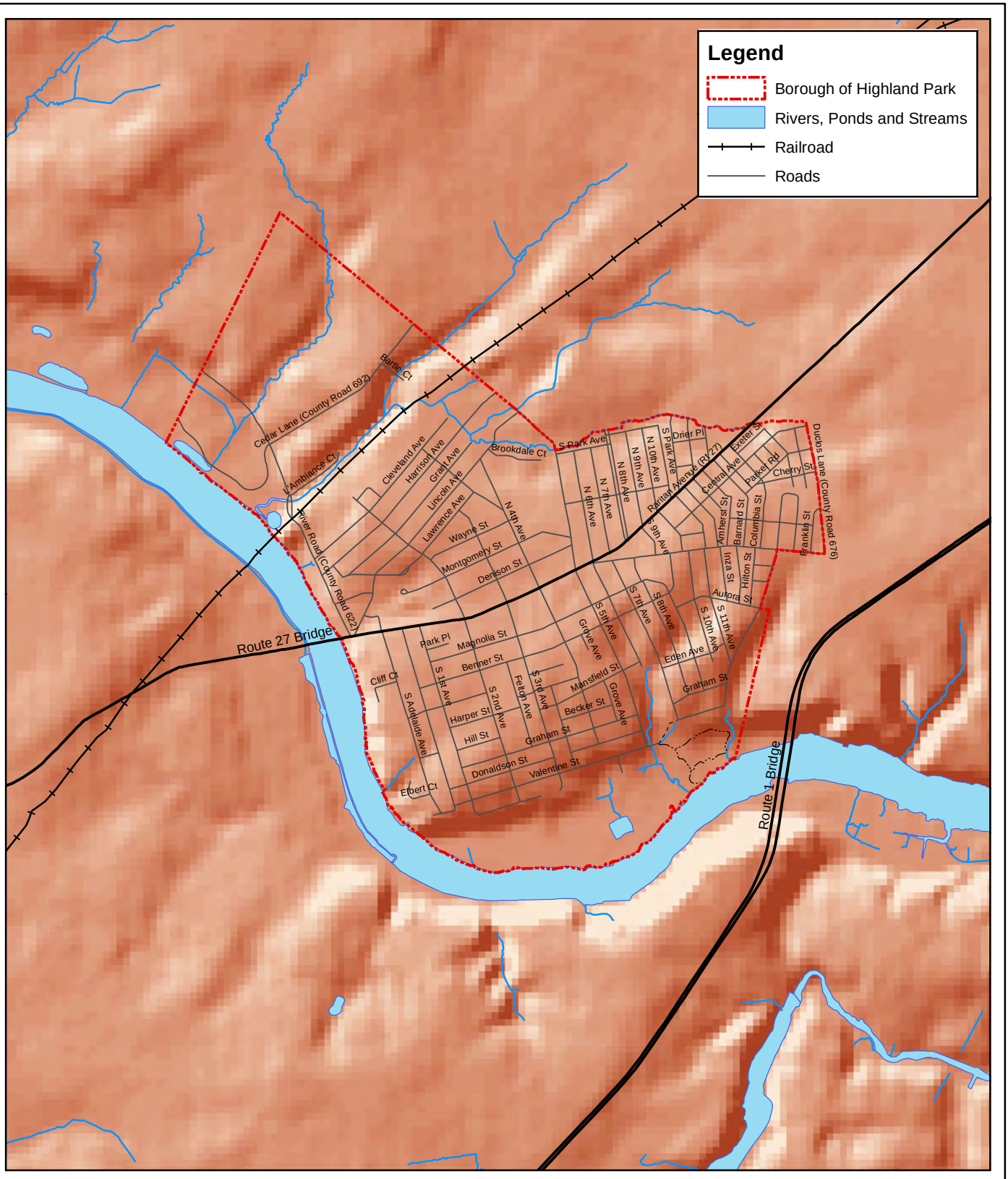

Figure 3c: Shaded Topography (Hillshade)

N
W E
S

0 0.25 0.5 1 Miles

0 500 1,000 2,000 Feet

Borough of Highland Park ERI 2012

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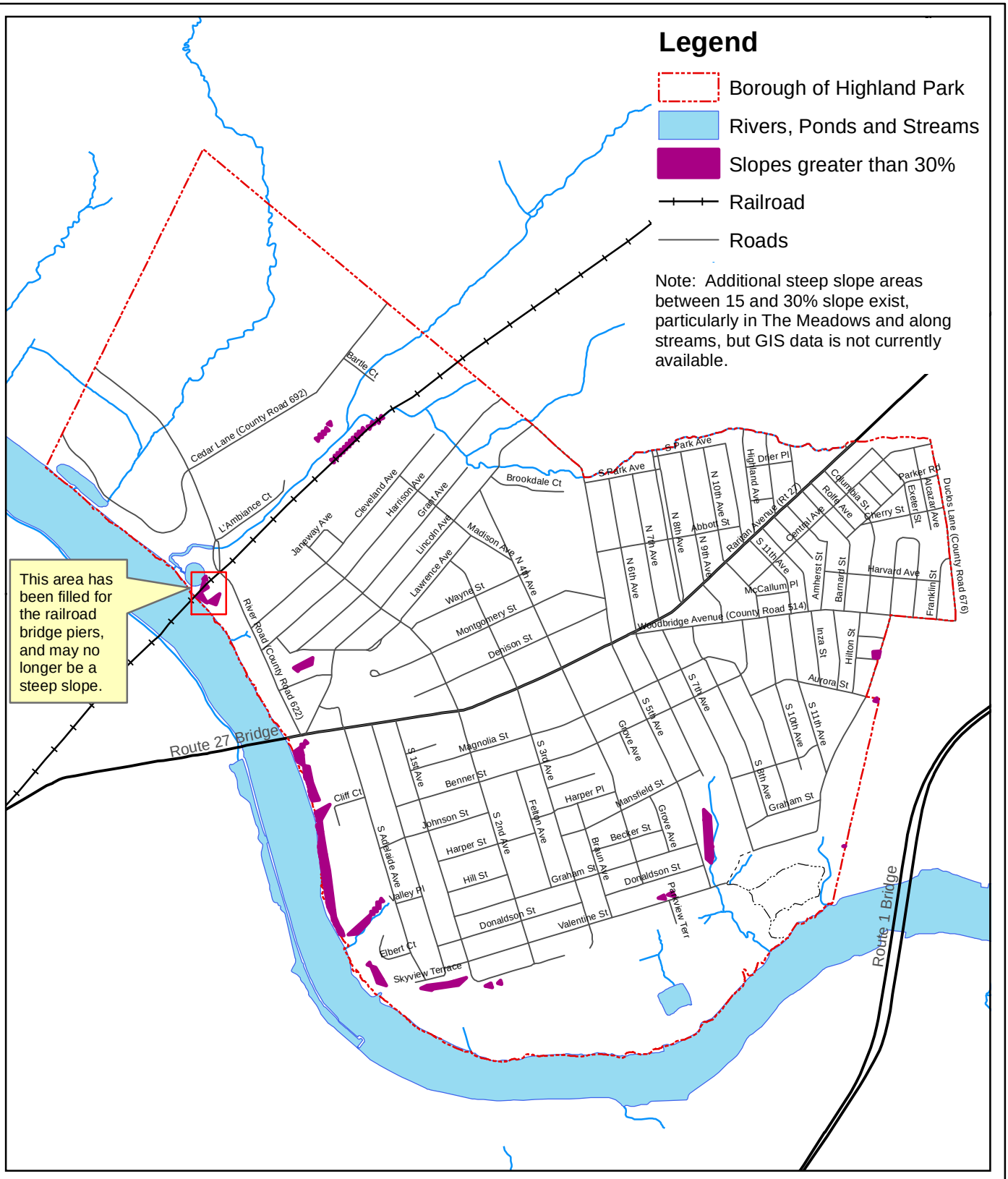

Figure 3d: Steep Slopes

Borough of Highland Park ERI 2012
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C. Bedrock Geology of Highland Park

Bedrock is the solid rock beneath the soil and surficial rock. The shales, siltstones, and sandstones of the *Passaic Formation* underlie the Borough of Highland Park (see **Table 3.2** and **Figure 3e**).

During the Mesozoic Era (248 to 65 million years ago, the time of the dinosaurs), streams eroded the high Appalachian mountains, dropping larger particles closer to the base of the mountains while carrying the smaller particles farther from the mountains. As the rivers reached flat plains, the water slowed and spread out into a fan shape. This alluvial fan deposited fine sands and clays, which, with time and pressure, became the sedimentary rocks of the Passaic Formation.[12] The Passaic shales were deposited during wet periods when the valleys drained to the sea (Dombroski, 1980).

There is no exact boundary between the Triassic and Jurassic periods; that is, the deposition was continuous during these time periods, resulting in a maximum thickness of 6,000 meters. Rocks that originally were laid down in nearly horizontal beds dipping[13] slightly to the south, have experienced geological forces which changed their inclination, and are now dipping about 15° northwestward (Dombroski, 1980; Olsen, 1980).

These Triassic-Jurassic sedimentary rocks exhibit two types of fracturing. Bedding fractures resulted from changes in the characteristics of the sediments at the time of deposition. In addition, fracturing occurred when weak sedimentary layers were pulled apart as the continents separated. Often these fractures have a vertical or near vertical orientation and extend a few inches to a few feet across (Van Houten, 1969).

Within Highland Park, the Passaic formation is exposed where the streams have eroded and cut into the formation (Townplan Associates, 1992).

Table 3.2: Characteristics of Bedrock Types Found in Highland Park

Abbre-viation	Geologic Formation	Lithology (physical character of the rocks)		Acres of Twp.	% of Twp.
		General	Detailed		
JTrp	Passaic Formation	red-brown shales, siltstones, and sandstones	Interbedded sequence of reddish-brown to maroon and dusky grayish-red siltstone, reddish-brown shaly siltstone to mudstone, separated by interbedded olive-gray to dark-gray siltstone and lesser silty argillite. Reddish-brown siltstone is medium-to fine-grained, thin- to medium-bedded, planar to cross-bedded, micaceous, locally containing mud cracks, ripple cross-laminations, root casts, load casts and evaporite minerals. Shaly siltstone to mudstone form rhythmically fining upward sequences as much as 15 feet thick. They are fine-grained, very thin- to thin-bedded, planar, to ripple cross-laminated, fissile, and locally bioturbated.	986	84%
Trpg	Passaic Formation Gray bed	sandstone, siltstone and shale	Gray bed sequences (JTrpg) are medium-to fine-grained, thin to medium bedded, planar to cross-bedded. Finer grained beds commonly laminated to thinly laminated, platy, with local desiccation features and disseminated pyrite. Thickness of gray bed sequences ranges from less than 1 foot to approximately 40 feet. Lower contact gradational into Lockatong Formation and placed where proportion of gray beds is greater than reddish-brown beds.	184	16%
Sources: NJGS, 2007; Van Houten, 1969; USGS, 2002; Stanford et al, 1989					

[12] The Passaic Formation was formerly known as the Brunswick Formation.
[13] In geology, dip means the inclination of the rock layer in reference to the plane of the horizon.

Mining & Quarrying

There are no records of mining or sand/gravel quarrying within Highland Park (NJGS, 2006).

Earthquakes

Damaging earthquakes are rare in Highland Park, but possible. Soils influence the potential for damage from earthquakes. Most areas of Highland Park have relatively shallow depth to bedrock, which dampens the movement of earthquakes (NRCS, August 18, 2008). However, soft soils (e.g. silt, clay, and fine sand) amplify the motion of earthquake waves, increasing ground shaking, while wet sandy soils can liquefy (Stanford, 2003).

No recorded earthquakes have had their epicenter in Highland Park, while 5 have occurred within 10 miles (see **Figure 3f)**. The closest, an earthquake of magnitude 4.1, was epicentered near South Amboy in 1895. This earthquake is the second most powerful earthquake of known magnitude recorded in New Jersey. The most recent nearby earthquake occurred in 2010 near Sayreville, with a magnitude of 2.3 (NJDEP NJGS, 2011).

Table 3.3: Earthquakes within 10 miles of Highland Park

Magnitude	Date	USGS Quadrangle Topographic Map	Location
4.1	9/1/1895	South Amboy, NJ	Near South Amboy
3.1	1/9/1992	Freehold, NJ	New Brunswick, NJ
0	3/11/1997	Monmouth Junction, NJ	3 km W of Rendall Park, NJ
2.3	7/15/1997	Monmouth Junction, NJ	12 km NE of Princeton, NJ
2.3	6/6/2010	South Amboy, NJ-NY	6 km SE of Sayreville, NJ
Source: NJDEP NJGS, 2011			

D. The Surficial Geology of Highland Park

Surficial materials are the unconsolidated sediments that overlie bedrock formations, and that are the parent material for soils. In Middlesex County they include fluvial (deposited by rivers), glacial, eolian (transported by wind), swamp, beach and estuarine deposits; weathered mudstone, sandstone and diabase material; and man-made fill. The surficial materials may be as much as 140 feet thick, although typically are less than 50 feet thick. They vary widely, leading to differences in the ability to transmit ground water to aquifers, to support structures and to provide sand and gravel resources (Stanford, 1999). The characteristics of surficial geology types found in Highland Park are provided in **Table 3.4** and illustrated in **Figure 3g**.

About 5 to 2 million years ago, a large southwesterly flowing river (the Pensauken River, which most likely drained a large area including what is now the Hudson River valley and southwestern New England) eroded a broad valley. When sea levels rose, sediments were deposited, building up the level of the streambed and filling the floodplain in a process known as aggradation. These deposits comprise the Pennsauken Formation (Tp)[14], which is found in the northeast section of Highland Park (Stanford, 1999).

About 2 million years ago, glaciation likely changed the course of the Pensauken River, and the Raritan River was established on the former Pennsauken Plain (although no glaciers reached as far south as Highland Park). Melting glaciers resulted in sea level rise, causing the sea to encroach on the Raritan River, resulting in the Raritan Bay (Stanford, 1999).

[14] Tp, Qal, etc. are standard abbreviations, with the first letter referring to the geologic period. See **Table 3.4**.

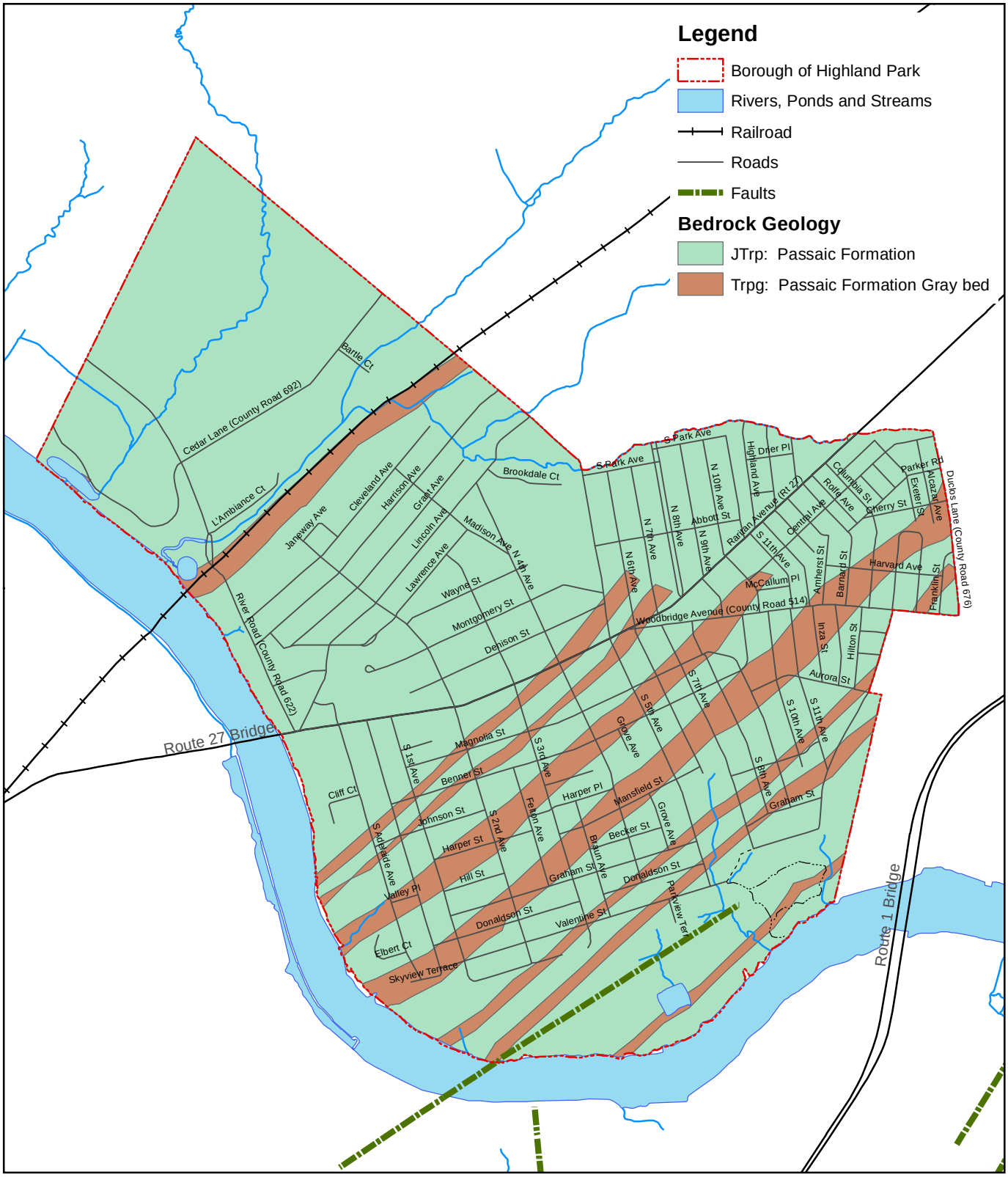

Figure 3e: Geology

Borough of Highland Park ERI 2012
Prepared by Kratzer Environmental Services

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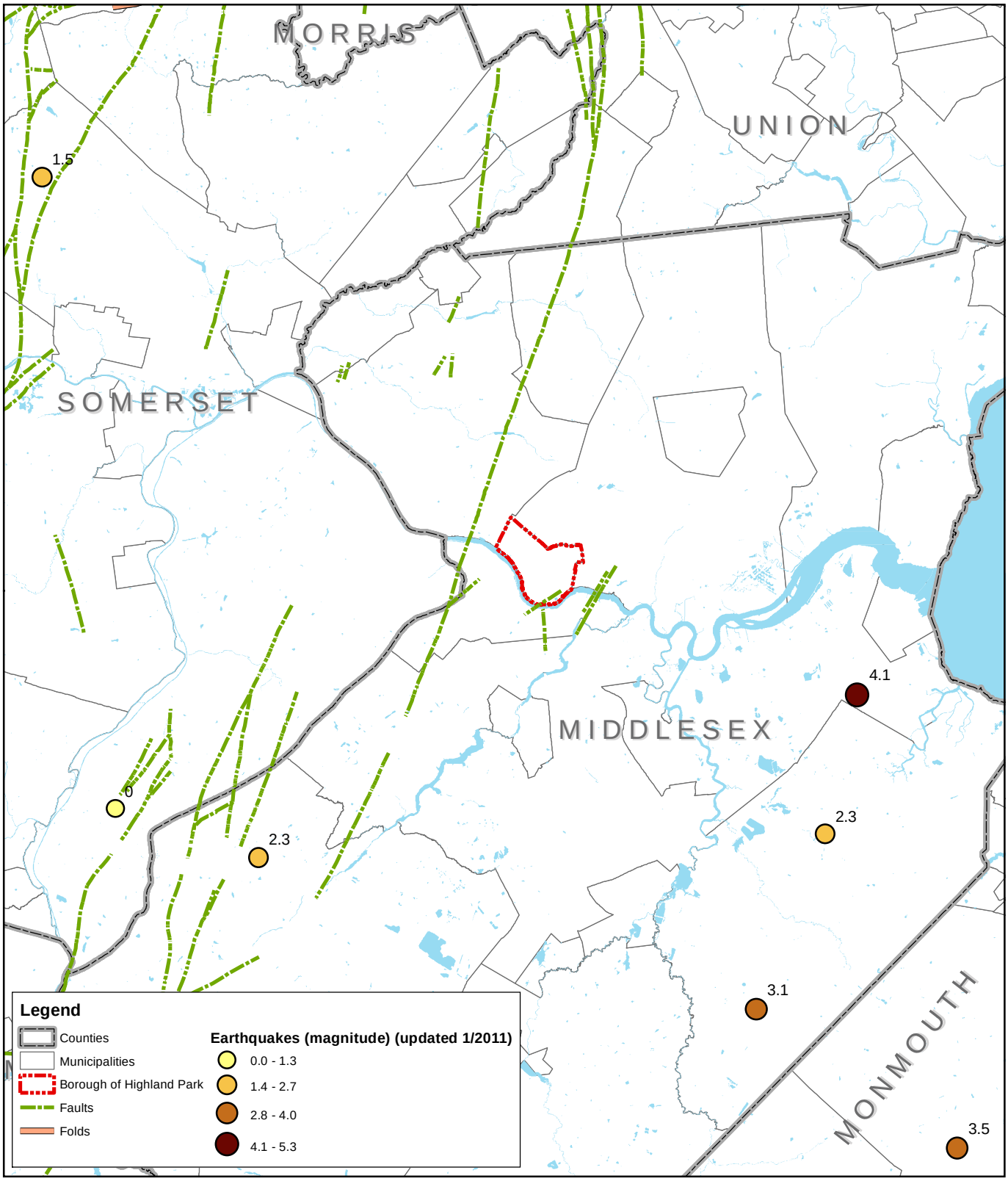

Figure 3f: Earthquakes, Faults and Folds

N
W E
S

0 1.25 2.5 5 Miles

Borough of Highland Park ERI 2012
Prepared by Kratzer Environmental Services

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The warming climate then allowed vegetation to grow and stabilize the ground, resulting in erosion rather than deposition. Erosion carved into the stream banks, where larger streams and rivers later deposited alluvium (floodplain and channel sediments) (Qal) (Stanford, 1999).

Areas subject to daily flooding by tides where rivers and streams adjoin the ocean resulted in the formation of estuarine deposits (Qmm). These contain abundant organic matter, with mineral soil textures dominated by silt and clay (Stanford, 1999).

Table: 3.4: Characteristics of Surficial Geology Found in Highland Park

Deposit Type	Lithology	Geologic Age	Notes
Pensauken Formation (Tp)	Sand, clayey sand, pebble gravel, minor silt, clay, and cobble gravel; yellow, reddish yellow, white. Sand typically includes weathered feldspar. Locally iron-cemented. As much as 140 feet thick.	Pliocene (approx. 5.3 to 2.6 million years ago)	The Pensauken Formation resulted from deposits in the former Pensauken River valley, which extended across the coastal plain from South Amboy, Middlesex County, NJ to Salem County in southern NJ.
Weathered Shale, Mudstone and Sandstone (Qws)	Silty sand to silty clay with shale, mudstone or sandstone fragments; reddish brown, yellow, light gray. As much as 10 feet thick on shale and mudstone, 30 feet thick on sandstone.	Pleistocene (approx 2.6 million to 10,000 years ago)	Weathered bedrock formed where the bedrock near the surface has been subjected to physical and chemical changes by atmospheric agents (i.e. the weather); soil textures depend on type of rock from which the soil is weathered.
Alluvium (Qal)	Sand, silt, pebble-to-cobble gravel; reddish brown, yellowish brown to brown. As much as 40 feet thick.	Holocene and late Pleistocene (approx 1.8 million to present)	Alluvium is deposited in modern floodplains and channels. Contains variable amounts of organic matter.
Estuarine Deposits (Qmm)	Silt, sand, peat, clay, minor pebble gravel; brown, dark-brown, gray, black. As much as 300 feet thick in the Hudson valley, up to 100 feet thick elsewhere.	Holocene (approx. 10,000 years ago to present)	Deposited in salt marshes, estuaries, and tidal channels during Holocene sea-level rise. Contain abundant organic matter.
Source: Stanford, 1999; NJGS, 2006			

Pensauken Formation (Tp)

The Pensauken plain, formed from deposits that filled the former Pensauken River valley, previously covered the entire area from South Amboy, Middlesex County, NJ to Salem County in southern NJ (NJGS, 2006). The oldest surficial deposit in Highland Park, it was laid down between 5 and 2 million years ago (Sanford, 2009).

The Pensauken formation consists of clayey fine-to-medium sand, clayey medium-to-coarse sand, some fine sand and silt, containing some to many pebbles and few cobbles. Color ranges from reddish-yellow, yellowish-brown, reddish-brown, very pale brown, to light gray. The sand consists of quartz and some feldspar. The feldspar has been weathered or fully decomposed to clay. The gravel consists mainly of well-rounded white to gray quartz and quartzite and dark gray chert, with some shale, sandstone and gneiss. The shale, sandstone and gneiss are deeply weathered to fully decomposed (Sanford, 2009).

The Pensauken formation can be as much as 140 feet thick and is moderately to highly permeable. The accumulation of silt and clay in the soil zone and the uppermost 10 feet of the deposit makes the top significantly less permeable, while the bottom 5 to 15 feet of the deposit is generally a coarse gravel and so is more permeable that the overlying material. In some places, however, iron oxide compounds have formed ironstone masses as much as 3 to 4 feet thick and 10 feet in diameter, which impede water movement (Stanford, 1999).

This formation is generally suitable for structures and septic systems. In low-lying areas adjacent to Alluvial deposits (Qal), or where the deposit is thin over low-permeability material, high water tables may limit use of septic systems. Small basins on the surface of this deposit may be subject to periodic inundation (Stanford, 1999).

In some places, the Pensauken formation provides an important source of sand and pebble gravel (Stanford, 1999), but not in Highland Park.

Weathered Shale, Mudstone and Sandstone (Qws)

Weathered shale consists of clayey silt, silty clay, with minor amounts of sandy clay to clayey sand and containing some red to gray shale and siltstone chips and flagstones. The color of this formation ranges from reddish-brown, brown to yellowish-brown. In places, there are some white and yellow-stained quartz pebbles left behind from erosion of the Pensauken formation.

The formation can be as much as 30 feet thick but is generally less than 10 feet thick (Stanford, 1999). It is thickest where it underlies the Pensauken formation because the weathered zone is protected from erosion (Stanford, 2009).

The weathered shale deposits have low to moderate permeability. Permeability is low on shale and mudstone bedrock and moderate on sandstone bedrock, generally impeding the flow of water into underlying formations. The formation is generally suitable for structures, but where the material is of low permeability, septic systems may be unsuitable (Stanford, 1999).

Alluvium (Qal)

Alluvium consists of sand, silt, clay, pebble gravel, and in some places cobble gravel. The color ranges from dark brown, brown, reddish-brown, yellowish-brown, gray, dark gray to black. It contains varying amounts of organic matter and, in some places, may contain demolition debris and trash. Where it is underlain by shale bedrock, the gravel consists of chips and small flagstone of red and gray shale and white, yellow and gray quartz and quartzite pebbles. The deposit typically consists of a base layer of sand and gravel deposited in the stream channel, overlain by silt, sand and clay deposited on the floodplain. In general, the alluvium can be as much as 15 feet thick. Along the Raritan River, levees of fine sand and silt up to 8 feet high border the channel where the floodplain is wide (Stanford, 2009).

The permeability of the alluvium is variable. Sand and gravel channel deposits are moderately to highly permeable. This formation is subject to regular flooding and bank and channel erosion. Due to a high water table, generally saturated to within 1 to 2 feet of the surface, it is unsuitable for permanent structures or septic systems (Stanford, 1999).

Estuarine Deposits (Qmm)

Estuarine deposits are made up of gray, brown, and black peat and organic-rich clay and silt, with minor amounts of white to gray sand and shell pieces, up to as 100 feet thick (Stanford, 1999).

The permeability is generally low to moderate, although sand, shell pieces and peat layers are moderately to highly permeable. This material generally impedes the flow of water between the surface and underlying formations. Excavation and dredging of the deposits may result in saltwater intrusion into the underlying formations (Stanford, 1999).

These deposits are subject to daily flooding and are saturated to the surface. The material is unstable because of abundant organic matter, water content, and lack of compaction. For these reasons, estuarine deposits are unsuitable for permanent structures and septic systems (Stanford, 1999).

Historic Fill

Historic fill is defined by NJDEP as non-indigenous material placed on a site in order to raise the topographic elevation of the site. Large areas (over 5 acres) of historic fill have been mapped by NJDEP, as required by the Brownfield and Contaminated Site Remediation Act (N.J.S.A. 58:10B-1 et seq.). While most urban and suburban areas are underlain by an irregular layer of excavated indigenous soil mixed with various amounts of non-indigenous material, this material generally does not meet the definition of historic fill. Also, there may be historic fill areas that were not detectable on aerial photography or by archival map interpretation, particularly along streams in urban and suburban areas. Areas of historic fill in Highland Park are shown on **Figure 3g** (NJGS, 2009)**.**

This artificial fill is generally composed of sand, gravel, silt, clay and rock fragments, and can include a variety of man-made materials, including cinders, ash, brick, concrete, wood, slag, asphalt, metal, glass and trash. Color is variable but generally dark brown, gray or black. Fill can be as much as 20 feet thick (Stanford, 2009).

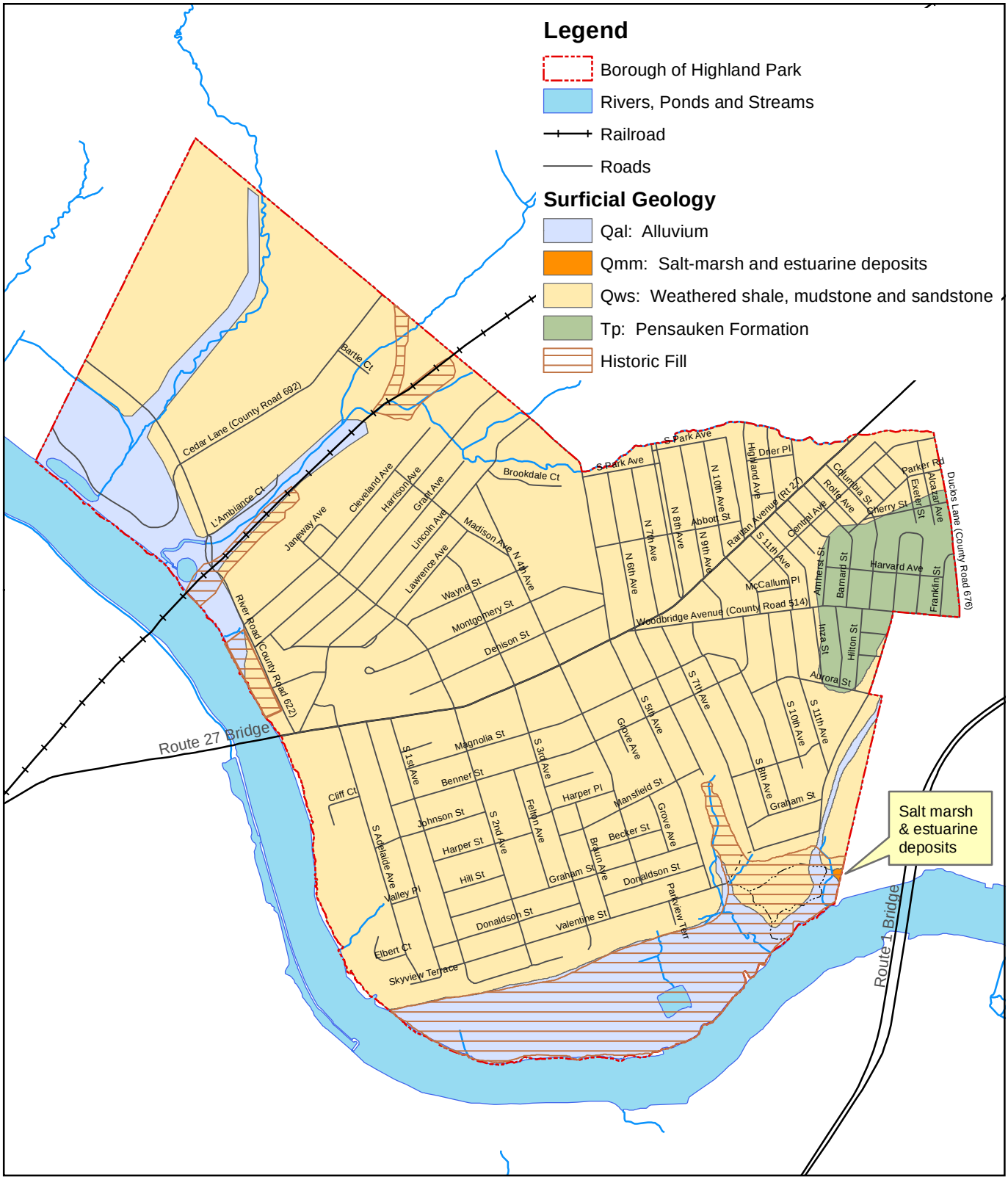

Figure 3g: Surficial Geology

Borough of Highland Park ERI 2012
Prepared by Kratzer Environmental Services

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Surficial Geology

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Borough of Highland Park, NJ. Chapter 230 Land Development Article XXIII Specific Standards §230-122 Steep Slope Ordinance. http://www.ecode360.com/14478770

The Geology of New Jersey (NJ Geological Survey): http://www.state.nj.us/dep/njgs/index.html

The Paleontology Portal: http://www.paleoportal.org

The Physiographic Provinces of NJ (NJ Geological Survey):
http://www.state.nj.us/dep/njgs/enviroed/infocirc/provinces.pdf

USGS programs in NJ: http://water.usgs.gov/pubs/FS/FS-030-96/

4: SOILS

A. Soil Survey Maps

The *soil* is the unconsolidated mineral material on the immediate surface of the earth and which serves as the medium for growth of land plants. The characteristics of each soil type have developed over time (usually many thousands of years) under the influence of the parent material (the bedrock that has broken down into small fragments to form the soil), climate (including moisture and temperature regimes), macro- and microorganisms, and topography. Soil is a basic resource for food production, in addition to its essential role in collecting and purifying water before it enters the ground water (Soil Science Society of America, 2011). However, soil itself can be a pollutant as dust in the air or as sediment in water.

The US Department of Agriculture Natural Resources Conservation Service (USDA NRCS) is the science-based agency which provides technical assistance based on sound science in the conservation and management of soil, water, and other natural resources to private land owners and local, state, and federal agencies and policy-makers (USDA NRCS, February 10, 2011).

One of these technical services is the soil survey. A *soil survey* is an inventory of the country's soil resources to determine soil characteristics and capabilities and to help people understand soils and their uses. Soil surveys help identify the best way to protect soil and water quality through the use of conservation practices and to identify which sites are suitable (and the degree of suitability) for various land uses (e.g. septic systems, roads, agriculture).

The objective of soil mapping is to separate the landscape into segments that have similar use and management requirements. Therefore, this data set is not designed for use as a primary regulatory or management tool, but may be used as a broad scale reference source. According to the Soil Survey Geographic Database (also known as SSURGO) information, field investigations and data collection were carried out in sufficient detail to name map units and to identify accurately and consistently areas of about 5 acres. As with other GIS data sets, enlargement of the maps to a scale greater than the accuracy of the data can cause misinterpretation of the data. Onsite sampling, testing, and detailed study of specific sites is essential for determining intensive uses, and managing farms and wetlands (USDA NRCS, November 11, 2009).

Beginning in 2005, the NRCS made its soil surveys available online (USDA NRCS, November 11, 2009). This provides the means for keeping the information current and available to the public. Users specify a geographic "area of interest" (must be less than 10,000 acres) and then may view a wide variety of tables of soil properties and soil interpretations. For this report, the entire SSURGO (Soil Survey Geographic Database) spatial data and tabular data for Middlesex County were downloaded for use in the GIS (USDA NRCS, August 18, 2008) [15].

B. Soil Series and Map Units

Soil characteristics vary from place to place in slope, depth, drainage, erodibility and other characteristics that affect management. A *soil series* is a basic unit of soil classification consisting of soils that are essentially alike, except that they may differ in surface texture, stoniness, slope or some other attribute. A *map unit* is the area delineated on a soil map,

[15] The maps in this report use the most recent data available (SSA NJ023 Middlesex County, NJ; Tabular Data Version 8, 8/18/2008; Spatial Data Version 2, 6/25/2008; Spatial Format=ArcView Shapefile; Coordinate System=UTM Zone 18, Northern Hemisphere (NAD 83)).

representing an area dominated by one major kind of soil, and is named according to the classification of the dominant soil or soils. However, soils are natural systems, with natural variability, and the range of some observed properties may extend beyond the limits defined for the class. In addition, small areas of contrasting soils may not be visible on the maps. The databases included with the soils data describe the characteristics of each soil map unit. The NRCS has included both estimated and measured data on the physical and chemical soil properties and soil interpretations for engineering, water management, recreation, agronomic, woodland, range and wildlife uses of the soil.

There are 8 soil series' found in Highland Park, such as Klinesville, Lansdowne, Nixon and Psamments. A total of 10 different map units are present in Highland Park. These map units are described below and listed in **Table 4.1**, along with several important properties of these soils, and shown on **Figure 4a**. **Figures 4b** through **4i** illustrate the distribution of some soil characteristics (descriptions, tabular data and GIS data are from USDA NRCS, August 18, 2008).

KkoB - Klinesville channery[16] loam, 2 to 6 percent slopes,
KkoC - Klinesville channery loam, 6 to 12 percent slopes and
KkoE - Klinesville channery loam, 18 to 35 percent slopes

The Klinesville series consists of shallow, somewhat excessively drained soils on uplands. They formed in material weathered from shale, siltstone, and sandstone. Typically these soils have a dark reddish brown very channery silt loam surface layer 5 inches thick. The subsoil from 5 to 15 inches is reddish brown very channery silt loam. The substratum from 15 to 19 inches is weak red weathered shale fragments. Bedrock is at 19 inches. Slopes range from 0 to 80 percent.

KkuB - Klinesville-Urban land complex, 0 to 6 percent slopes

45% of this unit is Klinesville (described above).

35% of this unit is Urban land. Urban land is land mostly covered by streets, parking lots, buildings, and other structures of urban areas. Slopes range from 0 to 45 percent.

LbuB - Lansdowne-Urban land complex, 0 to 6 percent slopes

45% of this unit is Lansdowne. The Lansdowne series consists of deep, moderately well to somewhat poorly drained soils on uplands. They formed in old alluvium and glacial till. Typically these soils have a dark reddish brown loam surface layer 9 inches thick. The mottled subsoil is mainly yellowish red. From 9 to 14 inches it is silty clay loam, from 14 to 25 inches it is silty clay, from 25 to 38 inches it is clay, and from 38 to 44 inches it is dark red silty clay. The substratum from 44 to 55 inches is dusky red shaly clay loam. Bedrock is at 55 inches. Slopes range from 0 to 8 percent.

40% of this unit is Urban land. Urban land is land mostly covered by streets, parking lots, buildings, and other structures of urban areas. Slopes range from 0 to 45 percent.

NkpB - Nixon-Urban land complex, 0 to 5 percent slopes

45% of this unit is Nixon. The Nixon series consists of deep, well drained soils on uplands. They formed in material weathered from old alluvium containing red shale and siliceous coastal plain sediments. These soils have a dark brown loam surface layer, 10 inches thick. The subsoil from 12 to 40 inches is strong brown and reddish brown loam and sandy clay

[16] Channery means having thin, flat rock fragments up to 6 inches.

loam. The substratum from 40 to 60 inches is yellowish red loamy sand. Slopes range from 0 to 5 percent.

40% of this unit is Urban land. Urban land is land mostly covered by streets, parking lots, buildings, and other structures of urban areas. Slopes range from 0 to 45 percent.

PssA - Psamments, 0 to 3 percent slopes

Psamments are excessively drained to well drained sandy fill land that has been smoothed. The thickness of the fill ranges from 24 to 48 inches but is dominantly 36 inches. Gravel content ranges from 0 to 50 percent. Slopes range from 0 to 5 percent.

RehA - Reaville silt loam, 0 to 2 percent slopes

The Reaville series consists of moderately deep, moderately well, and somewhat poorly drained soils on uplands. They formed in material weathered from interbedded triassic red shale and siltstone. Typically, these soils have a reddish brown, channery silt loam surface layer 9 inches thick. The mottled subsoil from 9 to 15 inches is reddish brown channery silt loam. The mottled substratum from 15 to 25 inches is dusky red, very channery silt loam. Bedrock is at 25 inches. Slopes range from 0 to 15 percent.

RorAt - Rowland silt loam, 0 to 2 percent slopes, frequently flooded

The Rowland series consists of very deep, moderately well to somewhat poorly drained soils on floodplains. They formed in alluvial sediments. Typically these soils have a dark reddish brown silt loam surface layer 10 inches thick. The subsoil from 10 to 28 inches is reddish brown silt loam mottled in the lower part. The substratum from 28 to 44 inches is weak red silty clay loam. Below 44 inches is stratified sand and gravel. Slopes range from 0 to 3 percent.

UR - Urban land

Urban land is land mostly covered by streets, parking lots, buildings, and other structures of urban areas. Slopes range from 0 to 45 percent.

C. Soil Quality, Soil Degradation & Relationship of Soil to Overall Environmental Quality

Soil is arranged in horizontal layers called horizons. These horizons have technical designations largely useful for soil scientists to distinguish one soil series from another. The descriptions in the NRCS soil survey are done using soil in its native state where possible, so a soil profile which has been disturbed may not match the written description for the series. This is the way the degree of disturbance is assessed—by comparing the soil in its native condition to the profile observed at a specific site. For example, the upper horizon is often an *A horizon*, commonly known as "*topsoil*." An A horizon typically exhibits increased organic matter, reduced clay percentage, a more granular structure of the soil aggregates, and a lower bulk density than the *B horizon* below it. If the A horizon is removed (a common practice in construction), this is evident to a trained observer and the soil would be described as having the A horizon missing. The material on the new surface does not automatically become an A horizon merely as a result of its position. It is possible over time for the newly exposed surface to acquire the characteristics of an A horizon, however this is not automatic and is highly management dependent. In technical writing, in particular guidance documents intended for post-construction remediation, the use of the term "topsoil" should be used with caution if at all

because there is no legal definition of topsoil and the materials available in commerce are highly variable in quality (Muldowney, 2011).

Soils vary naturally in their capacity to function. *Soil quality* is defined as the capacity of a specific kind of soil to function to sustain plant and animal productivity, maintain or enhance water and air quality, and support human health and habitation. *Inherent* or *intrinsic soil qualities* or characteristics of the soil are determined by factors of soil formation (climate, parent material, topography, time and biota). These are properties which cannot be altered by management except by actually replacing the present material with a different material altogether. An example is the soil's percent sand. The inherent soil quality is used to evaluate the suitability of soils for specific uses (buildings, roads, agriculture, septic systems, etc.). An example is soil particle size: A loam soil will have higher water holding capacity than a sandy soil, therefore will have a higher inherent quality for storing water (USDA NRCS, November 2010).

Contrasting with intrinsic soil properties are management-dependent soil properties, also known as *dynamic soil qualities*. As the term suggests, these can be altered significantly (for better or for worse) by the management of a specific parcel of land and they can have significant consequences for overall environmental quality. Dynamic quality is determined by soil characteristics that are affected by human use and management practices, including physical, chemical and biological properties. Soil quality or health may be evaluated by either comparing to a reference condition that represents full capacity of a soil for a specific function, or to a baseline for the management-dependent soils properties (such as before and after a land use change) (USDA NRCS, November 2010).

Degradation of soil quality occurs in many forms. In Highland Park, the significant issues are cutting and filling, compaction, excess salt content and organic matter content. *Cutting and filling* operations actually remove, bury, or invert existing horizons such that they no longer behave in a hydrologically coherent way, with precipitation and gases readily able to enter the soil surface and transmit to horizons lower in the profile. *Compaction*, the increase of bulk density as a result of compression from the surface, is another common form of soil degradation to which Highland Park soils are especially vulnerable due to their fine texture (high percentage of clay). Compaction can be avoided by not working soil at too high a moisture content. Even foot traffic on a near saturated soil can result in lasting damage which does not resolve itself naturally. A compacted soil can have runoff characteristics more similar to pavement than to the soil in good condition (Muldowney, 2011).

Excess salt content often results from deicing salts but sometimes from fertilizer preparations. It is especially common on roadside verges. The remedy is to either prevent or to wash the salt from the profile with excess water. Sodium salts are especially damaging because sodium causes the clays to disperse. Calcium chloride is relatively harmless to plants and soil (Muldowney, 2011; Wikepedia, November 22, 2011).

Organic matter content is another dynamic soil property. Rutgers New Jersey Agricultural Experiment Station (see **Internet Resources**) provides a chart for interpretation of organic matter percentages in New Jersey soils. Soils with a high organic content are better able to resist other forms of degradation than soils with depleted organic matter. Organic matter in the upper horizons of soil is a measure of carbon storage in soil. Soil is the largest terrestrial reservoir of carbon and has the greatest potential for long term storage if degraded soils are managed in a way that builds up carbon. Fine textured soils characteristic of Highland Park are able to store more carbon in the form of organic matter than sandier soil. Keeping soil in good condition reduces runoff, produces cleaner runoff, requires less irrigation, grows more robust plantings, and sequesters more atmospheric carbon than a damaged soil (Muldowney, 2011).

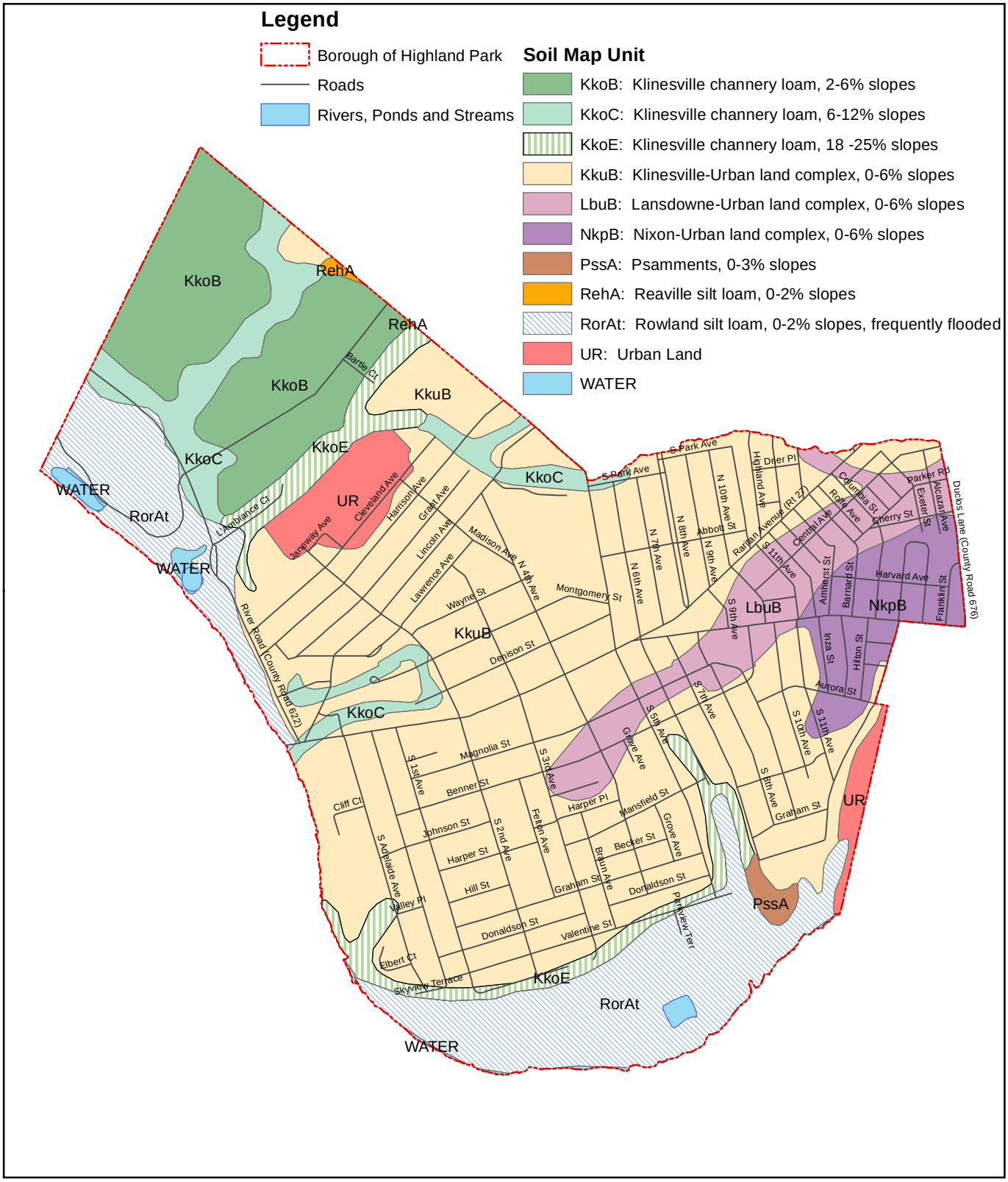

Figure 4a: Soil Map Units

The information in this map is from the SSURGO soils data Soil Service Area (SSA) NJ023, Middlesex County, New Jersey SSA Version 8 (8/18/2008), indicating the dominant soil condition but does not eliminate the need for onsite investigation.

N
W E
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0 0.125 0.25 0.5 Miles
0 500 1,000 2,000 Feet

Borough of Highland Park ERI 2012
Prepared by Kratzer Environmental Services

Data Sources: See Appendix B.
Note: Map accuracy is limited to the accuracy and scale of the original data sets; see Appendix B.
Disclaimer: This map was developed using NJDEP GIS digital data, but this secondary product has not been verified by NJDEP and is not NJDEP authorized.

D. Characteristics of Highland Park Soils

Soil properties contained in the NRCS soil survey and mapped in **Figures 4b through 4i** are *intrinsic* soil properties. These are properties which cannot be altered by management except by actually replacing the present material with a different material altogether.

Depth to Bedrock (Figure 4b)

According to NJDEP (1999), *bedrock* is defined as "any solid body of rock, with or without fractures, which is not underlain by soil or unconsolidated rock material."

The *depth to bedrock* is the distance from the land surface to bedrock. Each soil map unit is characterized by a range of depths to bedrock that is typical for the majority of that soil type. Depth to bedrock is an important factor when determining the suitability of land for building roads, foundations and septic systems.

The majority of the Borough of Highland Park has shallow depths to bedrock. The Klinesville channery loams are typically less than 20 inches deep, while the Reaville silt loam soil usually reach between 20 to 40 inches before bedrock is encountered. **Figure 4b** shows the range of depths to bedrock for the majority of each soil unit (see **Table 4.1** and **Figure 4b**).

Depth to Seasonal High Water Table (Figure 4c)

The *depth to seasonal high water table* (SHWT) is the distance between the ground surface and the top of the water surface in the saturated part of a water bearing zone. A SHWT of less than one foot severely constrains development, while SHWT between 1 and 3 feet also provides obstacles to development. On-site investigation will often reveal that these areas are actually wetlands or floodplains. High water tables impact the effectiveness of septic systems, and the freeze/thaw cycles cause frost heaving, which damages structures and roads.

The majority of Highland Park have not been evaluated for SHWT. The Reaville, Lansdowne and Psamments soils have shallow depths to seasonal high water table (see **Figure 4c**). The Rowland silt loam is subject to brief, but frequent flooding, usually during the winter (see **Figure 6b for floodplains**).

Hydrologic Soil Group (Figure 4d)

The *hydrologic soil grouping* describes a group of soils having similar runoff potential under similar storm and cover conditions (how much water would runoff compared to the rate that water would infiltrate into the ground). In areas of the borough rated for hydrologic soil group, much of the area has slow or very slow infiltration. A smaller portion of the borough has a moderate infiltration rate (Nixon-urban land soil), while a small area has a high infiltration rate (Psamments soil type) (see **Figure 4d**). The definitions of the hydrologic soil groups are shown in **Table 4.2**.

Table 4.2: Hydrologic Soil Grouping

Class	Definition
A	High infiltration rates. Soils are deep, well drained to excessively drained sands and gravels.
B	Moderate infiltration rates. Deep and moderately deep, moderately well and well drained soils that have moderately course textures.
C	Slow infiltration rates. Soils with layers impeding downward movement of water, or soils that have moderately fine or fine textures.
D	Very slow infiltration rates. Soils are clayey, have a high water table, or are shallow to an impervious layer.
Source: USDA NRCS, 2008	

Table 4.1: Characteristics of Soil Types Found in Highland Park[17]

Map Unit Symbol	Map Unit Name	Depth to Bedrock (inches)	Seasonal High Water Table Depth (inches)	Annual Flood Frequency, Duration, Months	Hydrologic Group*	Potential Frost Action	Drainage Class	Hydric Soil?	Prime Farmland?◆	Septic Disposal Field Rating Class & Limiting Features (NJ)
KkoB	Klinesville channery loam, 2 to 6 percent slopes	10 to 20	--	none	D	MODERATE	somewhat excessively	--		Somewhat Limited: Excessively coarse substratum
KkoC	Klinesville channery loam, 6 to 12 percent slopes	10 to 20	--	none	D	MODERATE	somewhat excessively	--	--	Somewhat Limited: Excessively coarse substratum
KkoE	Klinesville channery loam, 18 to 35 percent slopes	10 to 18	--	none	D	MODERATE	Somewhat excessively	--	--	Very Limited: Not permitted - too steep, Excessively coarse substratum
KkuB	Klinesville-Urban land complex, 0 to 6 percent slopes	10 to 20	--	none	D	MODERATE	Well	--	--	Somewhat to Very limited: Excessively coarse substratum; restrictive substratum
LbuB	Lansdowne-Urban land complex, 0 to 6 percent slopes	54 to 66	1 to 2.5 feet	none	C	High	Somewhat poorly	--	--	Very limited Restrictive substratum, Restrictive horizon, Depth to perched zone of saturation, Excessively coarse substratum
NkpB	Nixon-Urban land complex, 0 to 5 percent slopes	--	--	none	B	Moderate	Well	--	--	Not limited to Not rated
PssA	Psamments, 0 to 3 percent slopes	--	4 feet	none	A	Low	Well	--	--	Somewhat limited: Depth to apparent zone of saturation
RehA	Reaville silt loam, 0 to 2 percent slopes	20 to 40	1 to 2 feet	None	C	High	Somewhat poorly	--	SI	Very Limited: Restrictive substratum, Restrictive horizon, Depth to apparent zone of saturation, Excessively coarse substratum
RorAt	Rowland silt loam, 0 to 2 percent slopes, frequently flooded	--	1 to 3 feet	FREQUENT Brief Nov-Mar	C	High	Moderately well	--	--	Very Limited: Not permitted - flooding, Depth to apparent zone of saturation

[17] The information in this table indicates the dominant soil condition but does not eliminate the need for onsite investigation.

Map Unit Symbol	Map Unit Name	Depth to Bedrock (inches)	Seasonal High Water Table Depth (inches)	Annual Flood Frequency, Duration, Months	Hydrologic Group✳	Potential Frost Action	Drainage Class	Hydric Soil?	Prime Farmland?◆	Septic Disposal Field Rating Class & Limiting Features (NJ)
UR	Urban land	--	--	none	--	--	--	--	--	--
Water	Water	--	0	--	--	--	--	--	--	--

✳**Hydrologic Group:** see **Table 4.2**
◆**Farmland:** **P**=Prime; **SI**=Statewide Importance

Source: USDA NRCS, August 18, 2008
The information in this map is from the SSURGO soils data Soil Service Area (SSA) NJ023, Middlesex County, New Jersey
SSA Version 8 (8/18/2008), indicating the dominant soil condition but does not eliminate the need for onsite investigation.

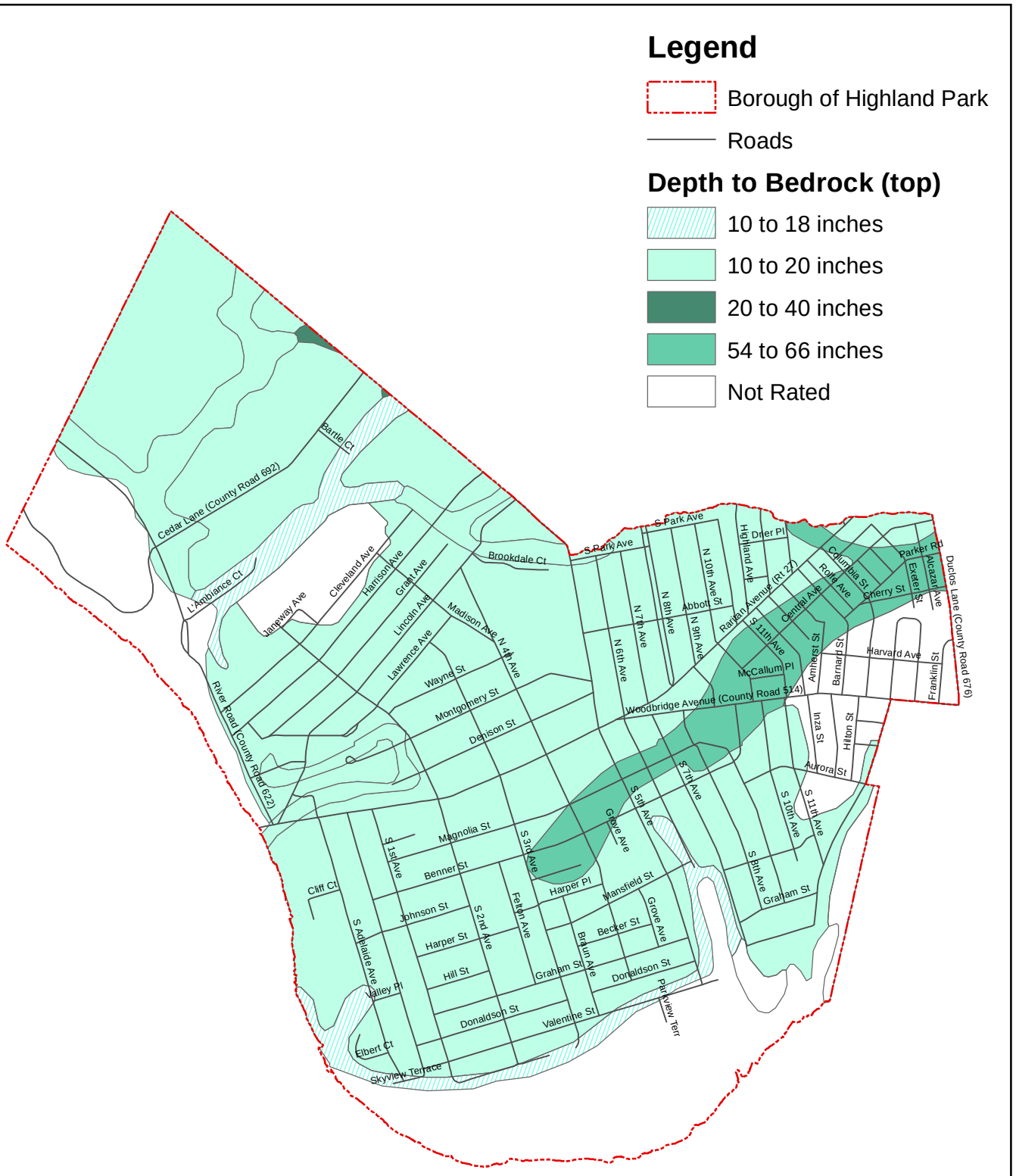

Figure 4b: Soils - Depth to Bedrock

The information in this map is from the SSURGO soils data Soil Service Area (SSA) NJ023, Middlesex County, New Jersey SSA Version 8 (8/18/2008), indicating the dominant soil condition but does not eliminate the need for onsite investigation.

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0 500 1,000 2,000 Feet

Borough of Highland Park ERI 2012
Prepared by Kratzer Environmental Services

Data Sources: See Appendix B.
Note: Map accuracy is limited to the accuracy and scale of the original data sets; see Appendix B.
Disclaimer: This map was developed using NJDEP GIS digital data, but this secondary product has not been verified by NJDEP and is not NJDEP authorized.

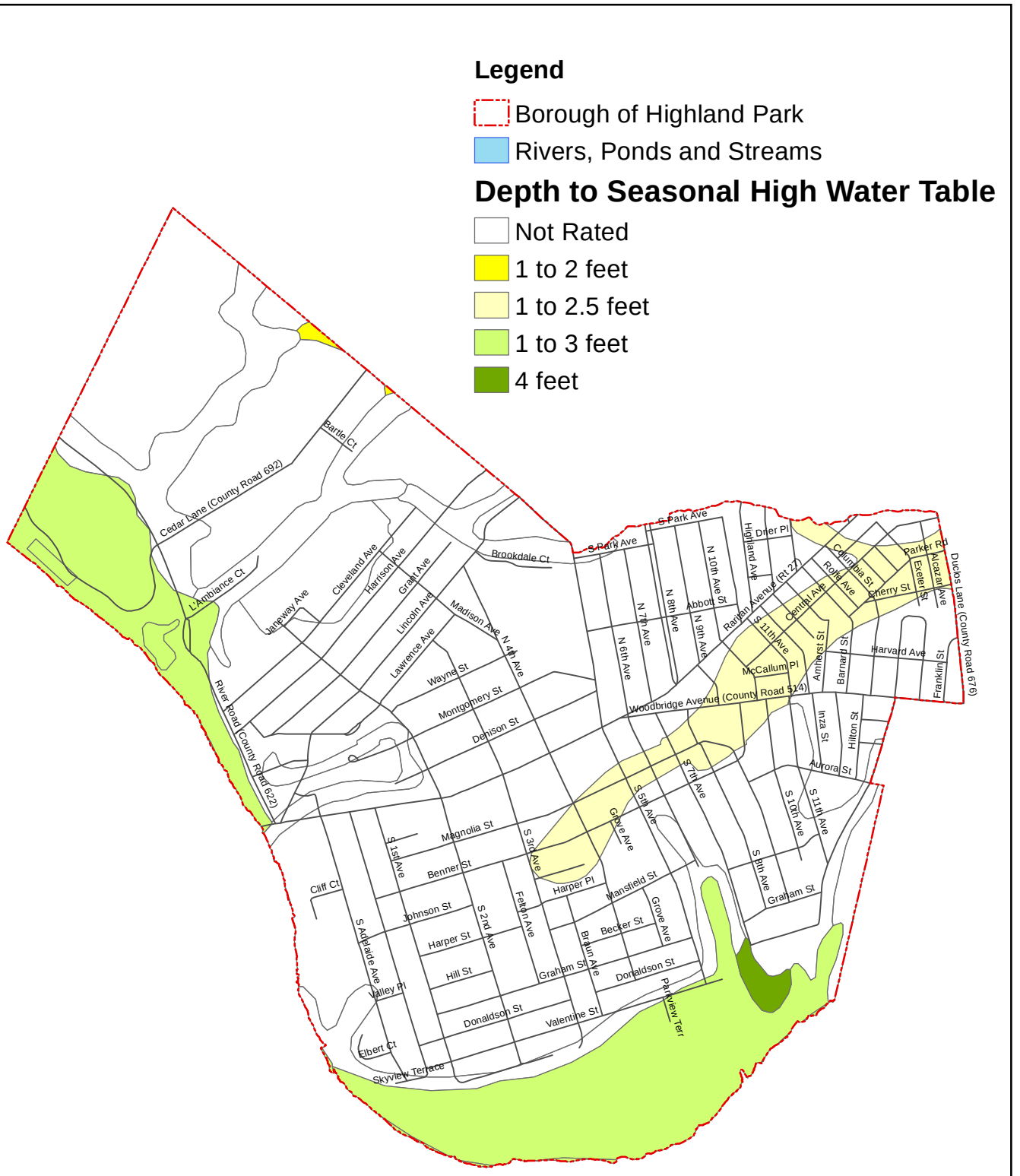

Figure 4c: Soils - Depth to Seasonal High Water Table

The information in this map is from the SSURGO soils data Soil Service Area (SSA) NJ023, Middlesex County, New Jersey SSA Version 8 (8/18/2008), indicating the dominant soil condition but does not eliminate the need for onsite investigation.

Borough of Highland Park ERI 2012

Prepared by Kratzer Environmental Services

Data Sources: See Appendix B.
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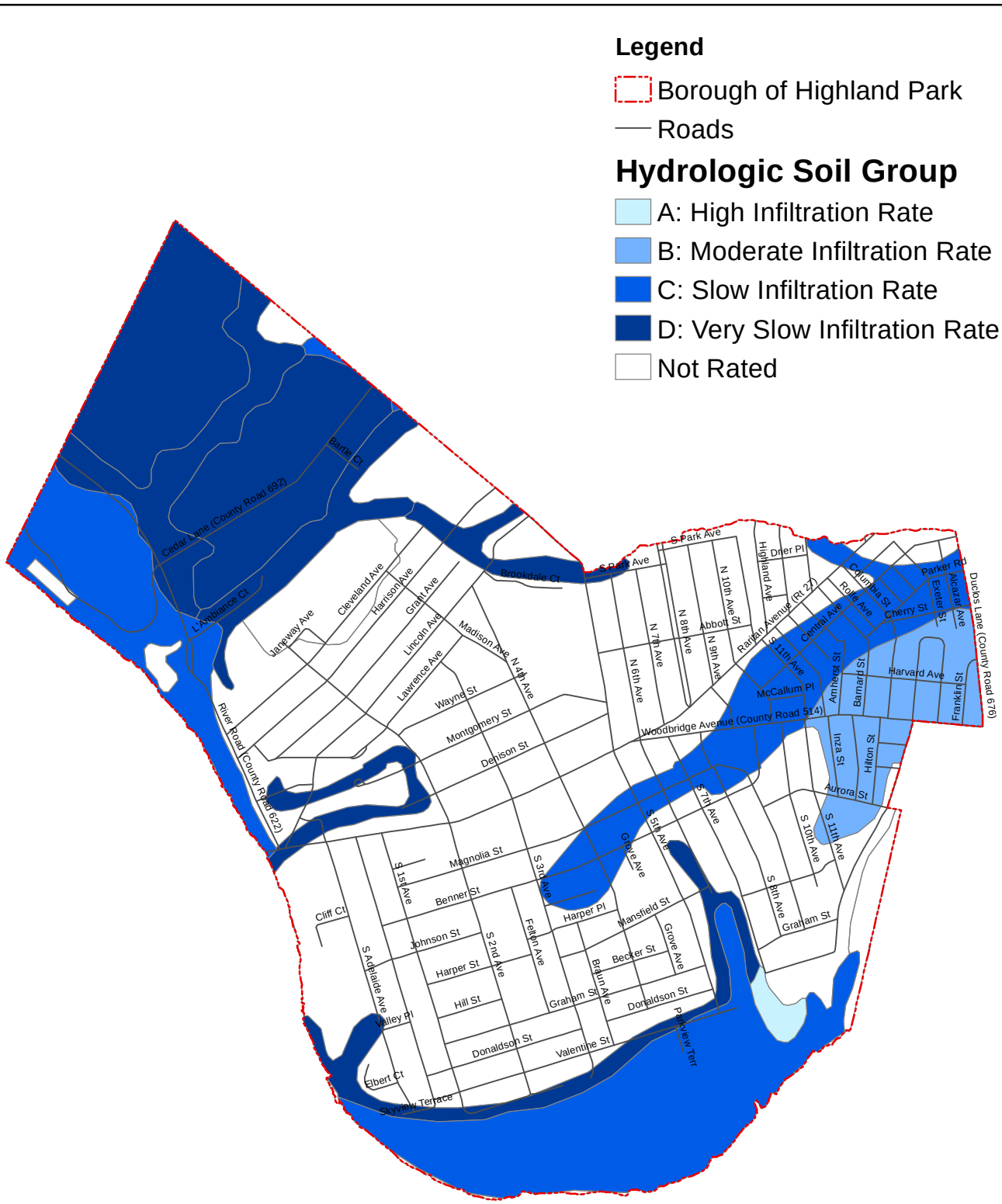

Figure 4d: Soils - Hydrologic Soil Grouping

The information in this map is from the SSURGO soils data Soil Service Area (SSA) NJ023, Middlesex County, New Jersey SSA Version 8 (8/18/2008), indicating the dominant soil condition but does not eliminate the need for onsite investigation.

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Borough of Highland Park ERI 2012
Prepared by Kratzer Environmental Services

Data Sources: See Appendix B.
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Septic Suitability (Figure 4e)

The NRCS SSURGO database provides an interpretation of limitations of each soil for *septic suitability*. The interpretation shown in **Figure 4e** is based on the N.J.A.C. 7:9A Standards for Individual Subsurface Sewage Disposal Systems, Subchapter 10 Disposal Fields. Factors which may affect the functioning of the system, and therefore limit septic suitability, are excessively coarse substratum (which allows effluent to percolate to ground water too rapidly); presence of water (including depth to high water table, flooding, and hydric soils); depth to restrictive layer (bedrock or restrictive substratum) and steep grades over 25%. N.J.A.C 7:9A prohibits septic systems in soils subject to flooding. In addition, septic disposal fields are prohibited in locations with the combination of slope greater than 10% and less than 50 feet upslope of any bedrock outcrop where signs of ground water seepage can be detected (NJDEP, 1999).

While the Borough of Highland Park does not rely on any on-site septic systems, **Figure 4e** demonstrates that there are few areas in the borough suitable for septic systems.

Erodibility (Figure 4f)

Erosion is the wearing away of the land surface by running water, wind, ice, or other geological agents. Erosion is often accelerated as a result of human activities. The *erodibility* takes into account the affects of infiltration rate, permeability and total water capacity and factors that resist the forces of the rainfall and runoff. The majority of Highland Park is rated potentially highly erodible. Some areas are highly erodible, (including the steeper slopes and portions of the 500-year floodplain) and small areas are considered not highly erodible (including the 100-year floodplains) (see **Figure 4f)**.

Soil Drainage Class (Figure 4g)

Soil Drainage Class is a code identifying the natural drainage condition of the soil and refers to the frequency and duration of periods when the soil is free of saturation or partial saturation during soil formation, and does not refer to saturation due to recently altered drainage (manmade or natural). The categories are as follows: well drained, moderately well drained, excessively drained, somewhat excessively drained, poorly drained, and somewhat poorly drained. For the most part, Highland Park has well drained and somewhat excessively drained soils. The floodplain has moderately well drained soils, while the area of the borough with Lansdowne-Urban land complex soil is somewhat poorly drained (see **Figure 4g).**

Prime Farmland Soils (Figure 4h)

Prime Farmland Soils include soils that have the best combination of physical and chemical characteristics for economically producing sustained high yields of crops when treated and managed according to acceptable farming methods and is also available for these uses. These soils have the soil quality, growing season, and moisture supply needed; they are not excessively erodible or saturated with water for a long period of time, and they either do not flood frequently or are protected from flooding (USDA NRCS NJ, 2006).

Farmlands of statewide importance include those soils with characteristics that are nearly Prime Farmland. They economically produce high yields of crops when treated and managed according to acceptable farming methods. Some may produce yields as high as Prime Farmland if conditions are favorable (USDA NRCS NJ, 2006).

A very small area of Highland Park, near where Route 692 crosses into Edison Township, is considered farmland of statewide importance (see **Figure 4h**).

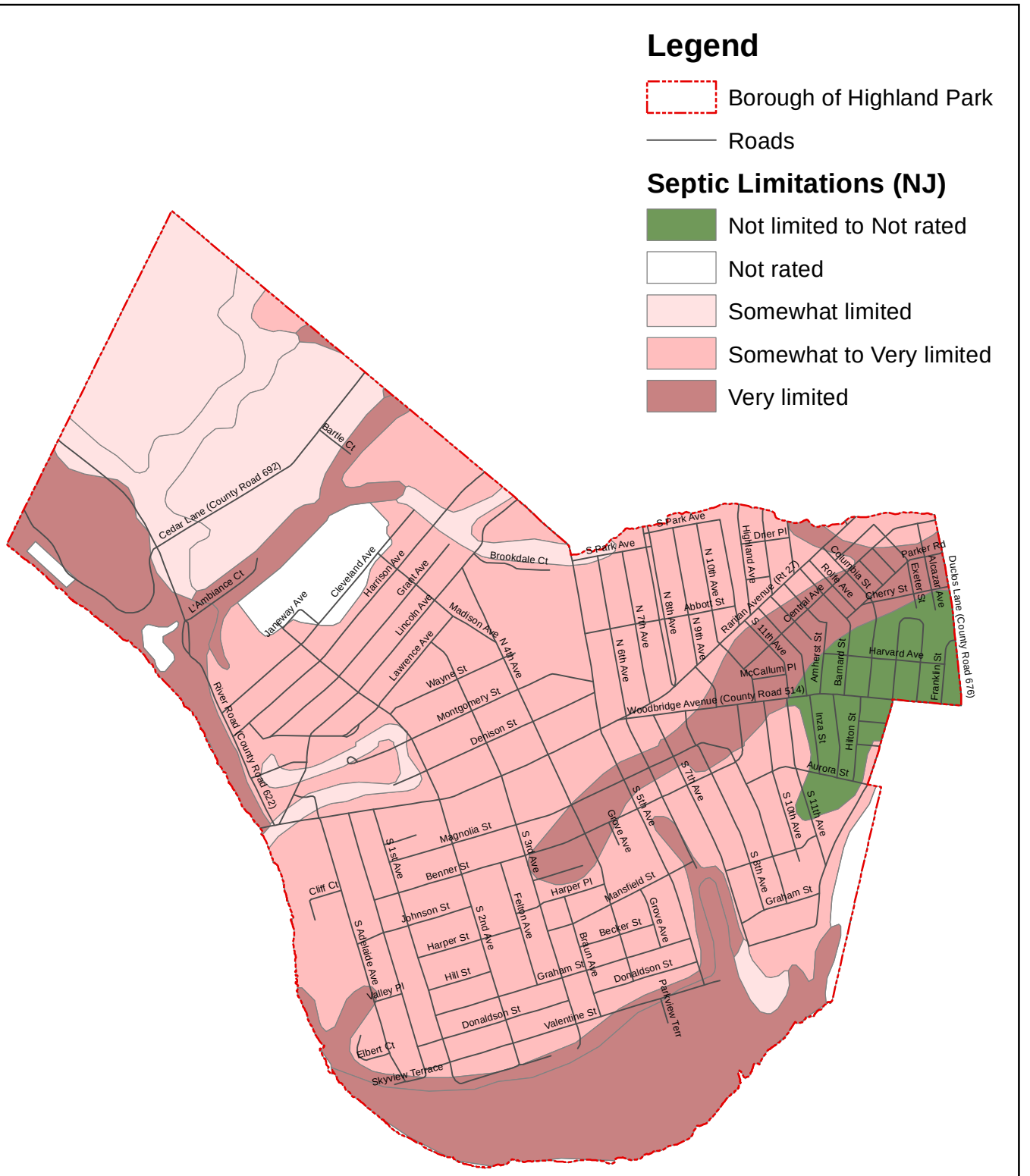

Figure 4e: Soil - Septic Limitations (NJ)

The information in this map is from the SSURGO soils data Soil Service Area (SSA) NJ023, Middlesex County, New Jersey SSA Version 8 (8/18/2008), indicating the dominant soil condition but does not eliminate the need for onsite investigation.

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Borough of Highland Park ERI 2012
Prepared by Kratzer Environmental Services

Data Sources: See Appendix B.
Note: Map accuracy is limited to the accuracy and scale of the original data sets; see Appendix B.
Disclaimer: This map was developed using NJDEP GIS digital data, but this secondary product has not been verified by NJDEP and is not NJDEP authorized.

Figure 4f: Soil Erodibility

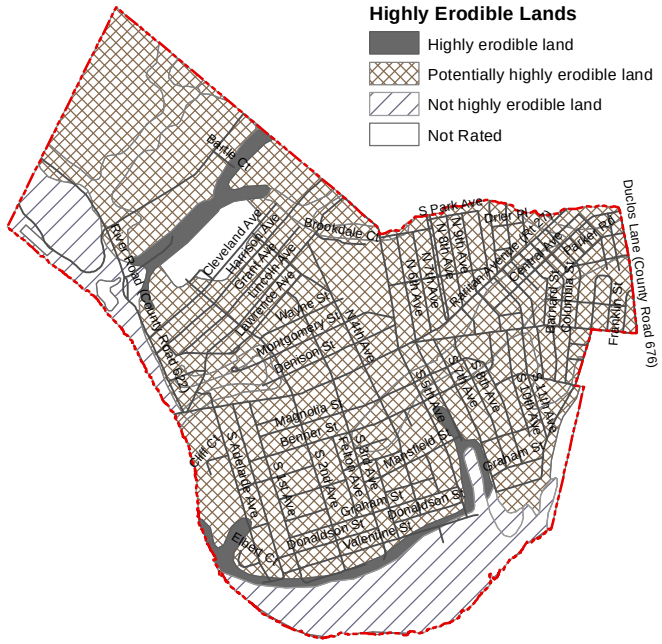


Figure 4g: Soils Drainage Class

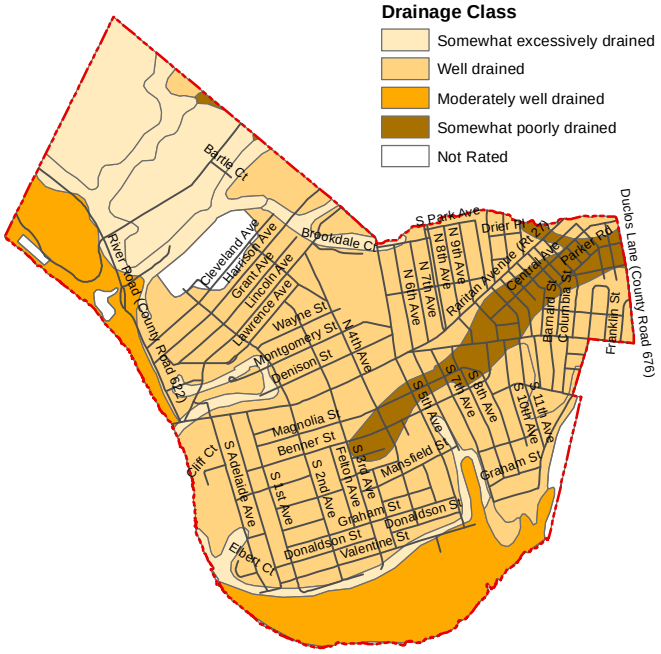


Figure 4h: Agricultural Soils

Figure 4i: Soils - Potential Frost Action

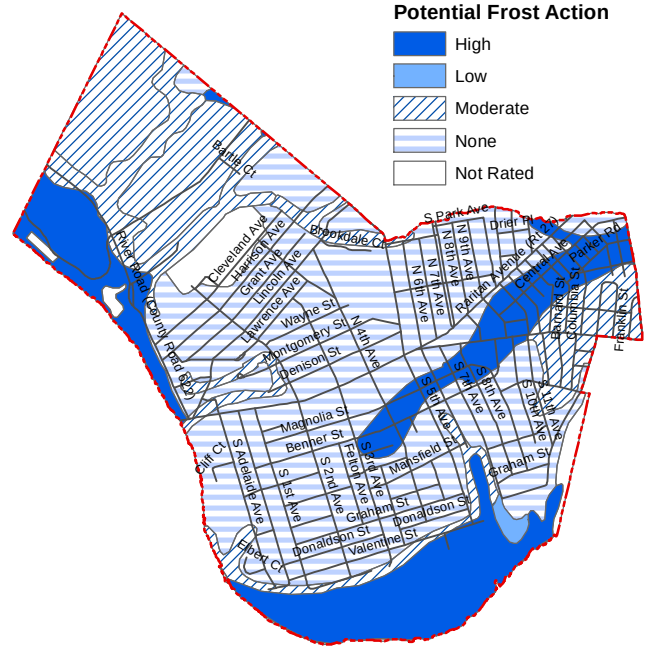
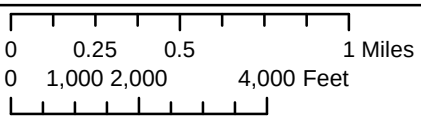


Figure 4f-4i: Soils

The information in this map is from the SSURGO soils data Soil Service Area (SSA) NJ023, Middlesex County, New Jersey SSA Version 8 (8/18/2008), indicating the dominant soil condition but does not eliminate the need for onsite investigation.



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Potential Frost Action (Figure 4i)

Potential Frost Action is an interpretation rating of the susceptibility of the soil to frost heaving. Most soils within Highland Park have moderate or no potential frost action. The Rowland silt loam of the floodplains and the Lansdowne-Urban land complex have high potential frost action, while in contrast, the Psamments soil has low potential frost action.

Flooded and Hydric Soils

Annual flood frequency is a descriptive term used to describe the frequency of flooding that is likely to occur in a year. **Frequent** is > 50% chance of flooding in a given year; **occasional** is 5 to 50%; **rare** is 0 to 5% chance of flooding. In Highland Park, the Rowland silt loam soil bordering the Raritan River frequently experiences wintertime flooding (see **Table 4.1**; **Figure 6c** shows floodplains, which corresponds with this soil map unit).

Hydric soils are those soils that are wet long enough to periodically produce anaerobic conditions, thereby influencing the growth of plants. For delineation of hydric soils the ponding event must last greater than seven days. No soils within Highland Park are hydric soils.

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Wikipedia. Accessed November 22, 2011. Calcium chloride. http://en.wikipedia.org/wiki/Calcium_chloride

Internet Resources: Soils

NRCS New Jersey Office: http://www.nj.nrcs.usda.gov/

NRCS Soils Website: Helping People Understand Soils: http://soils.usda.gov/

NRCS Soil Data Mart (download soils data for GIS): http://soildatamart.nrcs.usda.gov/

NRCS Soils Online Study Guide: http://www.nj.nrcs.usda.gov/partnerships/envirothon/soils/

Rutgers New Jersey Agricultural Experiment Station Soil Testing Laboratory Interpretation of Organic Matter Levels in New Jersey Soils: http://njaes.rutgers.edu/soiltestinglab/pdfs/nj-om-interpret.pdf

Web Soil Survey: Instructions: ftp://ftp-fc.sc.egov.usda.gov/NSSC/pub/WSS_brochure.pdf
Web Soil Survey Site (online soils mapping): http://websoilsurvey.nrcs.usda.gov/app/

5: GROUND WATER & DRINKING WATER

A. Water Cycle

Water is essential to all life on Earth. The abundance of water distinguishes the Earth from any other planet, but the amount of water on Earth has remained constant for millennia. Even though the quantity of water is great, only a small portion can be used for drinking water and other human needs. Ninety-seven percent of the world's water supply is saltwater stored in the oceans. The remaining 3% is fresh water. However, most of this is unavailable for human use because it is frozen in the polar ice caps, glaciers, and icebergs; too difficult to tap (below 1.6 miles depth); or too polluted. This leaves 0.003% of water that is available as fresh surface or ground water that humans can use (Miller, 1988).

Surface water is water that is visible above the ground surface, such as creeks, rivers, ponds, lakes, and wetlands. *Ground water* is that portion of water beneath the land surface that is within the zone of saturation (below the water table) where pore spaces are filled with water. An *aquifer* is a water-bearing rock or rock formation where water is present in usable quantities. Water is constantly recycled through the *hydrologic cycle*, also known as the *water cycle* (see **Figure 5a***)*. Precipitation falls on the ground and some travels on the surface of the land (called *surface runoff*), entering streams (where it can be seen as high flows after rain events), and eventually making its way back to the ocean. Some of the water from precipitation enters the ground but remains in the shallow layers where it is available for use by plants, where it returns to the atmosphere through *transpiration* by plants, while some water re-enters the atmosphere directly through *evaporation* from surface water. Evaporation and transpiration combined are known as *evapotranspiration*. The water that migrates below the root zone travels underground and exits the system as stream flow, known as *ground water baseflow* or *ground water recharge*. Ground-water baseflow can be calculated by measuring stream flow during dry weather conditions. A smaller portion of the water penetrates deeper into the ground and enters (or recharges) the saturated zone of the fractured bedrock, called the *aquifer,* where most wells obtain their water.

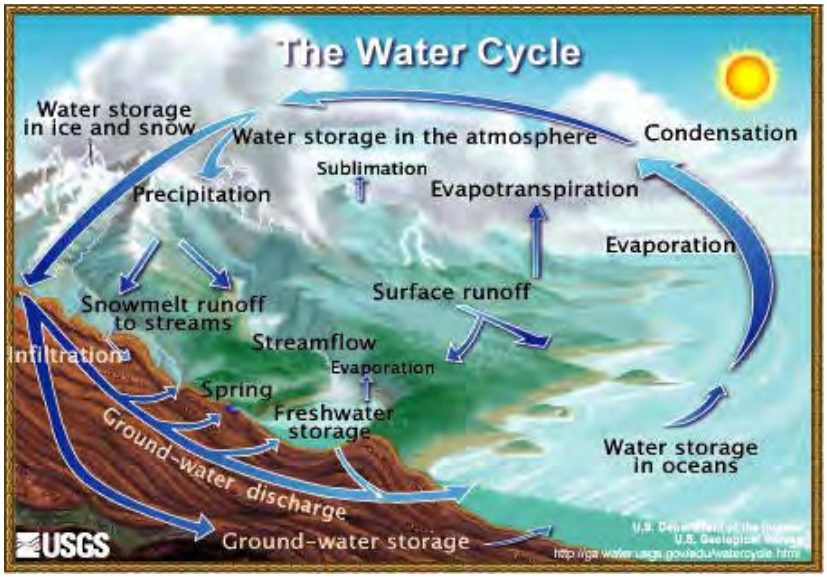


Figure 5a: The Water Cycle

Source: USGS, no date

Pollutants can enter water as it travels the water cycle. Surface runoff can pick up chemicals and soil on its way, depositing these pollutants in waterways. This is especially true of "uncontrolled runoff" on soils that are vulnerable to erosion (erodible soils are discussed in **Section 4C** of this report). Water seeping into the soil can be cleansed of many pollutants by natural soil processes. However, if the pollutant is one that is resistant to break-down, or if the

pollutant doesn't get exposed to the soil long enough (such as by entering a bedrock fracture or by entering the ground water through sub-surface disposal), pollutants can spread underground and pollute sources of drinking water.

Movement of ground water is usually quite slow, on average, ranging from about one foot per day to perhaps ½ inch per month. Therefore, in some areas, it might take days for water to travel from the point where it enters the ground, to a point of discharge into a stream, or it might take millennia (Heath, 1983). However, ground water in Highland Park, because it is present in fractures, can potentially move much more quickly. The rates of movement in large fractures may approach those observed in surface streams (Heath, 1983; Freeze and Cherry, 1979). A contaminant could also travel quickly through fractures, with little soil contact to allow for filtration or degradation of pollutants. Thus, a well located on a large fracture might have a very good yield, but may be highly susceptible to contamination.

An understanding of the water cycle emphasizes the connections between surface and ground water. While the Borough of Highland Park relies exclusively on public water (not individual wells), the water is no less part of the natural water cycle, and is susceptible to human impacts and the influence of climate and geology.

B. The Aquifer in Highland Park

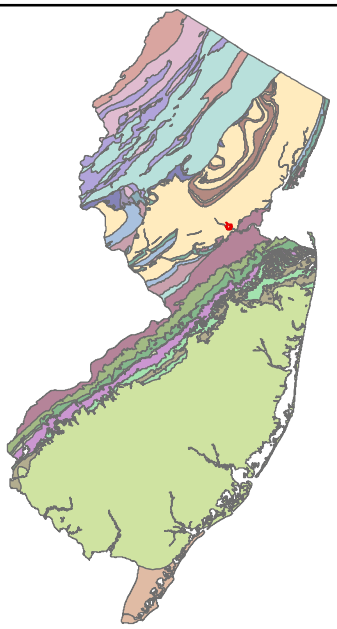
Almost half of New Jersey's drinking water comes from ground water. In the northern half of New Jersey, aquifer boundaries roughly correspond to physiographic province boundaries (discussed in **Section 3a** and **Figure 3a**). Highland Park is underlain by the Passaic[18] aquifer, which is in the Late Triassic Newark Group of sedimentary rocks. The Passaic aquifer is discussed in the paragraphs below and shown in **Figure 5b**, while the aquifer's characteristics are summarized in **Table 5.1**.

The hydrogeologic characteristics of an aquifer are dependent on the type of bedrock. In the report Geology as a Guide to Regional Estimates of Water Resources, State Geologist Kemble Widmer states "The six guiding principles in the application of geology to rock country [bedrock aquifers, including the Passaic] wells are: (1) there is no correlation between depth and yield, (2) each drainage basin, no matter how minor, is a surface and ground water entity, (3) water is usable only from fractures, fissures and solution openings, (4) successful industrial wells are completed in the first 200 to 500 feet of rock, (5) porous and permeable Pleistocene or deep weathered rock regolith zones [there are none of these in Highland Park] above the rock will usually act as a built-in reservoir to increase well capacity and (6) glacial till, heavy clay soil, or bedrock close to the surface will decrease well yields." (Widmer, 1968, p. 11)

In bedrock aquifers such as the Passaic, rocks near the land surface experience weathering, caused by freezing and thawing of water, which has widened fractures and dissolved some of the intergranular cement in the sedimentary rocks. This type of bedrock yields water mostly from *secondary porosity*[19] and permeability provided by fractures. Rocks below the weathered zone, which is usually about 75 feet thick, have no *primary porosity* (Lewis-Brown, 1995). Therefore, the distribution and orientation of these fractures control the rates and directions of ground water flow. The water bearing structures underground may bear little resemblance to the overlying topography.

[18] Also called the Brunswick aquifer.

[19] *Porosity* is the measure of voids in soil or rock, which are available to hold water (like holes in a sponge). *Primary porosity* is due to spaces between the soil or rock particles or within porous rock particles. *Secondary porosity* is found in fractures in bedrock. Aquifers with primary porosity store far more water than those with only secondary porosity.



Legend

Borough of Highland Park

Aquifer Name

- Basalt
- Brunswick aquifer
- Brunswick aquifer conglomerate
- Composite confining unit
- Composite confining unit aquifer
- Diabase
- Englishtown aquifer system
- Holly Beach water-bearing zone
- Igneous and metamorphic rocks
- Jacksonburg Limestone, Kittatinny & Hardyston
- Kirkwood-Cohansey aquifer system
- Lockatong Formation
- Lockatong Formation conglomerate
- Marshalltown-Wenonah confining unit
- Martinsburg Formation and Jutland Sequence
- Merchantville-Woodbury confining unit
- Mt. Laurel-Wenonah aquifer
- Potomac-Raritan-Magothy aquifer system
- Rocks of the Green Pond, Kittatinny & Minisink
- Stockton Formation
- Stockton Formation conglomerate

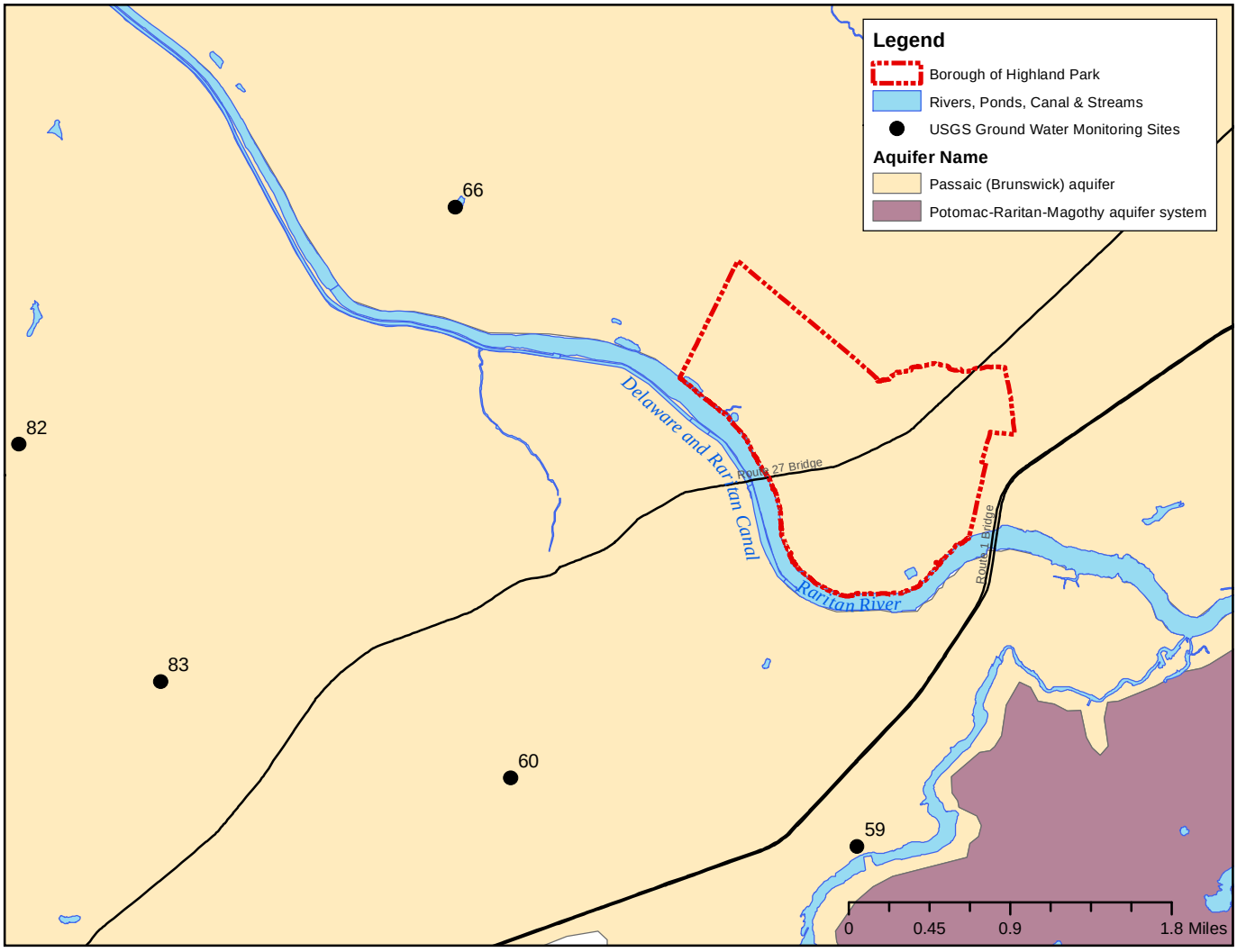


Figure 5b: Aquifers and USGS Ground Water Monitoring Sites

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Data Sources: See Appendix B.
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Unconfined conditions commonly exist above this level of about 75 feet because pores and fractures in this material are usually well-connected. Below this level, *confined* conditions are caused by the presence of low-permeability layers containing relatively few fractures (Lewis-Brown, 1995).

The Passaic Aquifer is composed of sandstone, siltstone, and shale of the Passaic geologic formation. Ground water is stored and transmitted in fractures. The water-bearing units are composed of fissile[20] shale and siltstone, and the confining units are composed of massive siltstone. The Passaic formations are characterized by several layers of extensively fractured rocks (water-bearing units) that typically are 1 to 10 feet thick interbedded with layers of sparsely fractured rocks (confining units) that typically are 30 to 100 feet thick. These geologic formations extend thousands of feet below ground, but the density of fractures decreases with depth. Water-bearing, interconnected fractures are present only from the land surface to a depth of about 300-500 feet in the Piedmont (EPA, 1988; Houghton, 1990). In the Triassic-Jurassic Passaic Formation, wells are drilled to these deep depths because there is a good potential to encounter additional water-bearing fractures and therefore, to increase the yield. For this reason, wells extended beyond this depth usually do not increase well productivity (the extra storage provided by the greater length of the well bore-hole may be necessary, however, to supply enough water for the well's intended use). The extensive fracturing and interconnection of these fractures results in most wells in the Passaic Formation being capable of transmitting and storing sufficient volumes of water to meet most needs.

Locally, however, the Passaic Formation rocks may not be as good an aquifer as regionally. Kasabach (1966) indicates that initial yields in the Passaic Formation are high and that these yields decrease with time as fractures are dewatered.

In general, the yield of a well is primarily dependent on the number and size of fractures directly intersected by the well bore. Other water-bearing units provide water by leakage through confining units. Wells near surface water bodies can also derive a significant amount of water from the surface water body by *induced infiltration* (Lewis-Brown, 1995). These wells located near surface water often have higher yields (Vecchioli and Palmer, 1962 in Lewis-Brown, 1995), but can be vulnerable to pollution if the surface water carries pollutants.

The density of housing and impervious surfaces can impact aquifers and may result in reduced recharge, lowered yields, increased interference (wells interfering with each other), and degradation of ground water quality. Furthermore, these changes can alter stream flow dynamics resulting in higher flows after storm events and lowered flows between events.

Table 5.1: Characteristics of Passaic Aquifer

Aquifer Unit	Characteristics	Typical Statewide well depth (feet)*	Avg. Yield (gpm)**	State Rank▪
Passaic Formation Shale, Sandstone, Mudstone, Siltstone	Water from secondary porosity, Water-bearing fractures to about 400', fresh (total dissolved solids < 1,000 mg/L), slightly alkaline, non-corrosive, hard, calcium bicarbonate	30 to 1,500	15	C
* **State Rank** is based on High Capacity Wells (such as water-supply, irrigation, and industrial-supply wells sited and tested for maximum yield. Many of the wells have boreholes exceeding the standard six-inch diameter for domestic wells. State Rank is best viewed on a relative basis, with "A" yielding the most water, and "E" the least. Median High Capacity Wells Yield (in gpm): [A] > 500; [B] 251 to 500; [C] 101 to 250; [D] 25 to 100; [E] <25				
Sources: * USGS, 2005b; **Widmer, 1968; ▪State Ranks are from NJGS GIS data				

[20] *Fissile* means capable of being split.

C. Highland Park's Water Source

Delaware and Raritan Canal

The Delaware and Raritan Canal (D&R Canal) was constructed in 1834 for transporting freight between Philadelphia and New York. A total of 43 miles of the main canal connect Trenton on the Delaware River and New Brunswick on the Raritan River, while 22 miles of feeder canal join Bull's Island in Hunterdon County and Trenton (illustrated in **Figure 5c**). The D&R Canal was taken over by the State of New Jersey in 1934 and was later rehabilitated to serve as a public water supply transmission system (NJWSA, 2011).

The New Jersey Water Supply Authority (NJWSA) was created in 1981 (P.L. 1981, c.293) and was established as a public entity "in but not of" the NJDEP. All water supply facilities owned or operated by the State of New Jersey were transferred to the NJWSA, which is supported by water fees. As a result, the NJWSA now operates the Delaware & Raritan Canal Transmission Complex as part of the Raritan Basin Water Supply System (which also includes Round Valley Reservoir and Spruce Run Reservoir). Water purveyors purchase raw water from NJWSA to distribute to approximately 1.5 million central New Jersey residents for drinking, irrigation, recreation and industrial uses (NJSA, 2011; NJWSA, 2005).

In 2005, NJWSA developed a new model of the Raritan Basin System to assess the safe yield, operational protocols, and future water supply alternatives. The *safe yield* is the amount of water that can be supplied without fail during the drought of record. The safe yield from the Raritan Basin was determined to be 241 million gallons per day (MGD) (176 MGD from the Raritan River and 65 MGD from the D&R Canal) (NJWSA, 2005).

Middlesex Water Company

Middlesex Water Company, the water purveyor serving Highland Park (among other communities), purchases water under contract from NJWSA. From 1996 to 2003, Middlesex Water Company purchased 20 MGD from NJWSA. From 2004 to 2010 the amount was increased to 27 MGD (NJWSA, December 2005; NJWSA, February 2011).

Middlesex Water Company distributes water from both surface and ground water supplies, so customers may receive either one or a combination of both sources depending upon location, time of year and demands. Surface water is obtained from the D&R Canal (71% of the water distributed), while ground water comes from wells in South Plainfield and Edison in the Passaic (Brunswick) Aquifer (23%) and purchased water from other water utility companies (6%) (see **Figure 5c**). Middlesex Water Company water is not flouridated (Middlesex Water Company, 2010).

D. Sole-Source Aquifers

The Safe Drinking Water Act (SDWA) of 1974 contains a provision in Section 1424(e) that provides for designating an aquifer that is the sole or principal drinking water source for an area and that, if contaminated, would create significant hazard to public health. As defined by the U.S. Environmental Protection Agency (EPA), s*ole-source aquifers* (SSA) are those aquifers that contribute more than 50% of the drinking water to a specific area and the water would be impossible to replace if the aquifer were contaminated. Once designated, no Federal financial assistance may be approved for any project that may contaminate the aquifer through a recharge zone so as to create a significant hazard to public health (US EPA, June 1988). Therefore, the EPA must review any federally-funded project in an area that could affect ground water in a sole-source aquifer, including the *aquifer's recharge zone* (the area through which water

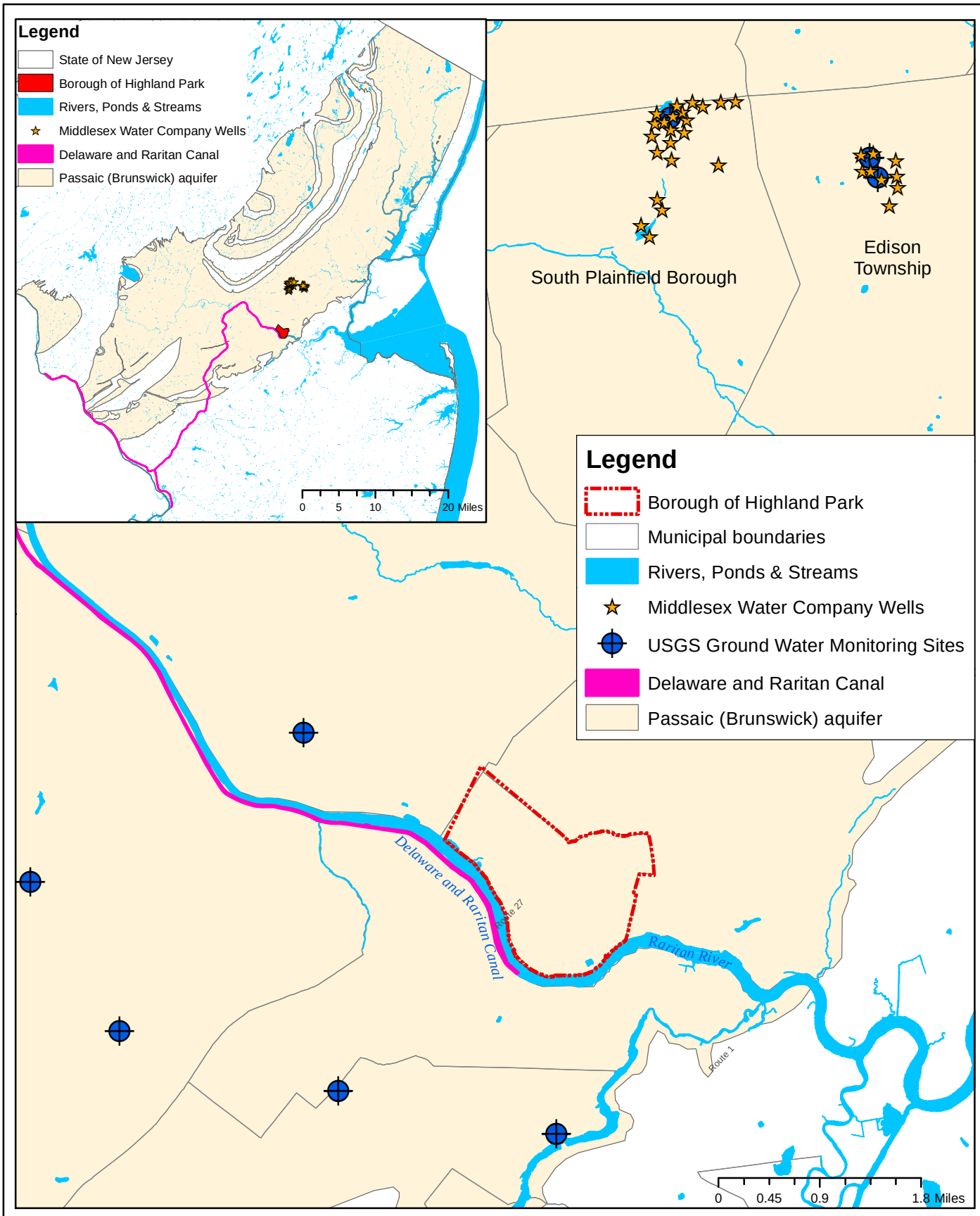

Figure 5c: Passaic Aquifer, Delaware and Raritan Canal, Supply Wells & Monitoring Wells

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recharges the aquifer) and its *stream-flow source zone* (the upstream area that contributes recharge water to the aquifer).

In November 1985, NJDEP petitioned the EPA to designate nearly all of the state as a SSA (excluding urban areas around Trenton and in Northeastern NJ). However, some areas did not meet the technical criteria for SSA designation (US EPA, June 1988). As a result, Highland Park is not part of a SSA.

E. Recharge

Ground water recharge is defined as water added to an aquifer (for example, precipitation that seeps into the ground deep enough to enter the saturated zone of the fractured bedrock). A g*round water recharge area* is the land area that allows precipitation to seep into the saturated zone. These areas are generally at topographically high areas with discharge areas at lower elevations, commonly at streams or other water bodies (i.e. the ground water returns to surface water). In general, ground water divides coincide with, or are slightly offset from, surface water divides (Lewis-Brown, 1995) (watersheds are described in **Section 6A** and shown in **Figure 6a**). Most ground water flows through the shallow layers of soil and weathered bedrock to the nearest stream. A smaller percentage penetrates deeper and recharges the aquifer.

Recharge rates are expressed in terms of the amount of precipitation that reaches the aquifer per unit of time (e.g. inches/year is used in Figure 5d). New Jersey receives an average of 44 inches of precipitation annually, and references vary widely about how much reaches the aquifer (Lewis-Brown, 1996; Kasabach, 1966; USGS, 2005a) in areas like Highland Park. This is because, while precipitation can be accurately measured, recharge cannot be directly measured. Many factors affect the amount of recharge that will occur in a given area, including climate (e.g. the amount, intensity, and form of precipitation, and the effect of wind, humidity and air temperature on evapotranspiration), soil, surficial geology, and vegetation factors. In addition, recharge of ground water varies seasonally. During the growing season, precipitation is intercepted by plants and returned to the atmosphere through transpiration (part of the hydrologic cycle, see Section 5A). Evaporation likewise, is higher during the warmer months. Together, these are known as evapotranspiration. Therefore, most recharge occurs during late fall, winter, and early spring, when plants are dormant and evaporation rates are minimal (Heath, 1983). Relative to land use, recharge rates in forests are much higher than those in urban areas (Heath, 1983). This is because urban areas have large areas covered with impermeable surfaces, hastening runoff to surface water, instead of allowing precipitation to percolate into the ground.

To ensure that water is available during all weather conditions for human consumption as well as ecosystems dependent on water, the NJDEP established the Planning Threshold, or *dependable yield,* to be used for planning purposes. *Dependable yield,* is defined as "the water yield maintainable by a ground-water system during projected future conditions, including both a repetition of the most severe drought of record and long-term withdrawal rates without creating undesirable effects." The most severe drought on record was in the early 1960's (see **Section 2A**), and this is used in the Statewide Water Supply Plan. However, the Plan acknowledges that there is insufficient long-term precipitation data to prove that this is the worst drought that could occur in the future, in duration or severity, and recommends re-evaluation of safe-yield estimates and development of optimal strategies for severe droughts (NJDEP OEP, 1996). Robert Canace, of the NJ Geological Survey, suggested that 20% of the estimated recharge should be used for planning purposes, representing the portion of recharge actually available for use during drought conditions (Canace, 1995).

In view of the importance of not exceeding the aquifers' safe yield, the New Jersey Geological Survey has completed studies quantifying recharge, as discussed in the following sections.

New Jersey Geological Survey Recharge Method GSR-32

N.J.S.A. 58:11A, 12-16 required the NJDEP to publish a methodology to map and rank aquifer-recharge areas. In addition, the legislation required the development of ground water protection practices designed to encourage ecologically sound development in aquifer-recharge areas (Charles et. al., 1993). To fulfill the requirements of this legislation, the NJ Geological Survey developed GSR-32, which estimates ground water recharge (but not aquifer recharge), and is useful for evaluating the relative effect of present and future land uses on recharge areas (Charles et. al., 1993). For this method, recharge was calculated based on data for precipitation, soil, land-use/land-cover[21], surface runoff, and evapotranspiration. This method was then applied by NJGS to create a GIS coverage (see **Figure 5d**). There were a number of assumptions made for the calculations and model inputs that limit the accuracy of the method: 1) the calculated ground water recharge includes any water entering the ground (lesser amounts actually enter the aquifer); 2) assumes that all water that migrates below the root zone recharges the aquifer (which doesn't happen); 3) addresses only natural ground water recharge, and does not include artificial recharge, withdrawals or natural discharge; 4) wetlands and water bodies were eliminated from analysis, because the direction of flow between ground water and surface water is site-specific and also varies seasonally, and this level of detail was beyond the scope of the study (these areas were assumed to provide no recharge or discharge); 5) stream baseflows used may not be representative of local streams (Charles et. al., 1993) and 6) does not consider topography, depth to bedrock, presence of impervious surfaces, and/or type of bedrock underlying soils. An additional limitation of the data is that they estimate long-term average annual recharge, which does not represent the reduced recharge during critical summertime conditions (NJ Water Supply Authority, 2002).

The method estimated average annual subsurface recharge rates from 0 to 16 inches per year in Highland Park (excluding surface water, wetlands and hydric soils) and 0 to 12 inches per year during drought (shown on **Figure 5d**). Applying the 20% consumptive use limit to these figures results in usable recharge from 0 to 2.5 inches per year. As previously mentioned, only a portion of water entering the ground actually recharges the aquifer, but since GSR-32 did not attempt to quantify this amount, this method would be better described as *soil recharge*.

New Jersey Geological Survey Ground Water Potential

In 2005, also in response to N.J.S.A. 58:11A, 12-16, the NJ Geological Survey developed a qualitative representation of the potential for aquifer recharge. This was created by combining ground-water recharge rankings and aquifer rankings.

NJGS assigned a relative rank based on the inches of ground-water recharge per year (mapped in **Figure 5d**), from A (highest recharge) to E (lowest recharge). Relative values of aquifer yield (based on high yield industrial wells and described in **Table 5.1**) were assigned to each aquifer, from A (highest yield) to E (lowest yield). The State Rank for the aquifer underlying all of Highland Park is C. For both data sets, areas of wetlands, open water and hydric soils were not ranked, since individual areas differ in whether they increase or decrease recharge, which varies seasonally. These two ranks are combined in the format "ground water

[21] Land use/land cover data from 1995-1997 were used for this study. Changes in land use/land cover and impervious surfaces affect recharge, but are not shown on **Figures 5d** or **5e**, because this involves complex calculations, and NJGS has not updated this GIS data layer.

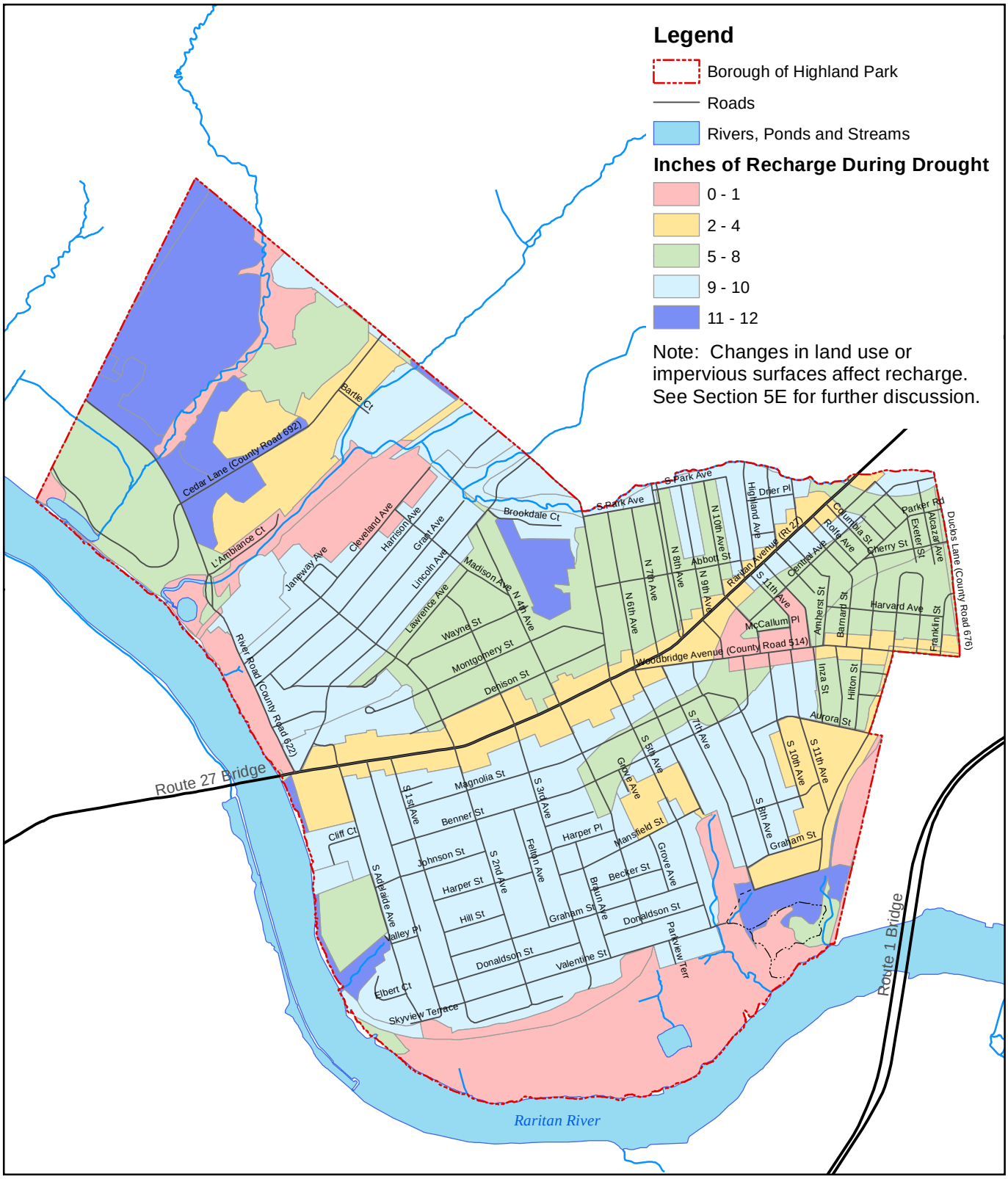

Figure 5d: Soil & Ground Water Recharge (NJGS)

N
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0 0.125 0.25 0.5 Miles
0 500 1,000 2,000 Feet

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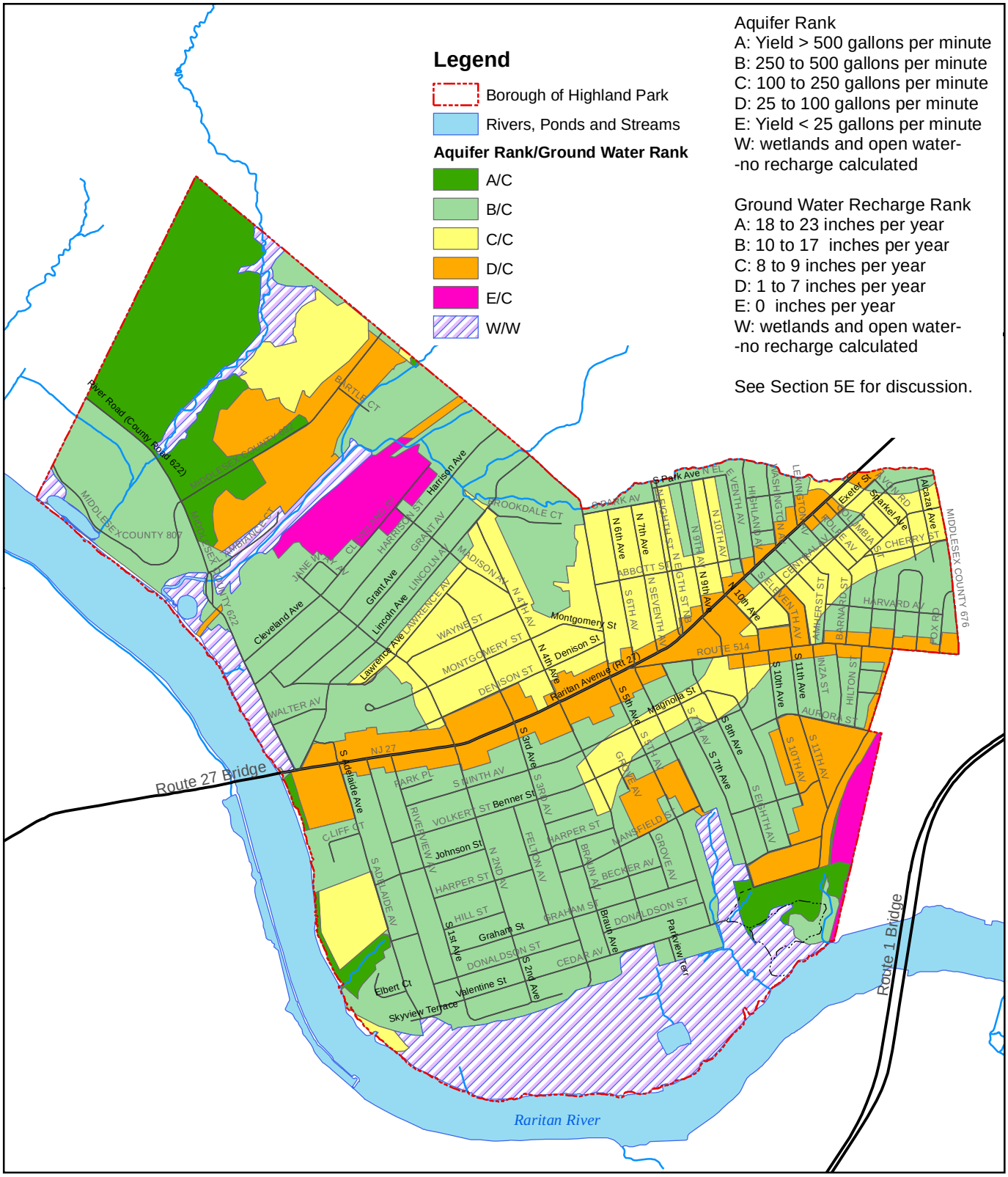

Figure 5e: Aquifer Recharge Potential

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recharge rank/aquifer recharge rank" and illustrated in **Figure 5e**. For example, A/A would be an area with the highest relative recharge and highest yield, and an area designated E/E would have the lowest recharge and lowest yield, while other combinations would lie somewhere in between (French, 2004).

F. Ground Water Quality

Pollution, such as nitrates, bacteria, metals, pesticides and antibiotics, can enter ground water via non-point sources (including septic systems and runoff from fields and roads), point sources (although there are no existing surface or ground water discharges within Highland Park), and rain. The New Jersey Comparative Risk Project (2003) identified a number of possible human health risks from drinking water, including lead (which, when present, is usually from the plumbing (NJDEP, 2004), radon, arsenic, MTBE, nitrates, and waterborne pathogens.

The NJ Geological Survey analyzed data from 150 wells in the Newark Basin in order to characterize the natural range of ground water quality parameters (Serfes, 1994; Serfes and Herman, 1995). While no sites were located within Highland Park, a number of sites were situated in neighboring municipalities (sites 59, 60, 66. 82 and 83 were the nearest) (shown on **Figure 5b**). Results showed that ground water in the Newark Basin, including the Passaic Formation, is normally fresh (total dissolved solids less than 1000 mg/L), somewhat oxidizing, slightly alkaline, non-corrosive, hard and of good natural quality. Calcium bicarbonate waters dominate, but calcium-sulfate waters exist and are associated with high total dissolved solids. Standards were exceeded for manganese in 27% of samples, maximum hardness in 21%, corrosivity 31% of the time, total dissolved solids 14%, sodium 8% and sulfate 8% of the time. The primary drinking water standard for gross alpha particle activity (radon and progeny) was exceeded in 6% of the samples, for radium in 3%, and for lead 1% of the time (Herman et al., 1998; Serfes, 1994). In addition, the water may have large concentrations of iron and sulfate. Areas with large ground water withdrawals near bays and estuaries have experienced saltwater intrusion (USGS, 2005a; Serfes, 1994).

The New Jersey Private Well Testing Act (N.J.S.A. 58:12A-26 et seq.) became effective in September 2002, which mandates private well testing upon the sale of a house. Since Highland Park has no private wells, none have been tested pursuant to this regulation (NJDEP Division of Science, Research and Technology, 2004).

G. Ground Water Quality Standards

The New Jersey Ground Water Quality Standards (GWQS; N.J.A.C. 7:9C) (last amended July 22, 2010) specify the quality criteria and designated uses for ground water, and serve as the basis for setting ground water discharge standards under the New Jersey Pollutant Discharge Elimination System program (see **Section 5H**), as well as for establishing standards for ground water cleanups and other relevant laws. The criteria are numerical values assigned to each constituent (pollutant). The GWQS also contain technical and general policies to ensure that the designated uses can be adequately protected.

Ground water within watersheds of FW1 surface waters (see **section 6D** for surface water classifications), state-owned Natural Areas, and the major aquifers of the Pinelands Area are designated *Class I*. The designated use for Class I ground water is the maintenance of special ecological resources, with secondary uses being potable, agricultural and industrial water. *Class II* waters are those not specifically designated Class I or Class III. The designated use of Class II ground waters is to provide potable water using conventional treatment. Class II criteria specify

the levels of constituents above which the water would pose an unacceptable risk for drinking water. *Class III* ground waters can be used for anything other than for potable water (September 28, 2010).

Highland Park's waters are designated Class II (to provide potable water with conventional treatment). It should not be assumed that ground water quality everywhere meets the criteria for each classification area in view of natural variability and the possibility of localized pollution. In fact, NJDEP has designated one area within the Borough where ground water contamination has been identified (Lukoil at 702 Raritan Avenue; see **Section 5I** and **Figure 5f**).

H. Ground Water Discharges

New Jersey regulates the discharge of pollutants to ground water under the authority of the New Jersey Water Pollution Control Act (WPCA) N.J.S.A. 58:10A. The New Jersey Pollutant Discharge Elimination System (NJPDES) permit program regulations are contained in N.J.A.C. 7:14A.

NJPDES permits are required for discharges to ground water of both sanitary and industrial wastes. These permits, which limit the mass and/or concentration of pollutants discharged, are issued to sanitary and industrial facilities that have ongoing, operational discharges of wastewater to ground water. The purpose is to restrict the discharge of pollutants to the ground waters of the state and protect the public health and the environment. Discharges from past activities may continue to be regulated under the Site Remediation Program or the Division of Solid and Hazardous waste.

There are no ground water discharges within Highland Park, nor in the surrounding HUC14 subwatershed (NJDEP, 2007).

I. Contaminated Sites

Known Contaminated Sites List (KCSL)

The NJDEP Bureau of Planning and Systems compiles a list of Known Contaminated Sites (KCS). The *Known Contaminated Sites List* [22] for New Jersey (as required under N.J.S.A. 58:10-23.16-17 and also the New Residential Construction Off-Site Conditions Disclosure Act N.J.S.A 46:3C1 et seq.) contains sites defined as those sites and properties within the state where contamination of soil or ground water has been confirmed at levels equal to or greater than applicable standards. It is important to note that the list may include sites where remediation is either currently under way, required but not yet initiated or has been completed (and no longer considered contaminated). In addition, new contaminated sites may have been identified since the creation of this list and are not included here. More information may be obtained by contacting the lead program identified with each site listed in this data base (NJDEP Site Remediation Program, August 2009).

Sites identified in the Known Contaminated Sites list can undergo a variety of activities, ranging from relatively simple soil removals to highly complex remedial activities. The sites included in this dataset are handled under various regulatory programs administered by the NJDEP's Site Remediation and Waste Management program, including the New Jersey

[22] The GIS data is updated periodically (the most recent data currently available is from Fall 2009). The tabular data is updated frequently, with new sites added and remediated ones removed, and is available at: http://datamine2.state.nj.us/DEP_OPRA/OpraMain/categories?category=Site+Case+sub-category

Brownfield and Contaminated Site Remediation Act, Industrial Site Recovery Act, Solid Waste Management Act, Spill Compensation & Control Act, Underground Storage of Hazardous Substances Act, Water Pollution Control Act and the Federal Comprehensive Environmental Response, Compensation and Liability Act, Superfund Amendments and Reauthorization Act, and Resource Conservation and Recovery Act Corrective Action Program. A site can be regulated under more than one of these regulatory programs.

Within the Borough of Highland Park, there are 16 KCSs, none of them on the National Priorities (Superfund) List (see **Table 5.2** and **Figure 5f**). See **Internet Resources** for a link to NJDEP's grant program for removal and cleanup of leaking underground storage tanks (USTs). These are listed in the data miner tabular report (see **Internet Resources**) (NJDEP Site Remediation Program, April 6, 2011).

Classification Exception Area (CEA)

The *Classification Exception Area* (CEA) dataset identifies those sites where ground water contamination has been identified and the NJDEP has established a Classification Exception Area (CEA). CEAs are institutional controls in geographically defined areas within which the New Jersey Ground Water Quality Standards (NJGWQS) for specific contaminants have been exceeded. When a CEA is designated for an area, the constituent standards and designated aquifer uses are suspended for the term of the CEA. This data is intended to provide information to the public regarding areas of contaminated ground water to prevent inappropriate well placement, preventing potential health risks and can minimize unintended contaminant plume migration (NJDEP Site Remediation Program, November 2010a). There is 1 CEA in Highland Park, a Lukoil Station (formerly Mobil) (see **Table 5.2** and **Figure 5f**), where the ground water is contaminated with Tert-butyl alcohol at a concentration of 267 ppb. There are an additional 10 CEAs within the watershed.

Deed Notice

A *Deed Notice* is defined by NJSA 58:10B-13a as a "...notice to inform prospective holders of an interest in the property that contamination exists on the property at a level that may statutorily restrict certain uses of, or access to, all or part of that property...." The purpose of the deed notice GIS layer is to minimize any chance of exposure to contaminants remaining on the property (NJDEP Site Remediation Program, November 2010b).

There are no Deed Notices delineated within the Borough of Highland Park, but there are 3 within the watershed (see **Table 5.2** and **Figure 5f**).

Remediated Sites

A current Data Miner search revealed that 102 contaminated sites within Highland Park have been remediated (55 homeowner and 47 non-homeowner) (NJDEP Site Remediation Program, April 15, 2011). These cases are closed and are not listed below**.**

J. Ground Water Level Monitoring

The *ground water level* is the distance from the land surface (i.e. top of well casing) to the water in a well. Ground water level monitoring is critical for determining the current state of the ground water, identifying trends and predicting ground water drought. In addition to drought, over-withdrawal of ground water can occur in areas where more ground water is being

Table 5.2: Contaminated Sites in and Near Highland Park (See Figure 5f)

Site Id. # PI #	Name	Block/Lot	Address	Status* Date	Lead Program◆	Remedial Level◆
Known Contaminated Sites (KCS) - 16 within Highland Park Only sites within Highland Park are shown below - an additional 63 sites are within the watershed.						
67015 G000010259	102 North 3rd Avenue (Remedial Action & Construction)	163/46	102 N 3rd Ave, Highland Park	1992	BFO-S	C1
471637	107 South 4th Avenue	37/4	107 South 4th Avenue	2008	BFO-S	C1
79576 G000038114	334 N 5th Ave	157/2.01	334 N 5th Ave, Highland Park	1999	BFO-S	C2
79563 G000038068	55 Adelaide Avenue S Case type CEHA	5/29	55 Adelaide Ave S, Highland Park	1999	CEHA	C1
45559 002762 030258	Acme Motors Inc. (UST remediation)	120/7	211 Woodbridge Ave, Highland Park	1995	BUST	C2
5789 004611	Astra Cleaners (Remedial Action & Construction) Case type MOA Current Name: Rainbow Cleaners	137/28	705 Raritan Ave, Highland Park	2001	BFO-S	C1
5779 012738	Donaldson County Park (Regulated UST)	75/11	Riverview Ave, Highland Park	2006	BUST	C2
45557 004444	Forners Service Center (Regulated UST)	70/5	148 Woodbridge Ave, Highland Park	2009	BUST	C1
44726 010999	Highland Park Department of Public Works (landfill) Activity number RPC060001	75/9	Valentine & Donaldson Sts, Highland Park	2006	OBR	C3
5795 032895	Highland Park Service Center, Inc. (Regulated UST)	13/4	126 Raritan Ave, Highland Park	1999	BUST	C1
5839 008535	Lukoil #57237 Case ID 008535 LSR 110001 Former Mobil Station CEA ID: 01-08-09-1327-40	87/25	702 Raritan Ave, Highland Park	2002	BUST	C2
188818 261197	MCUA Native Plant Reserve**/Former Residence/Park Case type MOA	186/9-12	River Road, Highland Park	2005	CAS	C1
5838 018773	Midland - Ross Corp Case type ISRA	172/2	Cleveland Ave, Highland Park	1991	BISR	D
5785 007545	Orchard Assos (UST Remediation)	64/46	277 South 11th St, Highland Park	1994	BFO-S	C2
5802 033393	Raceway Petroleum (Regulated UST)	5/1	60 Raritan Ave, Highland Park	1994	BUST	C2
23419 004442	Ubry's Inc (Regulated UST) Current Name: Highland Park One	173/47	115 Raritan Ave, Highland Park	1999	BUST	C2
3 KCS have been successfully remediated and are awaiting "No Further Action" letters from NJDEP						
262007	1 River Road	183/1	1 River Road and Rt. 27, Highland Park	2008	BOMM	B
146995 194327	Reds Marina Case types HDSRF - Muni, MOA, other	75/16	Donaldson St, Highland Park	2003	BFO-S	C1
5778 016414	Sunoco 0007-6406 (Regulated UST)	13/7	138 Raritan Ave, Highland Park	1994	BUST	C2

Classification Exception Area (CEA) ★ - One in Highland Park (listed first), 10 within the watershed						
008535 01-08-09-1327-40	Mobil 2634884 (now Lukoil)	87/25	702 Raritan Ave, Highland Park	2008	BUST	
1310	Amoco Service Station #842		Rt. 1 & Plainfield Ave., Edison Twp.	2005	BUST	
	Camp Kilmer		433 Plainfield Ave, Edison Twp.	2003	BCM	
1873	Continental Beverage Packaging Co.		24 Kilmer Rd, Edison Twp.	2001	BOMM	No further action
1229	Hess Service Station #30258		Rt. 27 & Highway Ter., Edison Twp.	1999	BUST	
	Private Formulations Inc.		460 Plainfield Ave, Edison Twp.	2002	BISR	
1923	Rt. 27 Service Station		1818 Lincoln Hwy, Edison Twp.	2002	BUST	
95-08-15-1338-40	Shilka Store (former US Oil SS)		2279 Woodbridge Ave, Edison Twp.	2004	BUST	
1848	U-Haul Moving and Storage		110 Rt. 1, Edison Twp.	2001	BUST	
780	Getty Service Station #56065		282 George St, New Brunswick City	1998	BUST	
	Gulf Service Station #60047		110 Memorial Pkwy., New Brunswick Twp.	2010	BUST	
Deed Notice Extent (DNA) - None in Highland Park, 3 within the watershed						
	Camp Kilmer		433 Plainfield Ave., Edison Twp.	2003	BCM	
98-12-29-1507-01	Fleet Bank		385 George St., New Brunswick City	2002	BOMM	No further action
E94688	PSE&G, New Brunswick Div		268 Baldwin St., New Brunswick Twp.	1998	BOMM	

***STATUS**: all sites in this list are Active: This status is designated when a contaminated site is assigned to a remedial program and measures such as a preliminary assessment, remedial investigation or cleanup work is underway; Status Date: The date that the site was assigned to the contact bureau.

◆**Lead Program:** **BCM**=Bureau of Case Management; **BFO-S** = Bureau of Field Operations –Southern (609) 633-1475; **BISR**=Bureau of Industrial Site Remediation; **BOMM** = Bureau of Operation, Maintenance & Monitoring (609) 984-2990; **BUST**=Bureau of Underground Storage Tanks; **CAS**=Case Assignment Section (now BCAIN) (609)292-2941; **CEHA**=County Environmental Health Agency; **OBR**=Office of Brownfields Reuse (609)292-1251

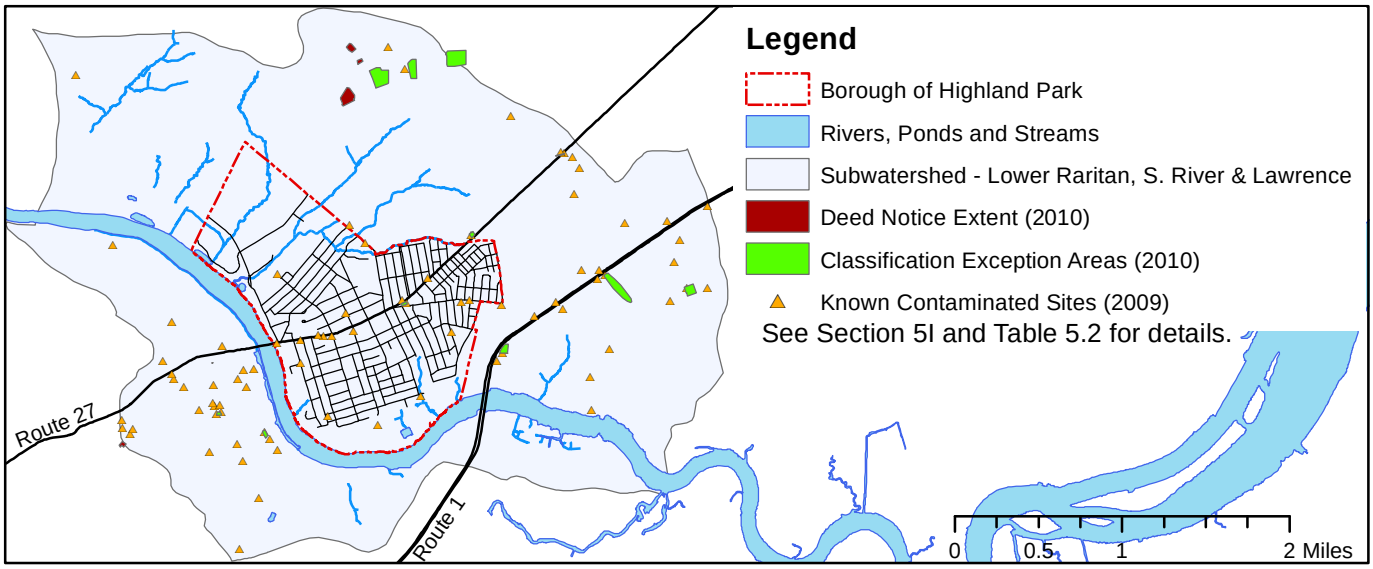
❖**Remedial Level**: **C1**: Remediation does not require a formal design. The source of the contamination is known or has been identified. There is a potential for ground water contamination; **C2**: Remediation requires a formal design. The source of the contamination is known OR the release has caused ground water contamination; **C3**: A multi-phased remediation action. Where the source of the contamination is either unknown or there is an uncontrolled discharge to Soil and/or ground water; **D**: A multi-phased remediation with multiple sources/releases to multiple media including ground water

★KCSs where ground water contamination has been identified and NJDEP has established a Classification Exception Area (CEA)

****** The site of the Eugene Young Environmental Education Center, Block 186/Lots 6-8, has been remediated in the area around the building but not the strip approximately 30 feet wide adjacent to the river.

Sources: NJDEP SRP, August 2009; NJDEP SRP, November 2010a; NJDEP SRP, November 2010b; NJDEP Data Miner, April 15, 2011; Highland Park, 2011

For updates, see: http://datamine2.state.nj.us/DEP_OPRA/OpraMain/categories?category=Site+Case+sub-category



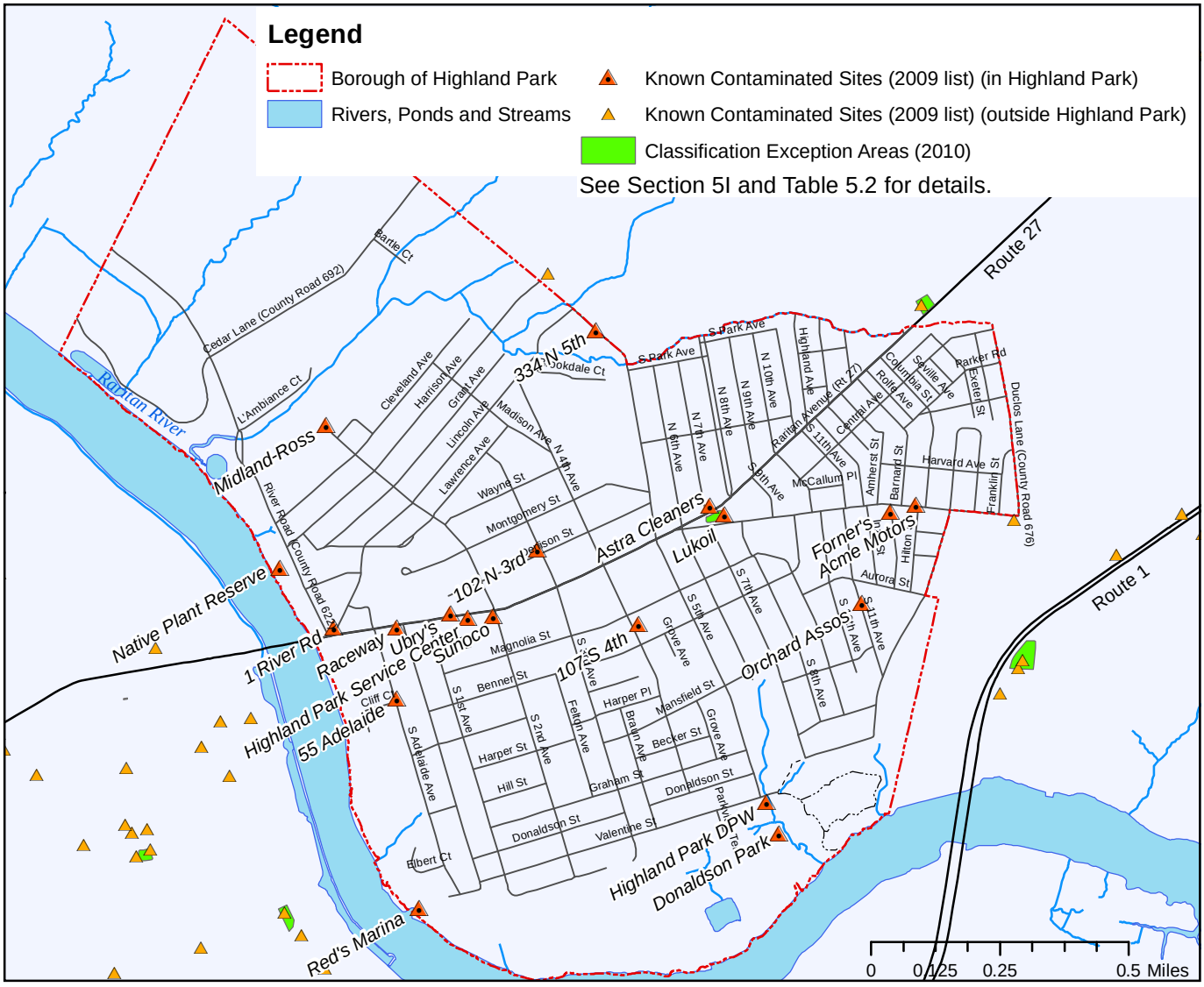


Figure 5f: Contaminated Sites

Top: Broad view of entire sub-waershed.

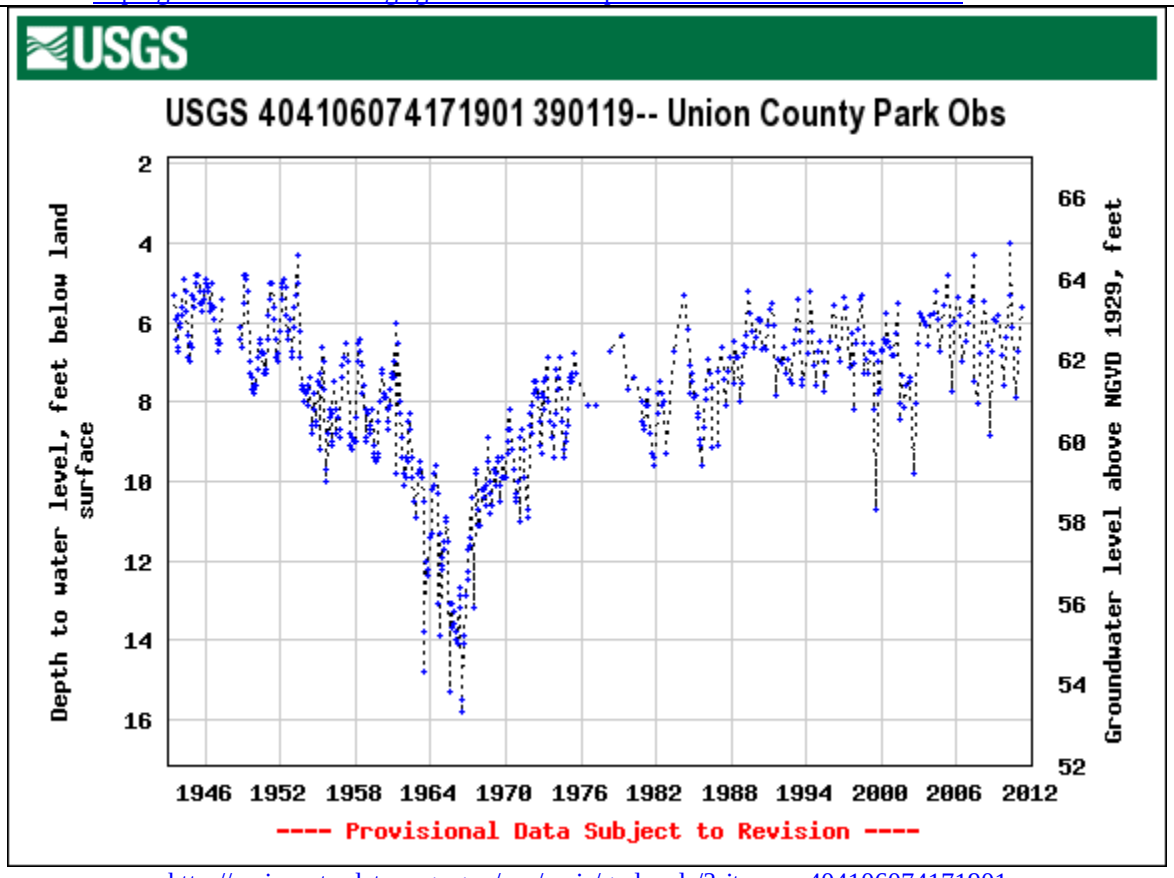
Borough of Highland Park ERI 2012
Prepared by Kratzer Environmental Services

Data Sources: See Appendix B.
Note: Map accuracy is limited to the accuracy and scale of the original data sets; see Appendix B.
Disclaimer: This map was developed using NJDEP GIS digital data, but this secondary product has not been verified by NJDEP and is not NJDEP authorized.

pumped out of the aquifer than is replenished through recharge. This could lead to a drop in the ground water level, affecting well performance, and sometimes causing wells to go dry; as well as causing a decrease in the baseflows of adjacent streams The USGS maintains a nation-wide network of wells to monitor the effects of droughts and other climate variability on ground water levels. The USGS monitoring well nearest to Highland Park and in the Passaic Aquifer is located in a Union County park (approximately 14 miles northeast of Highland Park)[23]. A description of this site and a graph of ground water level for the available period of record (1943 to the present) is shown in **Table 5.3**.

Table 5.3: USGS Real-Time Ground Water Level Network – well currently monitored near Highland Park

Site Number:	404106074171901 - 390119-- Union County Park Obs
Location:	Latitude 40°41'06", Longitude 74°17'19" NAD27 Union County, New Jersey, Hydrologic Unit 02030104 Kenilworth Borough, Union County, NJ, at Galloping Hill Golf Course
Well Characteristics:	**Depth:** 290 feet **Land surface altitude:** 69.00feet above NGVD29
Aquifer:	Well completed in "Early Mesozoic basin aquifers" (N300ERLMZC) national aquifer. Well completed in "Passaic Formation" (227PSSC) local aquifer
Begin date (periodic record):	06/30/1943 **Begin date (continuous record):** 11/17/1972
Extremes for Period of Record:	*Highest Water Level*: 3.06' *Lowest Water Level*: 16.05'
Website:	http://groundwaterwatch.usgs.gov/AWLSites.asp?S=404106074171901&ncd=rtn



http://nwis.waterdata.usgs.gov/usa/nwis/gwlevels/?site_no=404106074171901

Note: This site is maintained by USGS New Jersey Water Science Center.
Source: USGS, 2011

[23] USGS well "230070-- Fischer Obs," in East Brunswick, is physically closer to Highland Park, but is not in the same aquifer (it is in the Northern Atlantic Coastal Plain aquifer system).

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Internet Resources: Ground Water

Ground Water Primer (US EPA): http://www.epa.gov/seahome/gwprimer.html

NJDEP Data Miner: http://www.nj.gov/dep/opra/online.html
Report Categories: http://datamine2.state.nj.us/dep/DEP_OPRA/index2.html
Contaminated Sites: http://datamine2.state.nj.us/DEP_OPRA/OpraMain/categories?category=Site+Case+sub-category

NJDEP grants for Underground Storage Tank removal & remediation: http://www.nj.gov/dep/srp/finance/ustfund/

NJDEP Rules & Regulations (current & proposed): http://www.nj.gov/dep/rules/

NJDEP Surface & Ground Water Quality Standards and Assessment: http://www.state.nj.us/dep/wms/bwqsa/

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6: SURFACE WATER

A. Watersheds

Watersheds

A *watershed* (or basin) is the land area within the confines of a drainage divide in which all surface runoff will drain into a river, river system, or body of water. Highland Park is within the Raritan River watershed (see top left inset in **Figure 6a**), the largest river basin located entirely within the State of New Jersey. This watershed covers approximately 1,100 square miles (699,542 acres) and includes parts of seven counties (Hunterdon, Mercer, Middlesex, Monmouth, Morris, Somerset and Union counties) (USDA, Natural Resources Conservation Service, September 14, 2010).

"Water is vital to life and comprises an invaluable natural resource which is not to be abused by any segment of the State's population or economy." (NJDEP NJAC 7:9B, January 18, 2011).

Sub-watersheds are those smaller drainage areas that make up a larger watershed. Highland Park is located in a sub-watershed of the Raritan River watershed and is comprised of all or portions of several smaller drainage areas whose surface runoff drains directly into the Raritan River (lower inset of **Figure 6a)**.

Watershed Management Areas

Watershed management is the process of managing and protecting all of the water resources within the area of a watershed, rather than on a site-specific basis. The NJDEP recognizes that watersheds are "nature's boundaries," and has established a watershed management approach (NJDEP, 1997). A watershed management approach is based on three key components: 1) a geographic focus; 2) continuous improvement based on sound science; and 3) partnerships/stakeholder involvement. More information concerning watershed management is presented in **Section 10B**. NJDEP has divided the state's watersheds into 20 *Watershed Management Areas (WMAs)*. The Raritan River basin is divided into three WMAs (see top right inset in **Figure 6a**). Highland Park falls within WMA 9, which includes the Lower Raritan River, South River and Lawrence Brook.

Hydrologic Unit Codes (HUC)

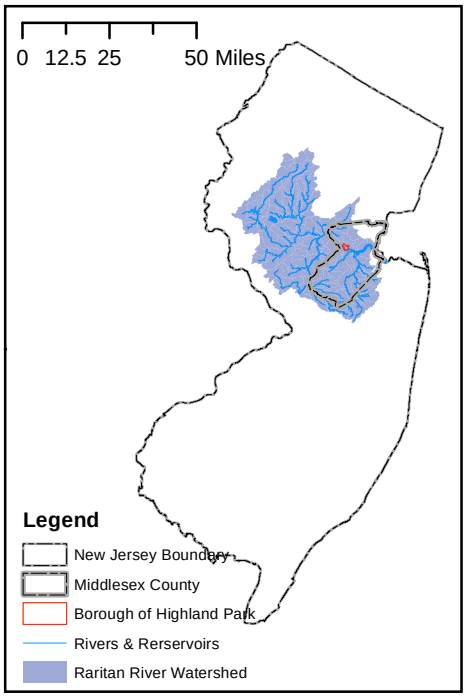
The classification system used by the NJDEP assigns each watershed a *14-digit Hydrologic Unit Code (HUC14[24])*. The HUC14 is a hierarchical system where the first 4 digits (also known as a HUC4) refer to the major drainage basin. The land area of New Jersey that drains to the Atlantic Ocean is assigned a HUC4 of "0203."

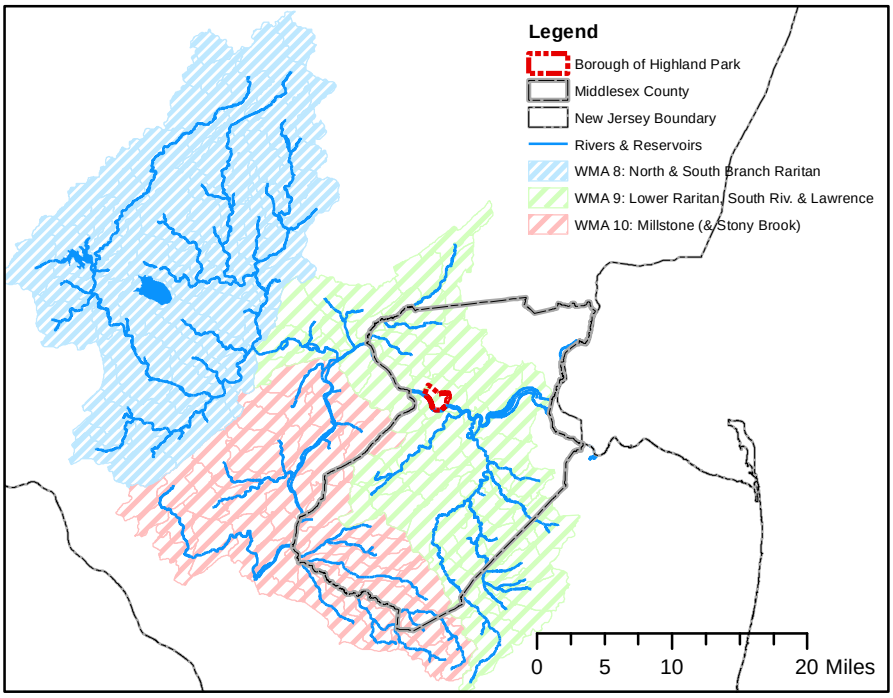
The Raritan River basin is assigned a HUC8 of "02030105," and every sub-watershed within this basin has a HUC that starts with "02030105."

All of Highland Park is within the Lower Raritan River watershed, with a HUC11 of "02030105120." HUC14 subwatersheds and streams either within and surrounding the Borough of Highland Park are shown in the lower inset of **Figure 6a**.

Table 6.1 lists the HUC14s for the subwatersheds encompassing and just upstream of Highland Park.

[24] The HUC14s have a minimum size of 3,000 acres, although some basins are defined with smaller areas. At other times, small subwatershed units are combined.





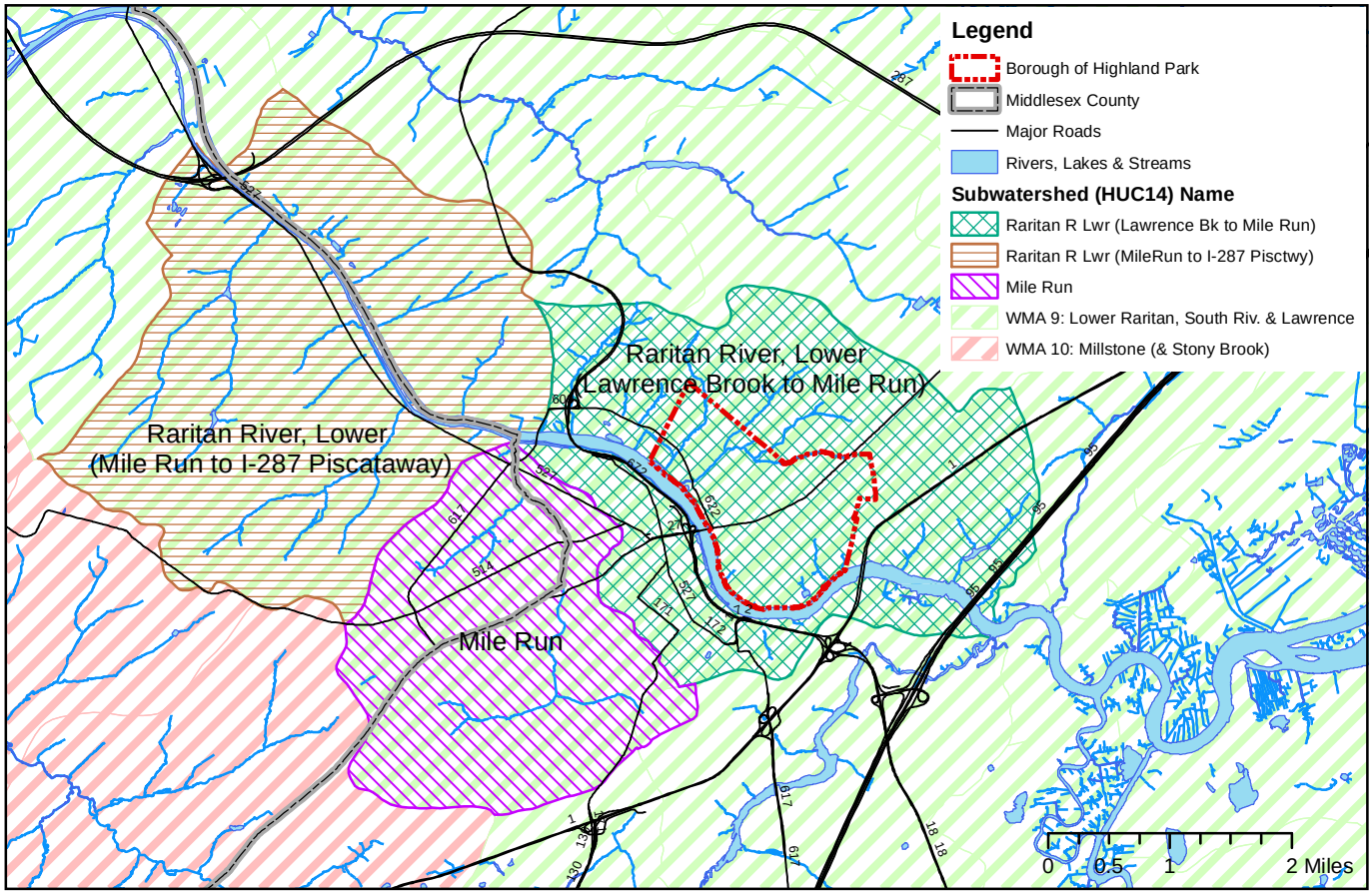


Figure 6a: Raritan River Watershed (Top Left), Watershed Management Areas (WMA) (Top Right) and Subwatersheds (HUC14) (Bottom)

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Borough of Highland Park ERI 2012
Prepared by Kratzer Environmental Services

Data Sources: See Appendix B.
Note: Map accuracy is limited to the accuracy and scale of the original data sets; see Appendix B.
Disclaimer: This map was developed using NJDEP GIS digital data, but this secondary product has not been verified by NJDEP and is not NJDEP authorized.

Table 6.1: Hydrologic Unit Codes for Highland Park's Subwatersheds

Subwatershed Name	14-Digit Hydrologic Unit Code (HUC14)	Comment
Lower Raritan River (Lawrence Brook to Mile Run)	02030105120170	This subwatershed encompasses all of Highland Park.
Lower Raritan River (Mile Run to I-287 Piscataway)	02030105120160	This subwatershed encompasses the segment of the Raritan River directly upstream of Highland Park.
Mile Run	02030105120150	This subwatershed encompasses the Mile Run, a tributary of the Raritan River, joining the River approximately 1 mile upstream of Highland Park
Source: NJDEP NJGS, May 2010		

River and Stream Descriptions

Raritan River

The Raritan River is a dominant feature of Highland Park comprising a major portion of the border of the borough. The range of the tide (difference between high and low tide) at Donaldson Park varies from 5-7 feet depending primarily on the lunar cycle. Daily high and low tides for the New Brunswick station (across from Donaldson Park at Rutgers Boat House) are provided at NOAA Tide website (See **Figure 6b**).

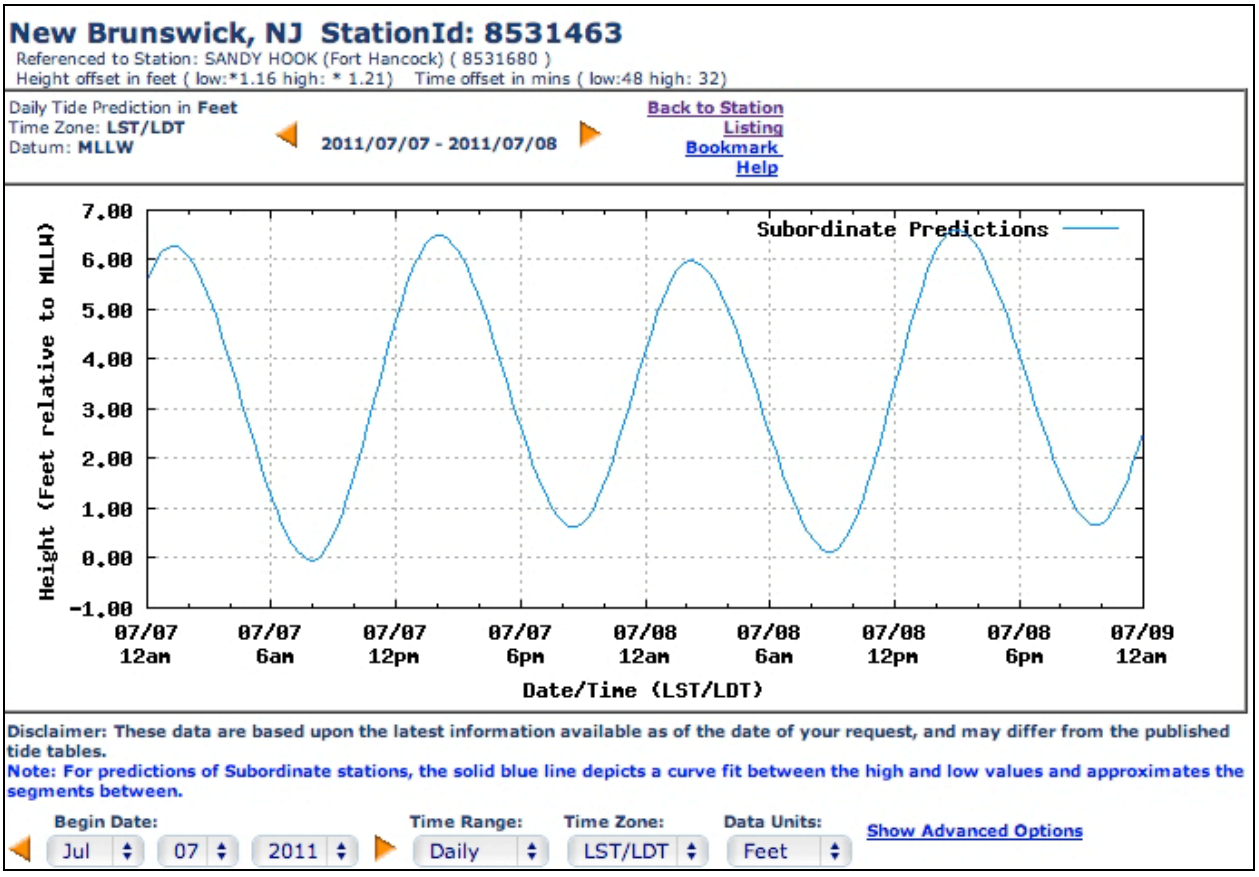

Figure 6b: Daily High and Low Tides for the New Brunswick Station (across from Donaldson Park at Rutgers Boat House)
(NOAA Tide website, July 7-9, 2011)

The level of the Raritan River at Bound Brook, NJ is a good qualitative predictor of the level of the Raritan at Highland Park with respect to flooding. The level at Bound Brook (and

many other NJ sites) is reported in real time at the National Weather Service Advanced Hydrologic Prediction Website (See **Figure 6c**). Flood stage at this location is 28.0 feet (equal to about 17,220 cfs (cubic feet per second)), moderate flooding occurs between 30 and 33 feet (23,000 to 33,400 cfs), and a major flood is one greater than 33 feet stage (33,400 cfs). The Raritan River exceeded flood stage three times in 2011 (see **Table 6.2**) (National Weather Service, July 2011). The worst flood on record for this location was on September 17, 1999, due to Hurricane Floyd, when crest stage reached 42.13 feet, or 82,900 cfs. Hurricane Irene caused the second highest flow on August 28, 2011, when the Raritan River crested at 41.90 feet, or 80,700 cfs [25]. Mean flow is 26,256 cfs (USGS, August 2011).

Table 6.2: Floods on the Raritan River at Bound Brook

Major Flood Crests (in order of highest flow first)				
Rank*	**Gage Height (feet)**	**Flow (CFS)**	**Severity**	**Date**
1	42.13	82,900	Major	09/17/1999
2	41.90•	80,700•	Major	08/28/2011
3	38.38	56,900	Major	04/16/2007
4	--	56,400	Major	02/06/1886
5	--	49,300	Major	09/23/1882
6	37.47	46,100	Major	08/28/1971
7	36.04	45,900	Major	03/14/2010
8	35.58	40,100	Major	10/20/1996
9	33.34	32,700**	Major	01/20/1996
10	33.18	34,600	Major	01/25/1979
11	33.14•	33,900•	Major	09/08/2011
Most Recent Flood Crests (in order of most recent first)				
Rank*	**Gage Height (feet)**	**Flow (CFS)**	**Severity**	**Date**
11	33.14	33,900	Major	09/08/2011
2	41.90	80,700	Major	08/28/2011
	31.10		Moderate	04/17/2011
	28.40		Minor	03/07/2011
	28.54	19,200	Minor	12/27/2009
	29.11	20,700	Minor	03/31/2010
7	36.04	45,900	Major	03/14/2010

*Rank refers to the relative severity of each flood, i.e. Rank 1 is the highest flood crest on record (1902 - present).
•Provisional data subject to revision.
**It is unknown why this flow is lower than the flow for the 10th ranked flood, but it is reported correctly as per USGS.

Sources: National Weather Service, July 2011; USGS, September 12, 2011; USGS, July 2011 http://nwis.waterdata.usgs.gov/nj/nwis/peak?site_no=01403060&agency_cd=USGS&format=html;

Buell Brook

Buell Brook is the most upstream of several tributaries of the Raritan River within Highland Park (see **Figure 6d**), originating in Piscataway Township, traveling about half a mile, before entering Edison Township for about 0.15 miles prior to entering Highland Park. The Buell Brook for most of its length is unaltered from historical times. In the 1930's, a pond was created by the Works Progress Administration (WPA) in Johnson Park. The brook now feeds into the pond, which flows into the Raritan. The pond was repaired and improved in 2010-2011 with a new spillway and an observation deck around portion of the pond. In the upper reaches of the Buell Brook, there are various short length culverts from when this area was part of the U.S. Army Camp Kilmer.

[25] Provisional data subject to revision.
http://nwis.waterdata.usgs.gov/nj/nwis/uv?cb_00060=on&cb_00065=on&format=html&period=7&site_no=01403060

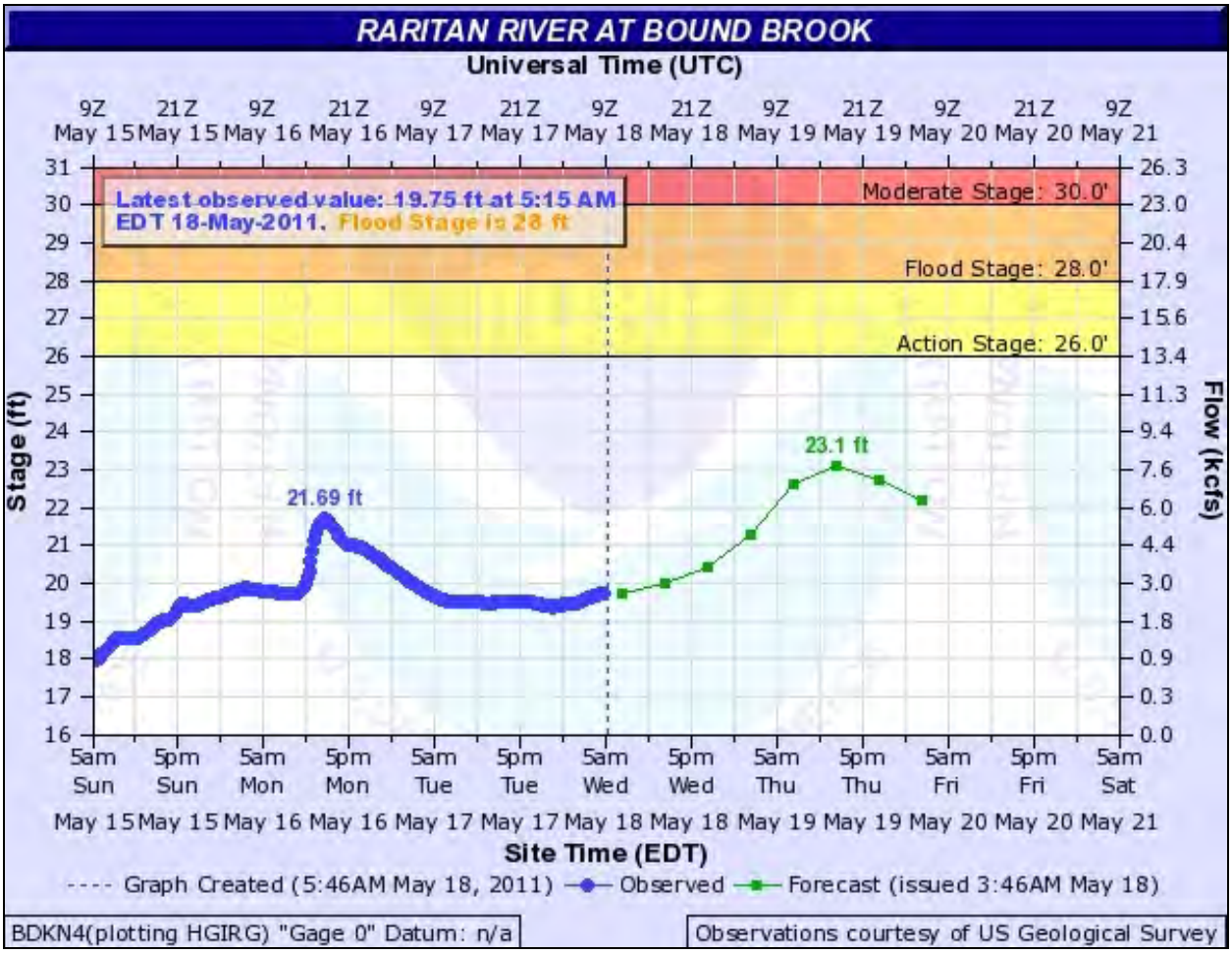

Figure 6c: Raritan River Water Level at Bound Brook
(National Weather Service website, May 15-21, 2011)

Mill Brook

Three branches of the Mill Brook begin in Edison Township, the easternmost branch forming part of the boundary between Edison and Highland Park. Mill Brook joins the Raritan River about $^1/_4$ mile downstream (southeast) of Buell Brook. The Mill Brook has undergone significant change since the 1700's and has been part of Highland Park's industrial past. The section of the stream between River Road and the culvert under the railroad has been the site of mills, factories, and water stops for steam locomotives. Historically, there have been ponds created to provide a continuous source of water power for mills and factories (see **Figure 6d**). The building of the railroad resulted in the creation of a culvert under the tracks, which is approximately 12 feet in diameter.

At the present time, the brook runs through three areas where it has been channeled with brick walls. One along the Millbrook by L'Ambiance Court where there is a wall along the west side of the stream then along the east side of the stream going toward the source. The second area is just west of Lincoln Avenue and is along the west side of the stream. The third area is just east of Lincoln Avenue with walls on both sides of the stream and a cement stream bed. These are marked on **Figure 6d**. The upper end of the main stem of the brook is culverted from Route 27 further upstream.

Unnamed Streams

Seven small unnamed streams lie entirely within the Borough of Highland Park. For the purposes of this report, these are designated with numbers on **Figure 6d**.

Stream 1, which enters the Raritan across from Cleveland Avenue, historically drained the hill above River Road. It now is fed by the storm sewers from Cleveland Avenue and River Road.

Stream 2 enters the Raritan River across from Valley Place Ravine. In the past, this stream was fed from the runoff of the neighboring hill section. Now the stormwater system in this area feeds Stream 2.

Stream 3 is a small stream that drains the marsh (Barwood property) at the west end of Donaldson Park.

Stream 4 is an intermittent stream that feeds a manmade pond in Donaldson Park. It is dry for the majority of the year. The pond was created in the 1930's by the Works Progress Administration (WPA). There is an outflow into the Raritan River, which allows water to enter the pond during high tide and provides most of the pond's water.

Historically **Stream 5** drained the "Buck Woods" area and the areas further north and east. Approximately 250 feet of this stream has been culverted north of Valentine Street and much of the runoff that previously drained into the stream now flows into the storm water system. As a result, it is now an intermittent stream.

Stream 6 is an intermittent stream that flows parallel to the Southside Bicycle Path and flows into the storm sewer at the trailhead of The Meadows, which feeds into Stream 5.

Prior to development in the vicinity, **Stream 7** drained an extensive area north of the current channel. The stream now derives most of its flow from the storm water sewers associated with the Crowell Road area. The stream has steep banks and flows through The Meadows before joining the Raritan River near the borough's southeastern boundary.

Channelized and Culverted Sections of Streams

Figure 6d illustrates the locations where streams are culverted underground within Highland Park. These include the upper Millbrook, northeast of Route 27 and Stream #6. Input to these culverted sections comes primarily from stormwater runoff from impervious surfaces within the streams' watersheds. Much of this runoff enters the streams through stormwater outfalls along roadways. Any runoff that feeds to roadways (from parking lots, structures, sidewalks, and other impervious or semi-permeable surfaces such as lawns) increases the volume the culverted portions of streams must carry and can, during heavy storm events, overwhelm the system.

Tidal Limit

A *tidal watercourse* is a stream or river affected by tides (the periodic rise and fall of the water surface resulting from the gravitational interaction of the earth, the moon, and the sun). The *Head of Tide* (HOT) is the point on a tidal watercourse at which measurement of the water surface vertical movement at the average high water level becomes negligible. All points seaward of the HOT on a tidal watercourse are tidal. The Raritan River is tidal in the vicinity of Highland Park. The HOT is at a point approximately 2 miles upstream of the Borough boundary with Piscataway Township and about 1 mile upstream of the County Route 609 bridge (Landing Lane) (illustrated in **Figure 6e**) (NJDEP, Office of Environmental Analysis, 1986).

Previously, the Head of Tides has been reported at the Fieldsville Dam in South Bound Brook, NJ by the US Geological Survey, which has tidal fluctuations (Environmental Commission, 2011).

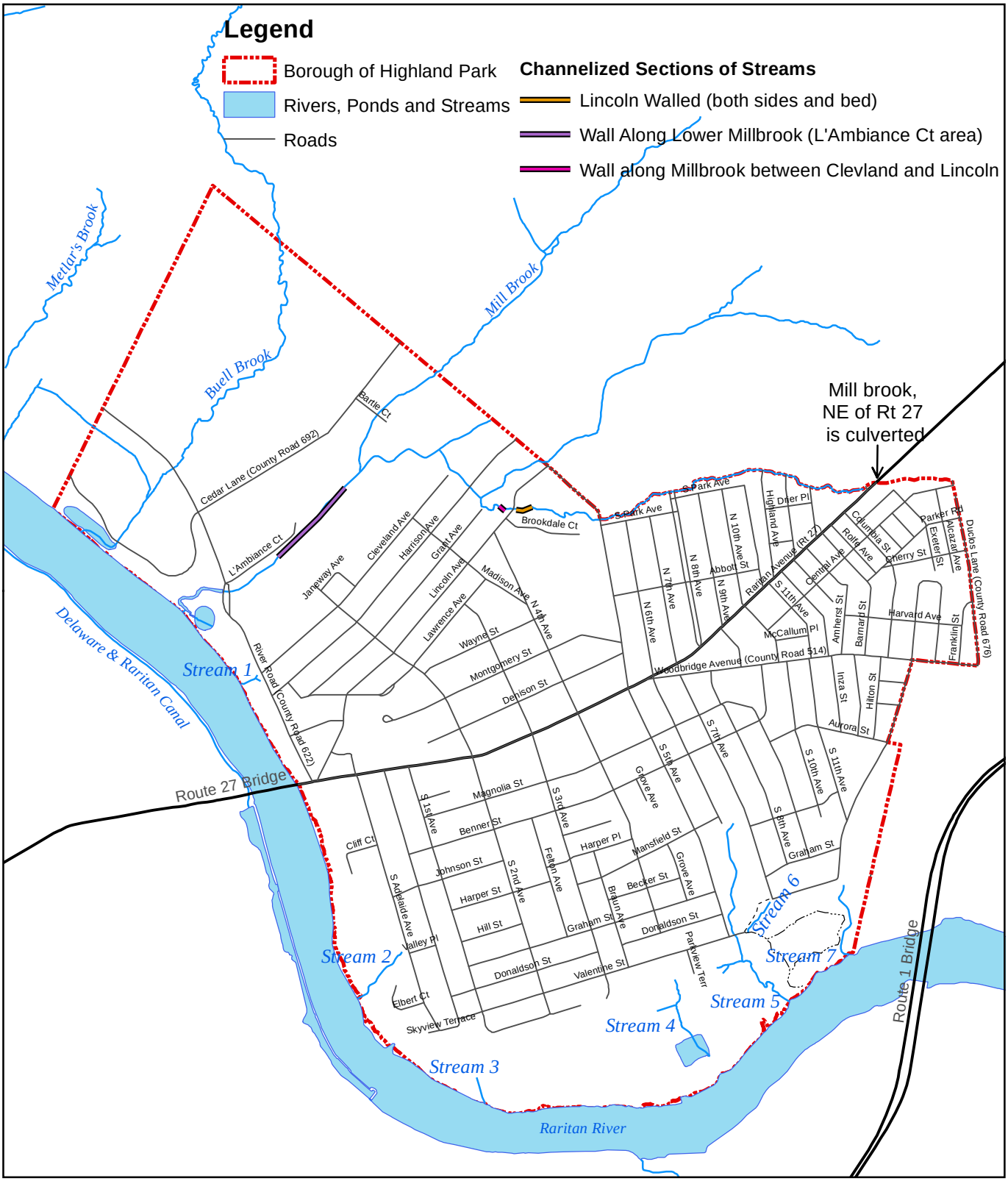

Figure 6d: Streams and Channeled and Culverted Sections of Streams

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0 500 1,000 2,000 Feet

Borough of Highland Park ERI 2012
Prepared by Kratzer Environmental Services

Data Sources: See Appendix B.
Note: Map accuracy is limited to the accuracy and scale of the original data sets; see Appendix B.
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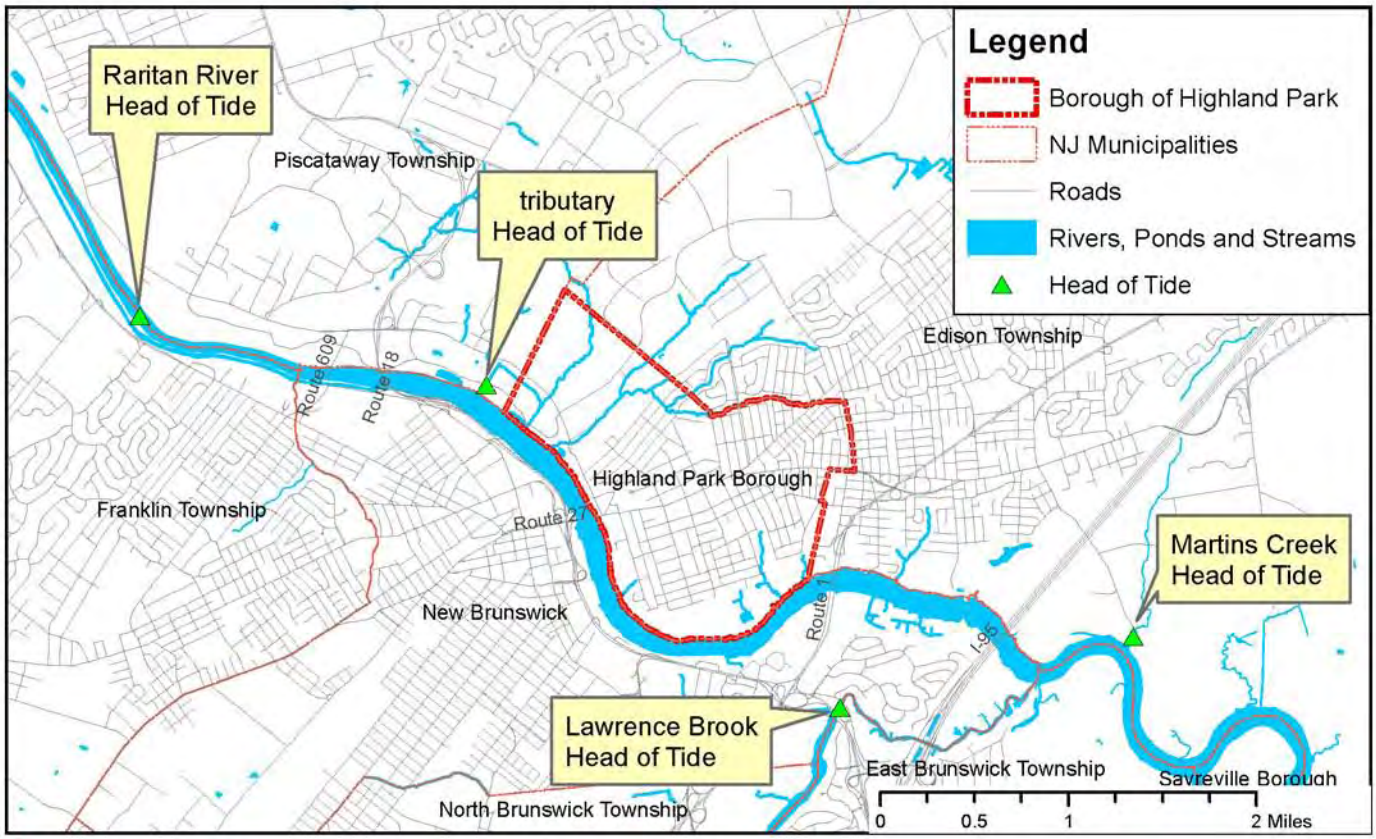

Figure 6e: Head of Tide (top) and Tidal Flats at Low Tide (bottom)

N W E S

Borough of Highland Park ERI 2012
Prepared by Kratzer Environmental Services

Data Sources: See Appendix B
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At low tide, mud flats are exposed on the Highland Park side of the Raritan River, particularly near Donaldson Park. The approximate extent of these mud flats is illustrated in **Figure 6e**.

Because the Raritan River is tidal, planning and management for the section of the river adjacent to Highland Park falls within the purview of the New York/New Jersey Estuary Program.

B. Floodplains/Flood Prone Areas

A *floodplain* is the land along a river or stream that is subject to periodic flooding when the river or stream overflows its banks. As required by the Flood Disaster Protection Act of 1973, the Federal Emergency Management Administration (FEMA) is responsible for delineating floodplains.

According to FEMA, "Everyone lives in some type of flood zone." FEMA defines these geographic areas based on studies of flood risk.

FEMA publishes *Flood Insurance Rate Maps* (FIRMs) that show the flood zone boundaries. FIRMs are the basis for floodplain management, mitigation, and insurance activities for the National Flood Insurance Program (NFIP). Changes to the flood risk information may only be performed by FEMA. The digital FIRM (DFIRM) which are shown in **Figure 6f** are produced by FEMA in conjunction with the hardcopy FIRMs and generally matches the hardcopy map exactly. However, the hardcopy flood maps and flood profiles are the authoritative documents for the NFIP.

Flood Facts

- Floods are the #1 natural disaster in the United States.
- Hurricanes, winter storms and snowmelt are common (but often overlooked) causes of flooding.
- New land development can increase flood risk, especially if the construction changes natural runoff paths.
- Federal disaster assistance is usually a loan that must be paid back with interest.
- If you live in a Special Flood Hazard Area (SFHA) or high-risk area and have a Federally backed mortgage, your mortgage lender requires you to have flood insurance (FEMA, March 2011).

Special Flood Hazard Areas (SFHAs) are defined as areas subject to inundation by a flood having, on average, about 1 in 100 chance in any given year, also referred to as the 1% annual chance flood[26] (FEMA, 1996). Below are brief definitions of the FEMA flood zones that occur within Highland Park.

Areas in *Zone X*, which includes the majority of Highland Park, have low to moderate risk of flooding and are not in the SFHAs. They correspond to areas outside the 1% annual chance floodplain, areas of 1% annual chance sheet flow[27] flooding where average depths are less than 1 foot, areas of 1% annual chance stream flooding or where the contributing drainage area is less than 1 square mile. No Base Flood Elevations or depths are shown within this zone. Insurance purchase is not required in this zone (FEMA, 2009).

Zones with a high-risk of flooding, or SFHAs, include *Zone A* and *Zone AE*. *Zone A* corresponds to the 1% annual chance floodplains that are determined by approximate methods of analysis (i.e., not with Base Flood Elevations). *Zone AE* corresponds to the 1% annual chance floodplains that are

[26] Flood designations are based on statistical averages, not the number of years between big floods. The term "100-year flood" does not mean a flood that happens once every 100 years. It is a statistical designation that there is a 1 in 100 chance that a flood of any given size will be equaled or exceeded during any year. Changes and variability in climate and land use over time can change flood frequency (Dinicola, 2005).

[27] Sheet flow, or overland flow, is flow that occurs overland in places where there are no defined channels, so the flood water spreads out over a large area at a uniform depth.

Note: Changes to the flood risk information may only be performed by FEMA. The digital data represented here are produced by FEMA in conjunction with the hardcopy FIRMs and generally matches the hardcopy map exactly. However the hardcopy flood maps and flood profiles are the authoritative documents for the National Flood Insurance Program (NFIP).

Legend

- Borough of Highland Park
- Roads
- Rivers, Ponds and Streams

FEMA DFIRM Flood Zones (July 6, 2010)

- AE: 1 in 100 chance annual flood, elevations determined
- A: 1 in 100 chance annual flood, no elevations
- 0.2 % Annual Chance Flood Hazard
- X: Not in floodplain

See Section 6B for discussion.

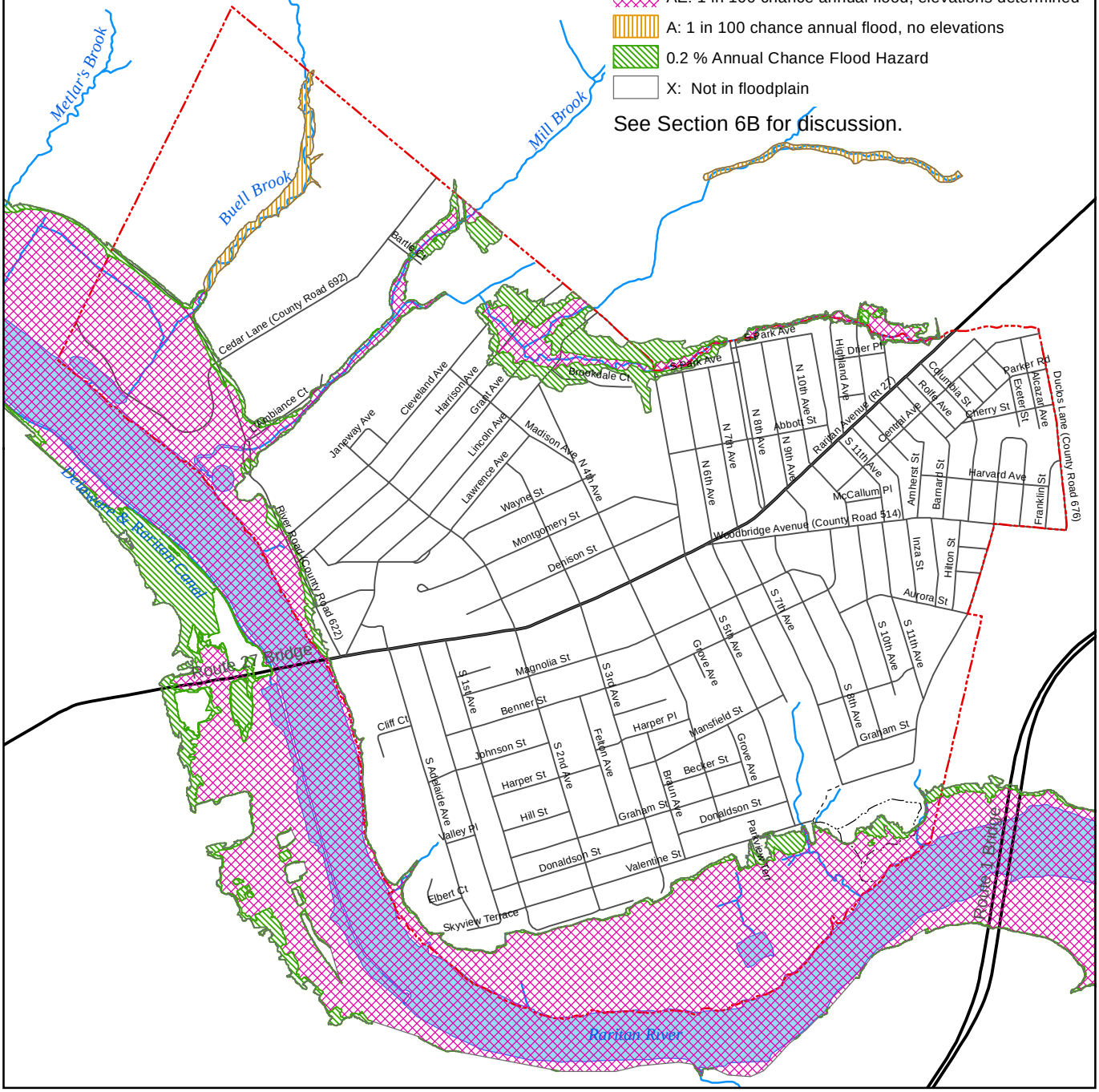

Figure 6f: Floodplains Federal Emergency Management Administration (FEMA) Digital Flood Insurance Rate Map July 6, 2010

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Borough of Highland Park ERI 2012
Prepared by Kratzer Environmental Services

Data Sources: See Appendix B.
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determined by detailed methods of analysis, which includes detailed hydraulic analyses to determine Base Flood Elevations. In communities such as Highland Park that participate in the NFIP, all homeowners in Zones A and AE are required to get flood insurance in order to get a loan from a federally regulated lender. These areas have a 26% chance of flooding over the life of a 30-year mortgage (FEMA, 2009).

Areas with a 0.2% annual chance of flooding (typically referred to as the 500 year flood) are not considered high risk, but are susceptible to periodic flooded.

Floodplains in Highland Park are shown in **Figure 6f**, based on FEMA determinations (as of July 6, 2010, the most recent GIS data available). Frequent flooding occurs in areas adjacent to the Raritan River, where the 1% annual chance floodplain varies from about 600 to 1,900 feet wide (about 400 to 1,500 feet on the Highland Park side). The floodplain of Buell Brook merges with the Raritan River floodplain up to about 1,000 feet from its confluence with the Raritan, and is approximately 700 feet wide where the brook crosses River Road (County Route 622). Buell Brook's 1% floodplain then narrows to approximately 100 feet wide. Similarly, the floodplain for Mill Brook merges with the Raritan River floodplain for the first 500 feet from the River. It then contracts to about 600 feet width at River Road, and narrows to roughly 70 to 100 feet for the remainder of its length within Highland Park, including the length of the split near Bartle Court, and to both tributaries formed by the split between Harrison Street and Lincoln Avenue. The 1% annual chance flood of the eastern branch of Mill Brook widens to about 100 to 200 feet along the northeastern boundary of Highland Park with Edison Township.

Floodplain management is the operation of a community program of corrective and preventative measures for reducing flood damage. These measures may include zoning, subdivision, or building requirements, and special-purpose floodplain ordinances. Community involvement is an important element in making flood insurance available to home and business owners. Riparian buffer and wetlands protection regulations and ordinances can also reduce flood damage by protecting those areas most susceptible to flooding and providing natural flood control. These efforts benefit downstream areas, as well.

C. Riparian Zone

Highland Park Borough Council passed a Riparian Buffer Conservation Zone Ordinance (§230-194 et seq.) with a Riparian Map on May 3, 2011. In the process of generating the ERI, errors in the maps were detected, which require a change in the ordinance. The modified ordinance is in process. The Borough's engineer (CME Associates) will produce the corrected Riparian Map in March 2012. A technical report (in progress) on the rationale, need and legal basis for a riparian zone in the Borough will be adopted as part of the Master Plan. In addition, the ordinance states that every second year the Borough's engineer will evaluate whether the riparian zone map needs updating. Any applicant is responsible for the initial determination of the presence of a riparian zone on a site, for review by the Borough and, where required, by the NJDEP. **Figure 6g** represents approximate riparian zones (to be approved March 2012), but it should be noted that the current and future official maps are on file at the Borough offices.

D. Wetlands

A *wetland* is a transitional area between aquatic and terrestrial ecosystems. Wetlands are those areas that are inundated or saturated by surface water or ground water at a frequency and duration sufficient to support, and that under normal circumstances do support, a prevalence of vegetation typically adapted for life in saturated soil conditions, commonly known as

Legend

- Borough of Highland Park
- Rivers, Ponds and Streams
- Roads
- Slopes greater than 30%*
- 50 Foot Riparian Buffer (minimum)
- Flood Zones AE and A

*The ordinance extends the riparian zone where slopes >15% are adjacent to the riparian zone, but GIS data is only available representing 30% slope.

Notes:

1. This is an approximate representation of Highland Park's riparian zone ordinance designations.
2. Based on NJAC 7:9B (Surface Water Quality Standards), there are no streams classified as Category One or Trout Production or Trout Maintanance waters within the Borough.
3. Based on NJDEP published information, no areas of documented habitat for a threatened or endangered species of plant or animal, which is critically dependent on the surface water body for survival and/or acid producing soils were identified within the Borough.
4. To confirm applicability of a 50-ft wide Riparian Zone, site verification should be performed prior to development.
5. Where slopes (in excess of 15%) are located within the designated widths, the riparian zone shall be extended to include the entire sloped area (maximum 300 feet).
6. Floodway information shown on this map was obtained from FEMA Digital Flood Insurance Rate Map (July 6, 2010). NJDEP verification needs to be obtained for each individual lot.

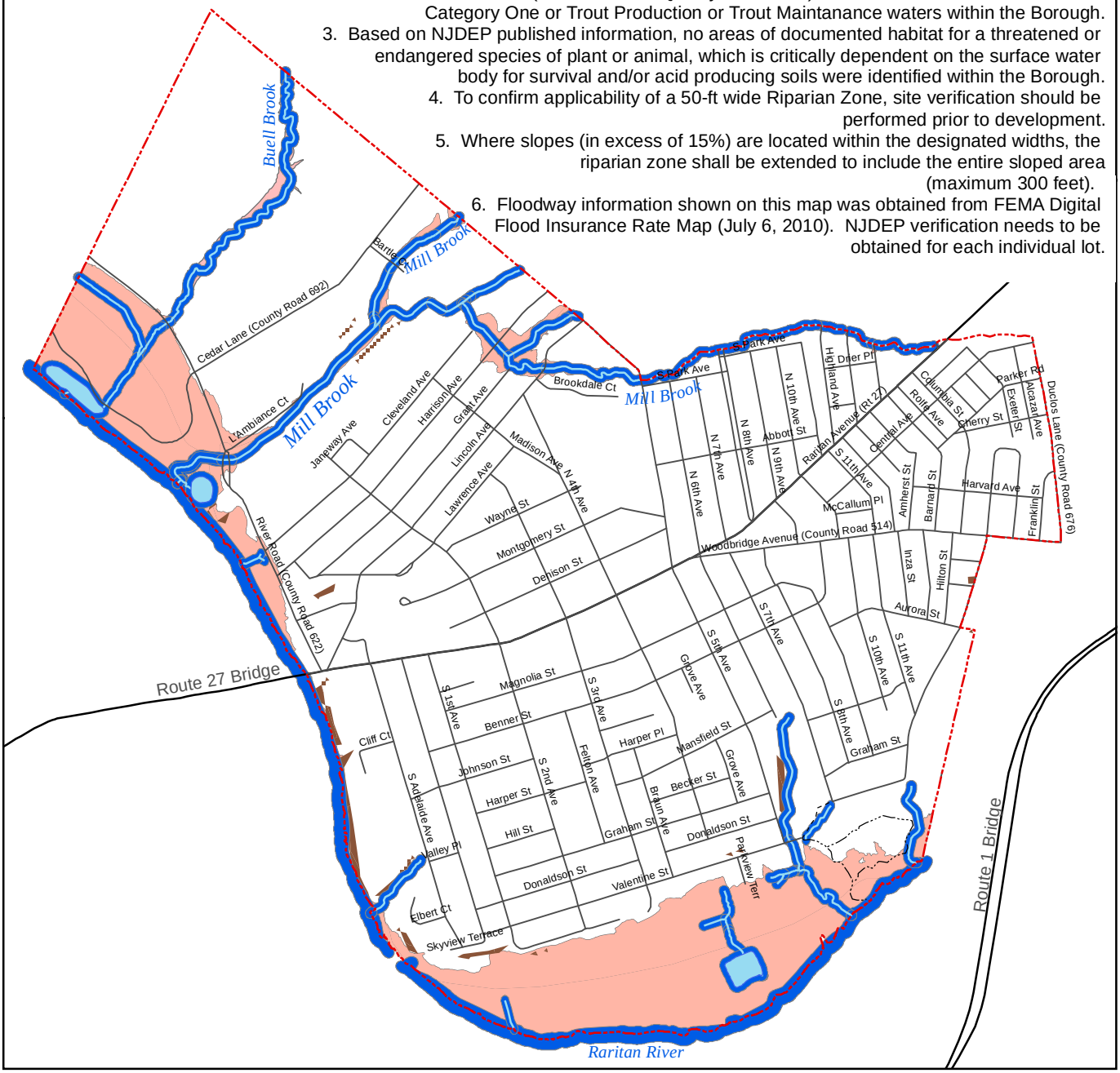

Figure 6g: Riparian Buffer Conservation Zone (approximate)

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0 500 1,000 2,000 Feet

Borough of Highland Park ERI 2012
Prepared by Kratzer Environmental Services

Data Sources: See Appendix B.
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hydrophytic vegetation. To determine if an area is a wetland, the vegetation (plants that like wet conditions), soils (wetland types, which often show mottling) and hydrology (low spots or evidence of water) are evaluated. A *transition area*, or buffer, is an area of land adjacent to a freshwater wetland that minimizes adverse impacts on the wetland or serves as an integral component of the wetlands ecosystem (N.J.S.A. 13:9B-3 in NJDEP Division of Land Use Management, July 1998).

In the past, wetlands were often regarded as wastelands – only useful when drained and filled. In contrast, a 1978 Tufts University study showed that one acre of wetland provides at least $153,000 (1978 dollars) of public value, considering proven monetary benefits of flood protection, pollution reduction, water supply, recreation and aesthetics (Fair, 2004). Some of the benefits of wetlands include:

- Wetlands protect drinking water by filtering out pollutants and sediments that would otherwise obstruct and contaminate our waters.
- Wetlands soak up runoff from heavy rains and snow melts, providing natural flood control.
- Wetlands release stored waters during droughts.
- Wetlands provide critical habitats for a major proportion of the state's fish and wildlife, including many endangered, commercial and recreational species.
- Wetlands provide high quality open space for recreation and tourism (NJDEP Land Use Regulation, 2011).

However, already over 54% of the total wetlands in the continental US have been lost, and an additional 200,000 acres disappear every year (NJDEP Land Use Regulation, 2011). Loss of wetlands has resulted in erosion, flooding, sedimentation, and decreased populations of many types of wildlife. Structures built in wetlands suffer from frost heaving and other structural problems.

New Jersey protects wetlands under the 1987 New Jersey Freshwater Wetlands Protection Act (N.J.S.A. 13:9B) and Rules (N.J.A.C. 7:7A) (NJDEP Division of Land Use Management, July 1998 and November 2009). Under these, NJDEP regulates virtually all activities proposed within wetlands and transition areas or buffers around freshwater wetlands, including cutting of vegetation, dredging, excavation or removal of soil, drainage or disturbance of the water level, and filling or discharge of any materials. Development that would impair the wetland's ability to provide the values listed above (filtration, flood control, etc.) is prohibited. There are limited exemptions for existing farming, ranching, or forestry operations.

On-site inspection (direct testing and observation of soils, hydrology and vegetation) by a qualified professional is needed prior to making any disturbance within a wetland or transition area. Only an official determination from NJDEP, called a *Letter of Interpretation* (LOI) can verify the presence, absence, or boundaries of freshwater wetlands and transition areas on a site. Copies of these maps are filed at the NJDEP and the borough building, but unfortunately, NJDEP does not digitize these determinations into a GIS layer[28].

In addition to defining the boundary of the wetland, the LOI establishes the value of the wetland, which will determine the width of the regulated transition area. *Ordinary Value*

[28] Digitizing involves giving latitude and longitude coordinates to areas and lines to depict mapped features.

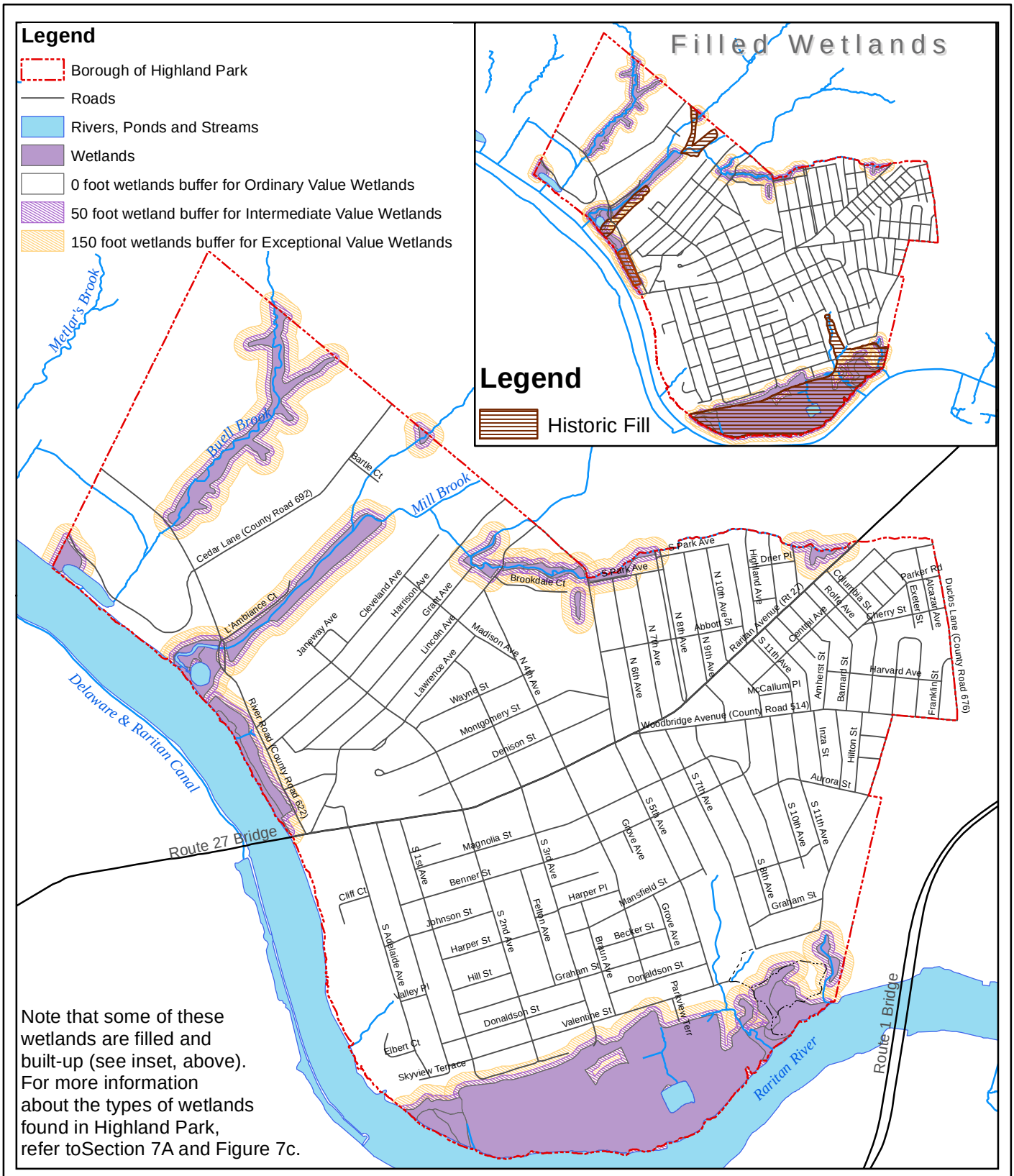

Figure 6h: Wetlands (from 2007 Land Use) Inset: Filled Wetlands

Note: Only an official determination from NJDEP, called a "Letter of Interpretation" can verify the presence, absence or boundaries of freshwater wetlands and transition areas.

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0 500 1,000 2,000 Feet

Borough of Highland Park ERI 2012
Prepared by Kratzer Environmental Services

Data Sources: See Appendix B.
Note: Map accuracy is limited to the accuracy and scale of the original data sets; see Appendix B.
Disclaimer: This map was developed using NJDEP GIS digital data, but this secondary product has not been verified by NJDEP and is not NJDEP authorized.

wetlands, such as man-made drainage ditches and swales, have a 0 foot buffer. *Intermediate Value* wetlands have a 50 foot buffer, which includes those wetlands not included in the definitions of Ordinary or Exceptional value. *Exceptional Value* wetlands have a 150 foot buffer width. Exceptional Value wetlands include wetlands that provide habitat for endangered and threatened species and those contiguous with FW-1, FW-2 Trout Production waters and their tributaries, and Category 1 classified streams (see **Section 6D** for descriptions of stream classifications, below). A determination of threatened and endangered species habitat is provided by using the Landscape Project data (see **Section 7F**).

The wetlands shown in **Figure 6h** were determined by selecting all wetlands land use types from NJDEP's 2007 Land Use GIS data. **Figure 6h** provides guidance on where wetlands are found in Highland Park. This dataset is intended to serve as a resource for analysis rather than regulatory delineations because it is derived from aerial photos rather than on-site surveys. The transition area widths of 0, 50 and 150 feet are mapped in **Figure 6h**, because the GIS data does not determine the value of each wetland. The actual transition area width required by the NJDEP is determined in the LOI.

There are approximately 151 acres of wetlands within Highland Park, or 7% of the borough (NJDEP, 2010). However, a large portion of these have been filled and built on, particularly in Donaldson Park and in what is now the Native Plant Reserve and The Meadows (see inset of **Figure 6h)**. There are several types of freshwater wetlands in Highland Park, such as deciduous wooded wetlands, scrub/shrub wetlands, herbaceous wetlands and managed wetland in built-up recreation area (see **Section 7A** and **Figure 7c**).

E. Surface Water Quality Standards

Surface Water Quality Standards (SWQS) are the rules in chapter N.J.A.C. 7:9B that set forth designated uses, use classifications, and water quality criteria for the State's waters based upon the uses, and the NJDEP's policies concerning these uses, classifications and criteria, which are necessary to protect the State's waters. The SWQS operate in conformance with the Federal Water Pollution Control Act (33 U.S.C. 1313(c)), commonly known as the Clean Water Act (CWA), and the Federal Water Quality Standards Regulation at 40 CFR 131.

According to the Surface Water Quality Standards N.J.A.C. 7:9B,

> "Water is vital to life and comprises an invaluable natural resource which is not to be abused by any segment of the State's population or economy. It is the policy of the State to restore, maintain and enhance the chemical, physical and biological integrity of its waters, to protect the public health, to safeguard the aquatic biota, protect scenic and ecological values, and to enhance the domestic, municipal, recreational, industrial, agricultural and other reasonable uses of the State's waters.
>
> "The restoration, maintenance and preservation of the quality of the waters of the State for the protection and preservation of public water supplies is a paramount interest of the citizens of New Jersey.... Toxic substances in waters of the State shall not be at levels that are toxic to humans or the aquatic biota, or that bioaccumulate in the aquatic biota so as to render them unfit for human consumption.... Human health-based ambient criteria have been established in freshwaters due to consumption of fish and water, and in saline water due to consumption of fish. For carcinogens, the criteria have been established at levels which would result in no greater than a one-in-one-million lifetime excess cancer risk. For non-carcinogens, the criteria have been established which would result in no appreciable risk of deleterious effect." (NJDEP Land Use Management, Water Monitoring and Standards, January 2011)

According to the designated uses under the SWQS, NJDEP assigns *surface water classifications* to each stream in order to group waters and assign water quality criteria. Designated uses include potable water, propagation of fish and wildlife, recreation, agricultural and industrial supplies, and navigation. The *criteria* are numerical targets for constituent concentrations (such as toxic pollutants) or narratives that describe in-stream conditions to be attained, maintained or avoided, so that the specified uses are protected for the different use classifications.

The SWQS are used by several NJDEP programs, including the New Jersey Pollutant Discharge Elimination System program, Site Remediation program, Stream Encroachment, Land Use Regulation Program and Total Maximum Daily Loads (TMDLs, see **Section 6E**).

Table 6.3 describes the definitions of the surface water classifications, while **Figure 6i** illustrates the stream categories within Highland Park.

The Raritan River and all streams within Highland Park are designated Freshwater 2 (FW2) and Non-Trout production (NT) (NJDEP Land Use Management, Water Monitoring and Standards, January 2011).

F. Integrated List and Total Maximum Daily Loads

States are required by the Federal Clean Water Act (US Federal Water Pollution Control Act, January 2011) to develop a Water Quality Inventory Report (required under Section 305(b) of the act) and a List of Water Quality Limited Segments (required under Section 303(d)). Since 2001, the USEPA has recommended that states integrate these two, producing the *Integrated List.* The goal is to provide an effective tool for maintaining high quality waters where designated uses (designated by the SWQS, discussed above in **Section 6D**) are attained, and improving the quality of waters that do not attain their designated uses (NJDEP Water Monitoring and Standards, September 2010).

The Integrated List is subject to regulatory requirements, which include public participation and submission to the USEPA for approval and adoption. The Integrated List identifies the status of all applicable designated uses for every assessment unit (usually by HUC14 subwatershed) by labeling the results of each designated use assessment as one of the five sublists (see **Table 6.4** sublist descriptions).

The NJDEP is required to use all existing and readily available data to assess water quality for the Integrated List. As a result, assessment of the HUC14 that encompasses Highland Park may include sites in Piscataway, Edison and New Brunswick, in addition to Highland Park; and may include sites on the Raritan River as well as the small tributaries within this subwatershed. A methods document summarizes each step in the assessment process; to evaluate stations and data quality, combine stations to evaluate an assessment unit, assess uses, rank and prioritize assessment units that do not attain designated uses, develop a monitoring and assessment plan and provide for public participation (NJDEP Water Monitoring and Standards, September 2010). It does not, however list the details of the station locations and data used for the assessments.

The 2008 Integrated List (the most recent available), which summarizes whether or not stream water quality of the HUC14 of the "Lower Raritan River (Lawrence Brook to Mile Run)" meets the SWQS, is shown in **Table 6.4**. The water quality does not support the uses of drinking water supply, general aquatic life, or fish consumption, while there is insufficient data to assess safety for recreation use. **Table 6.5** displays information about the impaired waters within Highland Park (NJDEP Water Monitoring and Standards, November 2010 and November 1, 2010).

Table 6.3: Surface Water Quality Standards Classification

Category	Definition
Freshwater General Surface Water Class	
FW1	**FW1** means those fresh waters, as designated in N.J.A.C. 7:9B-1.15(j), that are to be maintained in their natural state of quality (set aside for posterity) and not subjected to any man-made wastewater discharges or increases in runoff from anthropogenic activities. These waters are set aside for posterity because of their clarity, color, scenic setting, other characteristic of aesthetic value, unique ecological significance, exceptional recreational significance, exceptional water supply significance or exceptional fisheries resource(s).
FW2	**FW2** means the general surface water classification applied to those fresh waters that are not designated as FW1 or Pinelands Waters. In all FW2 waters the designated uses are: 1. Maintenance, migration and propagation of the natural and established biota; 2. Primary contact recreation; 3. Industrial and agricultural water supply; 4. Public potable water supply after conventional filtration treatment (a series of processes including filtration, flocculation, coagulation, and sedimentation, resulting in substantial particulate removal but no consistent removal of chemical constituents) and disinfection; and 5. Any other reasonable uses.
Trout Water Status - this is for information only and does not affect the water quality criteria for those waters.	
TP	***Trout production*** means waters designated at N.J.A.C. 7:9B-1.15I through (i) for use by trout for spawning or nursery purposes during their first summer.
TM	***Trout maintenance*** means waters designated at N.J.A.C. 7:9B-1.15I through (i) for the support of trout throughout the year.
NT	***Nontrout waters*** means fresh waters that have not been designated in N.J.A.C. 7:9B-1.15(b) through (h) as trout production or trout maintenance. These waters are generally not suitable for trout because of their physical, chemical, or biological characteristics, but are suitable for a wide variety of other fish species.
Antidegradation	
ONRW	***Outstanding National Resource Waters*** means high quality waters that constitute an outstanding national resource (for example, waters of National/State Parks and Wildlife Refuges and waters of exceptional recreational or ecological significance). Waters classified as FW1 waters and Pinelands waters are Outstanding National Resource Waters.
FW1/Non-degrada-tion	***Nondegradation waters*** means those waters set aside for posterity because of their clarity, color, scenic setting, other characteristic of aesthetic value, unique ecological significance, exceptional recreational significance, or exceptional water supply significance. These waters include all waters designated as FW1.
C1	***Category one waters*** means those waters designated in the tables in N.J.A.C. 7:9B-1.15(c) through (i), for purposes of implementing the antidegradation policies set forth at N.J.A.C. 7:9B-1.5(d), for protection from measurable changes in water quality based on exceptional ecological significance, exceptional recreational significance, exceptional water supply significance or exceptional fisheries resource(s) to protect their aesthetic value (color, clarity, scenic setting) and ecological integrity (habitat, water quality and biological functions).
C2	***Category two waters*** means those waters not designated as Outstanding National Resource Waters or Category One at N.J.A.C. 7:9B-1.15 for purposes of implementing the antidegradation policies set forth at N.J.A.C. 7:9B-1.5(d).
SE	***SE*** means the general surface water classification applied to saline waters of estuaries. Unlisted saline waterways and waterbodies are classified as SE1 in the Atlantic Coastal Basin; designated uses are listed in N.J.A.C. 7:9B-1.12(d). In all **SE1** waters the designated uses are: 1. Shellfish harvesting in accordance with N.J.A.C. 7:12; 2. Maintenance, migration and propagation of the natural and established biota; 3. Primary contact recreation; and 4. Any other reasonable uses. FW2-NT/SE1 (or a similar designation that combines two classifications) means a waterway in which there may be a salt water/fresh water interface. The exact point of demarcation between the fresh and saline waters must be determined by salinity measurements and is that point where the salinity reaches 3.5 parts per thousand at mean high tide. The stream is classified as FW2-NT in the fresh portions (salinity less than or equal to 3.5 parts per thousand at mean high tide) and SE1 in the saline portions.
Source: NJDEP Land Use Management, Water Monitoring and Standards, January 2011	

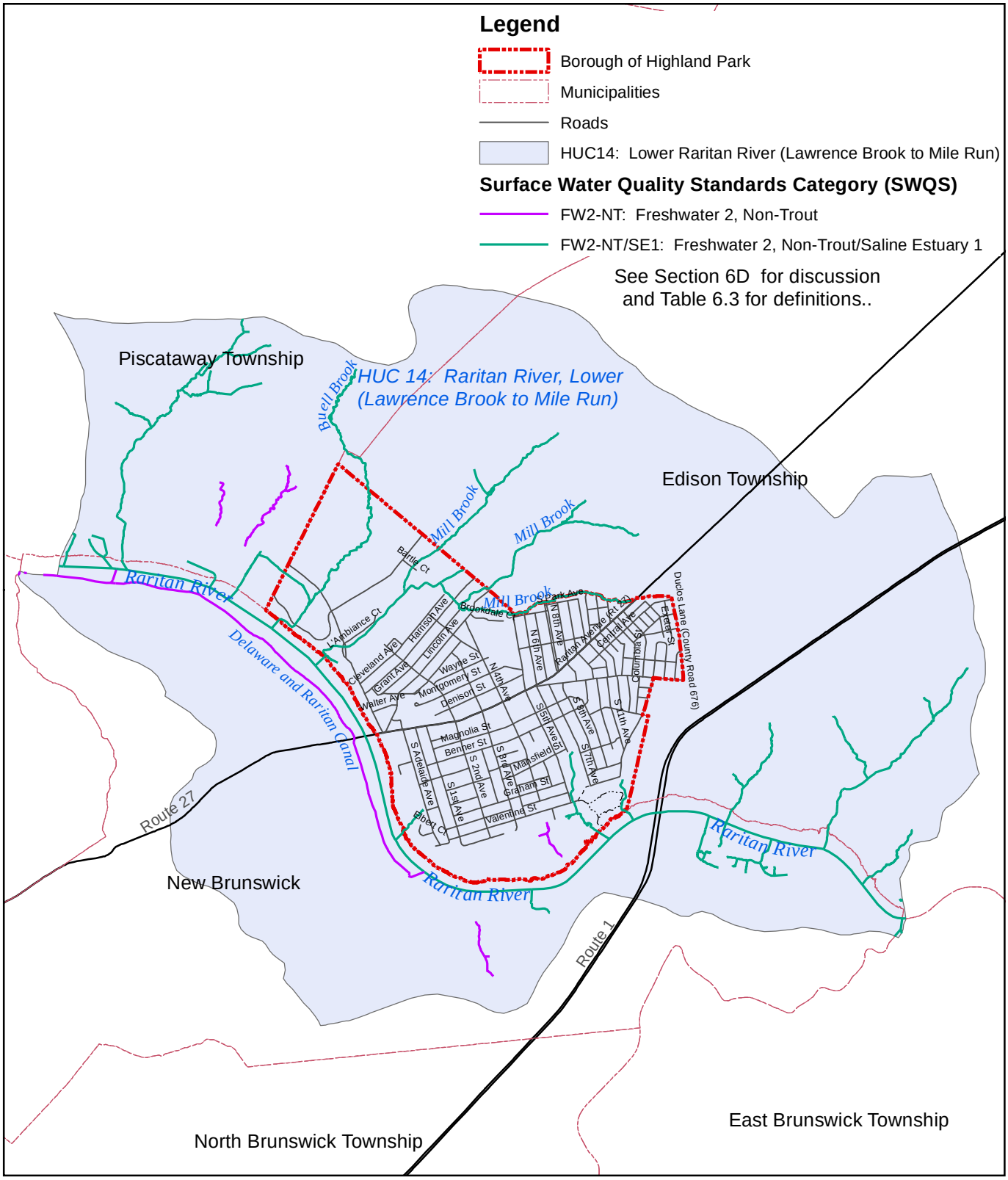

Figure 6i: Surface Water Quality Standards (SWQS, 2010)

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Borough of Highland Park ERI 2012
Prepared by Kratzer Environmental Services

Data Sources: See Appendix B.
Note: Map accuracy is limited to the accuracy and scale of the original data sets; see Appendix B.
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Table 6.4: 2008 Integrated List for Highland Park

HUC14	Watershed	Sublist								
		Drinking Water Supply	Recreation (Primary & Secondary Contact)	Aquatic Life General	Shellfish for Consumption	Industrial Water Supply	Agricultural Water Supply	Aquatic Life Trout	Fish Consumption	Overall
02030105120170	Lower Raritan River (Lawrence Brook to Mile Run)	5	3	5	N/A	2	2	N/A	5	5

The assessment units were placed on one of five sublists according to the following: (See Section 7 of the Integrated List Methods Document for more detail on the Sublists). N/A (not applicable) is used when the designated use does not apply to a particular assessment unit.

Sublist 1: There is sufficient data to assess all applicable designated uses for the waterbody and the assessment indicates full attainment for all designated uses.

Sublist 2: Waterbodies are placed on this sublist when an assessment for an individual designated use is complete and results for that assessment indicates full attainment but other designated uses are unassessed, assessed as non-attain or have an approved TMDL. When all designated uses are assessed as full attain, these waterbodies will be moved to Sublist 1.

Sublist 3: Waterbodies are placed on this sublist when the designated use assessment indicated insufficient or no data to assess the designated use.

Sublist 4: The waterbody is impaired or threatened for one or more designated uses. There are three subcategories:

Sublist 4A. Waterbodies are placed on this sublist when the designated use is non-attain due to pollutants and a TMDL has been adopted in New Jersey Register and approved by the USEPA.

Sublist 4B. Waterbodies are placed on this sublist when the designated use is non-attain due to pollutants and other enforceable pollution control requirements are reasonably expected to result in the conformance with the applicable water quality standard(s) in the near future.

Sublist 4C. Waterbodies are placed on this sublist when the designated use is non-attain and the impairment is not caused by a pollutant.

Sublist 5: Designated use assessment is complete and results for the assessment indicate non-attain.

(The individual pollutants causing the non attainment of the designated uses will be identified on the "303(d) List of Impaired Waterbodies by Parameter with Ranking". The Pollutant will be listed if known or "pollutant unknown" or "toxic unknown" will be used when the pollutant is not known.)

Source: NJDEP Water Monitoring and Standards, July 2009

When surface waters do not meet the SWQS, *Total Maximum Daily Loads* (TMDLs) must be developed, as specified under Section 303(d) of the Federal Clean Water Act (US Federal Water Pollution Control Act, January 2011). A TMDL identifies all the contributors to surface water quality impacts and sets goals for load[29] reductions for specific pollutants in order to meet the Surface Water Quality Standards. Regulations concerning TMDLs are contained in EPA's Water Quality Planning and Management Regulations (USEPA, 2011).

TMDLs represent the assimilative capacity of surface water for a given parameter of concern. The development of TMDLs includes balancing the impacts from point sources, nonpoint sources and natural background levels of a specific pollutant. The TMDL then quantifies the amount of a pollutant a water body can assimilate without violating a state's water quality standards and allocates that load capacity to known point and nonpoint sources in the form of waste load allocations (WLAs) for point sources, load allocations (LAs) for nonpoint sources, plus a margin of safety (MOS) (NJDEP Division of Watershed Management, 2010). Load allocations (for nonpoint source pollution) consist of identifying categories of nonpoint sources that contribute to the parameters of concern, followed by recommendations for implementation measures for specific load reductions. Examples include best management practices (BMPs), including structural (stormwater runoff controls) and non-structural (local

[29] Load is the total amount of material (pollutants) entering the system from one or multiple sources; measured as a rate in weight per unit time (USEPA, 2011).

ordinances for stormwater management and nonpoint source pollution control) mechanisms for addressing the water quality parameter(s) of concern.

Waters requiring TMDLs are identified as sublist 5 in the Integrated List of Waterbodies that combines the 303(d) list of impaired waters and the surface water quality inventory report (305b), which NJDEP prepares every two years. After the Integrated List is approved, the NJDEP Division of Watershed Management writes a TMDL report, which is a proposed Water Quality Management Plan Amendment. When this is published in the NJ Register for public review and comment, the TMDL is considered *proposed*. NJDEP then considers comments received during public comment and finalizes the TMDL report, and the TMDL is considered *established* when it is formally submitted to the US EPA Region 2 for thirty-day review. The TMDL is considered *approved* when the US EPA Region 2 approves it. Next, the TMDL is referred to as *adopted* when the EPA-approved TMDL is adopted by NJDEP as a water quality management plan amendment and the adoption notice is published in the NJ Register (NJDEP Division of Watershed Management, 2010).

For those streams not attaining compliance, TMDLs will be developed, but for this subwatershed, are not scheduled until "beyond 2012" (NJDEP Water Monitoring and Standards, November 2010 and November 1, 2010). However, NJDEP is scheduled to propose a TMDL for the main stem Raritan River in 2012 (NJDEP representative at 3rd Annual Sustainable Raritan River Conference, June 16, 2011).

Table 6.5: Integrated Water Quality Assessment for Lower Raritan River (Lawrence Brook to Mile Run) 02030105120170

Use	Attainment	Cause	First on 303(d) List	TMDL Priority*	Sources
Agricultural Water Supply	Fully Supporting				Industrial Point Source Discharge Urban Runoff/Storm Sewers Source Unknown Atmospheric Deposition - Toxics
Aquatic Life	Not Supporting	Cadmium	2002	L	
		Phosphorus (Total)	2006	M	
		Total Suspended Solids (TSS)	2006	M	
		Zinc	2002	L	
Fish Consumption	Not Supporting	Benzo(a)pyrene (PAHs)	2008	M	
		Chlordane	2008	M	
		DDD	2008	M	
		DDE	2008	M	
		DDT	2008	M	
		Dieldrin	2008	M	
		Dioxin (including 2,3,7,8-TCDD)	2008	M	
		Mercury	2008	M	
		Polychlorinated biphenyls	2008	M	
Industrial Water Supply	Fully Supporting				
Primary Contact Recreation	Insufficient Information				
Public Water Supply	Not Supporting	Arsenic	2002	L	
		Benzo(a)pyrene (PAHs)	2008	M	
		Heptachlor epoxide	2008	M	

*__L__=low; __M__=medium; all are scheduled for completion "beyond 2012"
Sources: NJDEP Water Monitoring and Standards, November 2010 (draft);
NJDEP Water Monitoring and Standards. November 1, 2010

G. Point Source Pollution

Point source pollution (as defined by N.J.A.C. 7:9B Surface Water Quality Standards) refers to discernible, confined, and discrete conveyance, including, but not limited to, any pipe, ditch, channel, tunnel, conduit, well, discrete fissure, container, rolling stock, concentrated animal feeding operation, landfill leachate collection system, vessel, or other floating craft, from which pollutants are or may be discharged. This term does not include return flows from irrigated agriculture (NJDEP Land Use Management, Water Monitoring and Standards, January 18, 2011).

Point source discharges are regulated by NJDEP under the New Jersey Pollutant Discharge Elimination System (NJPDES). There are no existing discharges within Highland Park, but there are 2 revoked/terminated discharges within the Borough (see **Table 6.6** and **Figure 6j**). An additional 13 NJPDES point source discharges exist within the HUC14 subwatershed, but outside of Highland Park.

Table 6.6: NJ Pollutant Discharge Elimination System Surface Water Discharges

ID♦	NJPDES ID. #	Facility Name	Status*	Discharge Type*	Receiving Waters
NJPDES Within Highland Park					
17	NJ0100161.001A	Grimes Aerospace Company	R	IMI	Raritan River via storm sewer
14	NJG0076996.001A	Sunoco S/S - Highland Park	R	B4B	Raritan River via storm sewer
NJPDES Within the Subwatershed Lower Raritan River (Lawrence Brook to Mile Run), but outside of Highland Park					
0	NJG0156272.001D	Route 18 2F Project	E	B4B	Raritan River
1	NJG0156272.002D	Route 18 2F Project	E	B4B	Raritan River
2	NJG0156272.003D	Route 18 2F Project	E	B4B	Raritan River
3	NJG0156272.004D	Route 18 2F Project	E	B4B	Raritan River
4	NJG0156272.005D	Route 18 2F Project	E	B4B	Raritan River
5	NJG0003603.521	PSE&G - Edison G S	X	RF	Raritan River
6	NJ0000582.026A	PSE&G Central Plant	R	IMI	Raritan River
7	NJ0000582.029A	PSE&G Central Plant	R	IMI	Raritan River
8	NJ0000582.030A	PSE&G Central Plant	R	IMI	Raritan River
9	NJG0156272.006D	Route 18 2F Project	E	B4B	Raritan River
10	NJG0156272.007D	Route 18 2F Project	E	B4B	Raritan River
11	NJ0020141.002A a	Middlesex County UA	R	IMI	Mill Brook via storm sewer and unnamed tributary
12	NJG0156272.008D	Route 18 2F Project	E	B4B	Raritan River
13	NJG0156272.009D	Route 18 2F Project	E	B4B	Raritan River
15	NJG0156272.010D	Route 18 2F Project	E	B4B	Raritan River
16	NJG0156272.011D	Route 18 2F Project	E	B4B	Raritan River
18	NJG0136158.001A	Amoco S/S	R	B4B	Raritan River via storm sewer
19	NJG0105716.001A	Private Formulations - CVS Inc	E	BGR	Mill Brook via storm sewer and unnamed tributary

♦ID number corresponds to numbers on **Figure 6j**

***Notes for Above Codes** (NJDEP's codes and definitions were used):

Status: **E**=Existing in the Point Source Permitting Regions; **R**=Revoked/Terminated - Pipe no longer permitted for discharge; **X**= Transferred to BNPC - Permits transferred to Bureau of Nonpoint Pollution Control

Discharge type: **B4B**=Petroleum hydrocarbon remediation; **BGR**= General Groundwater Remediation; **IMI**= Industrial Minor - based on the amount of pollutant(s) in the effluent; **RF**=Stormwater Discharge

Source: NJDEP, Environmental Regulation, Division of Water Quality, November 2011

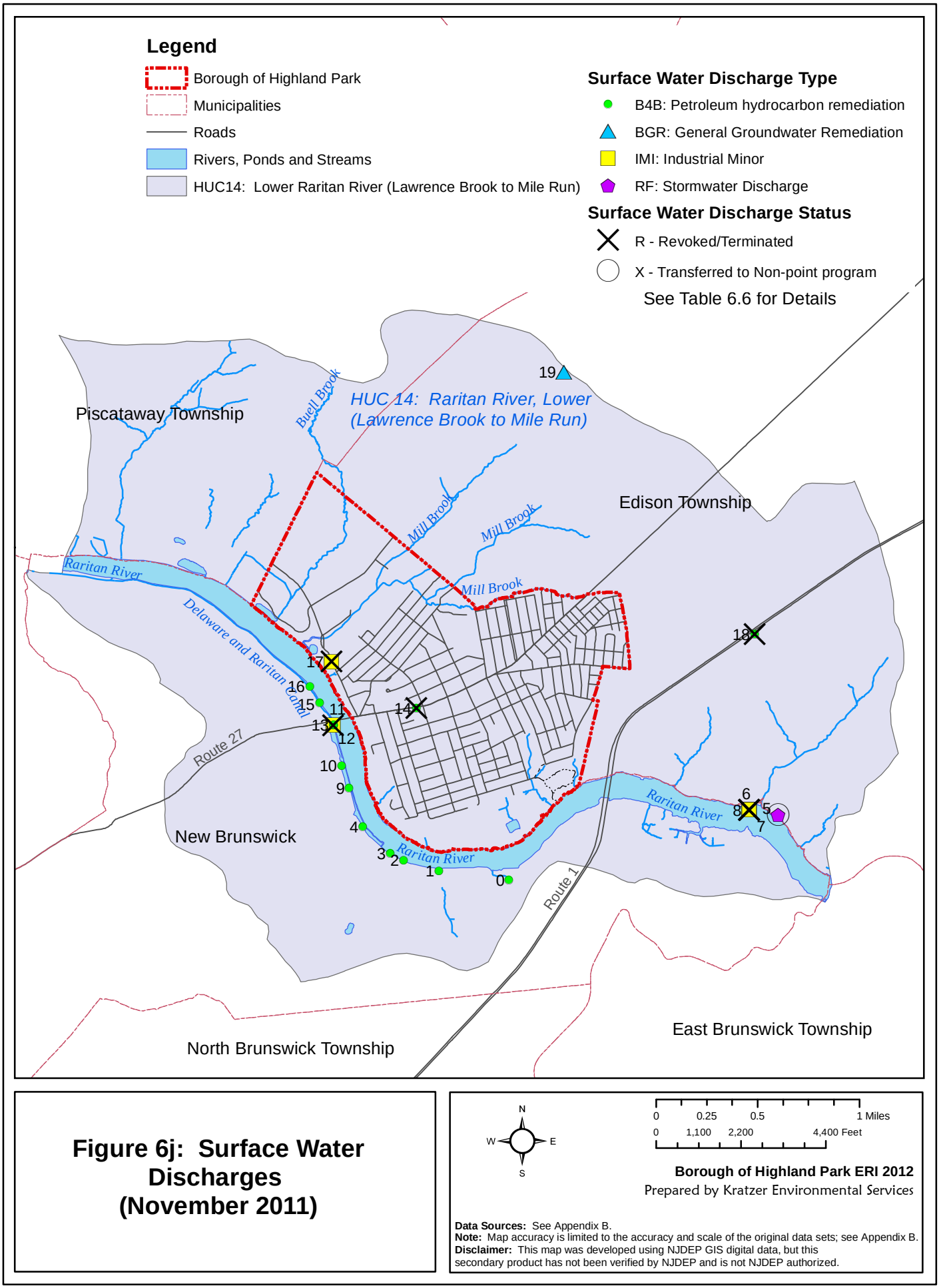

Figure 6j: Surface Water Discharges (November 2011)

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Monthly monitoring reports for the Grimes Aerospace Company[30] discharge from July 2000 to May 2001 are available according to the NJDEP Dataminer site (NJDEP, 2011). Parameters monitored included 1,2-cis-Dichloroethylene, 1,2-trans-Dichloroethylene, IC25 Statre 7day Chr Mysid Bahia (a bioassay using mysid shrimp), pH, Toluene, Trichloroethylene and Vinyl Chloride. Monthly discharge monitoring reports for the Sunoco station are available for the period July 2000 to September 2003 (testing included Benzene, Total Organic Carbon (TOC), Methyl tert-butyl Ether, Naphthalene, Petroleum Hydrocarbons, pH, Total Suspended Solids and Tertiary Butyl Alcohol (TBA)) (NJDEP, 2011).

H. Nonpoint Source Pollution

Nonpoint source or NPS pollution is any man-made or man-induced activity, factor, or condition, other than a point source, from which pollutants are or may be discharged. Nonpoint pollution may temporarily or permanently change any chemical, physical, biological, or radiological characteristic of water from what was the natural, pristine condition of such water. Nonpoint source pollution is directly associated with stormwater.

When water flows off impervious surfaces, such as buildings, homes, parking lots and roads and through storm drains and ditches, it is known as *stormwater*. As the velocity of water increases, the amount that can infiltrate into the soil and ground water is reduced and scouring and erosion increase. The stormwater eventually discharges into streams and rivers, carrying pollutants that it has picked up along the way (e.g. trash, used motor oil, sediments, fertilizers, pesticides, pet droppings, etc.). The transport of these pollutants into local water bodies can result in the destruction of fish, wildlife, and habitats; threats to public health due to contaminated food and drinking water supplies; and losses of recreational and aesthetic values.

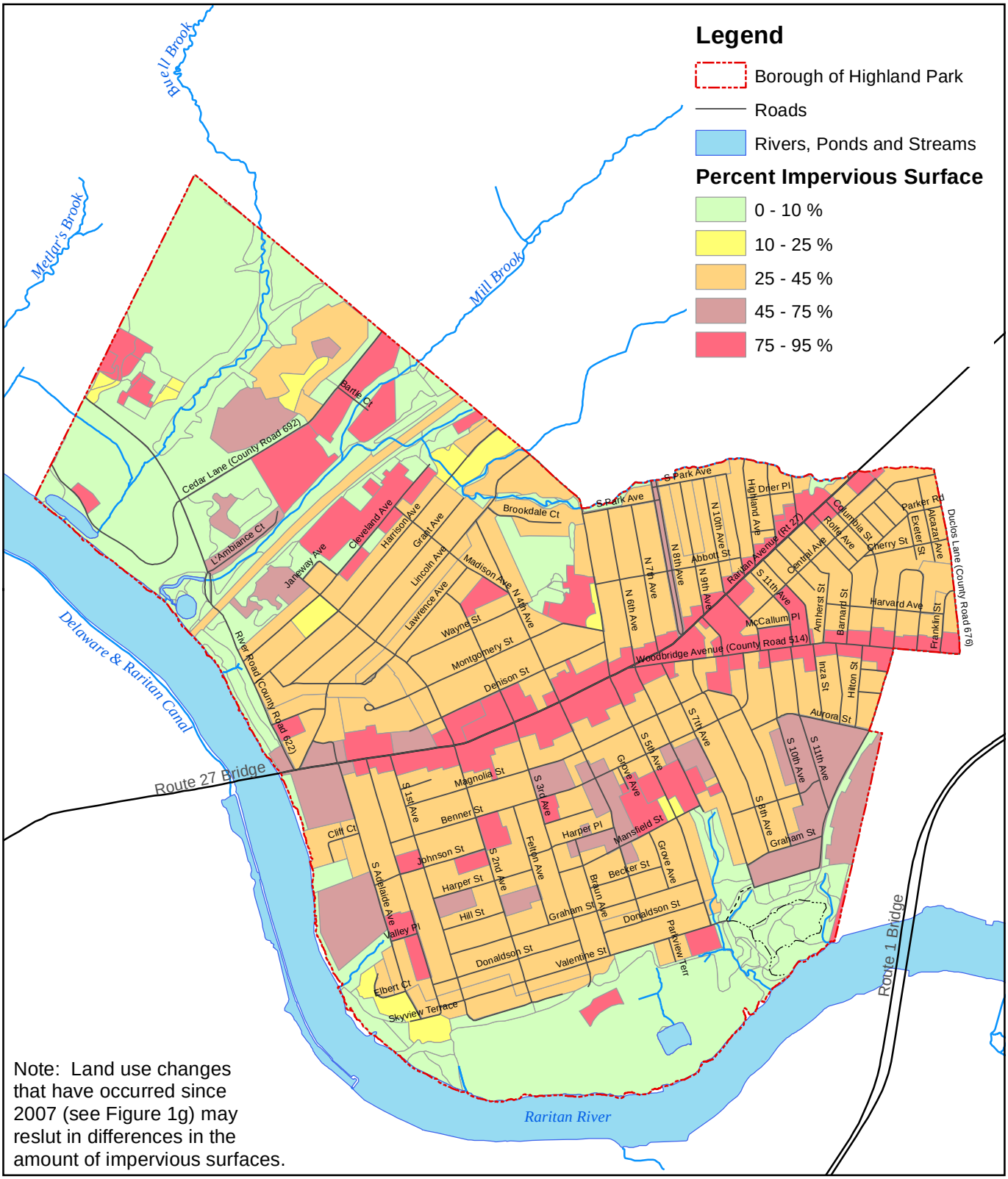
Areas with a high proportion of impervious surface contribute greater non-point pollution. The approximate percent impervious surface within Highland Park is shown in **Figure 6k**.

The goals of New Jersey's Stormwater Management Rule (N.J.A.C. 7:8) include reducing runoff, flooding, erosion and non-point pollution for public safety as well as ecological and biological integrity. There are requirements for stormwater management measures and regional and municipal stormwater management planning (NJDEP, April 2010).

The purpose of the Municipal Stormwater Regulation Program is to ensure a consistent approach to stormwater management statewide, reduce costs for regulated entities, and allow for a simple process for requesting authorization. All municipalities within the State are assigned either Tier A (more developed or coastal municipalities, including Highland Park) or Tier B (less developed and non-coastal) (NJDEP Bureau of Nonpoint Pollution Control, December 2006).

The permits address stormwater quality related issues to new and existing development and redevelopment by requiring the preparation of a stormwater program and implementation of specific permit requirements referred to as Statewide Basic Requirements (SBRs). The Tier B Permit concentrates on new development and redevelopment projects and public education. The Tier A Permit has additional requirements aimed at controlling stormwater pollutants from existing development, such as public education, disposal of waste, solids and floatable controls, maintenance yard operations and employee training (NJDEP Bureau of Nonpoint Pollution Control, April 2010). Many resources are available on the Internet (see **Internet Resources**), including a New Jersey Stormwater Best Management Practices Manual and general educational materials.

[30] Now known as the Midland-Ross property, which is currently owned by Honeywell.



Note: Land use changes that have occurred since 2007 (see Figure 1g) may reslut in differences in the amount of impervious surfaces.

Figure 6k: Percent Impervious Surface (from 2007 Land Use)

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0 500 1,000 2,000 Feet

Borough of Highland Park ERI 2012
Prepared by Kratzer Environmental Services

Data Sources: See Appendix B.
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I. Surface Water Quality and Flow Monitoring

Local watershed associations, educational institutions and governmental agencies play a key role in monitoring water quality within the Raritan River basin. Currently, the New Jersey Water Supply Authority (NJWSA) and the D&R Canal Commission monitor water quality in the D&R Canal, NJDEP monitors water quality at numerous locations, USGS monitors stream flow and a number of the regional watershed associations conduct monitoring along the waterways in the Upper Raritan and the Stony Brook Millstone River basins (Ferrer et al, 2010). However, very little surface water quality monitoring is currently done within the Borough of Highland Park.

The various monitoring programs in the region are discussed below. A list of the sites sampled for each program is provided in **Table 6.7** and shown on **Figure 6l**. Sites located outside of Highland Park (but upstream) are included because of the usefulness of knowing the water quality and stream flow entering the Borough. While upstream water quality affects the water quality within the streams of the Borough, data collected outside of the HUC14 subwatershed are not used in the Integrated List discussed in **Section 6E.**

NJDEP Ambient Stream Quality Monitoring Sites for New Jersey (SWpoints)

These data represent ambient stream sites monitored cooperatively by the NJDEP and the USGS for water quality parameters. This network was established in 1976 to determine status and trends of ambient surface waters in New Jersey. The sampling frequency is four times per year. A wide range of conventional parameters, metals, pesticides and sediments are monitored in this program. Metals, pesticides and sediments are monitored on a reduced sampling frequency. Data is available from the following sources: 1.) the USGS computerized data system, NWIS, 2.) EPA's computerized data system, STORET or 3.) USGS's annual reports "Water Resources Data-New Jersey". The Raritan River is sampled at Queens Bridge in Bound Brook.

NJDEP Ambient Supplemental Surface Water Monitoring (SASMN)

This network was established in 2000 to supplement the existing Ambient Surface Water Quality Monitoring Network (described above) to improve spatial coverage by siting an ambient monitoring station in every HUC11. Water quality is measured at one site within the same HUC14 as Highland Park, on the Raritan River at Landing Lane Bridge in Johnson Park. The nearest upstream site is located on the Raritan River at Queens Bridge in Bound Brook.

NJDEP Existing Water Quality Stations in New Jersey (EWQPOI)

These data represent sampling points for the EWQ (Existing Water Quality) project at NJDEP. The EWQ Network was designed to provide supplemental data for water quality for the entire state to support water management and monitoring activities within NJDEP, and to be a valuable layer for computerized cartographic products. One location in this sampling network is located within the same HUC14 as Highland Park, on the Raritan River at Landing Lane in Johnson Park.

NJDEP Ambient Biomonitoring Network (AMNET) (Biopts)

Sites are sampled for benthic aquatic macroinvertebrate using the Rapid Bioassessment Protocol in order to make assessments at three levels of impairment; non-impaired, moderately impaired, and severely impaired. Sites are sampled every 5 years. There are no monitoring sites

within Highland Park, but there is one on the Raritan River at the Fieldville Dam at Route 287. Results for this site are summarized in **Table 6.8**.

Fish Index of Biotic Integrity Stations (FIBI)

The Fish Index of Biotic Integrity supplements the macroinvertebrate biomonitoring network by assessing the biological health of a stream based on resident fish populations. Like AMNET, sites are sampled once every 5 years. No sites are located within Highland Park, but there are FIBI sites on tributaries of the Raritan River, such as Mile Run in New Brunswick.

NJDEP/USGS Surface WQ Gage (WQgage)

This network is jointly funded by USGS and NJDEP. USGS maintains a network of gages across NJ at which surface water quality is measured. As project needs and funding levels change, different sites may be active in any given year. The data measured at the active sites are published annually as part of the USGS' series of annual water-data reports. While no sites are located within the Borough, 2 stations are on the Raritan River and 3 stations are on the Delaware and Raritan Canal (2 of the canal sites are within the HUC 14). The nearest station with water quality data for 2009 is the Raritan River at Queens Bridge (USGS, 2009), and for 2010, the closest is the Raritan River at Manville (USGS, 2010).

USGS Continuous-Stream Flow Gaging (Streamgage)

These sites are maintained by the United States Geological Survey (USGS), Water Resource Division (WRD). The station closest to Highland Park on the Raritan River is located below Calco Dam at Bound Brook. The gage continuously monitors stream flow and these data are available online in real-time (see **Internet Resources**). In addition, water quality was measured at this location between 1952 and 2000.

USGS Stream Crest Gaging (Creststage)

USGS measures gage height (relative height of water level; not actual flow volume) occasionally at these sites. There are no USGS Stream Crest Gage located in Highland Park, but there are both active and discontinued sites located on tributaries of the Raritan River upstream of the Borough.

USGS Stream Low Flow Gaging (Lowflow)

USGS measures gage height (relative height of water level; not actual flow volume) occasionally at these sites. There is one inactive low flow stream gaging site located on Mill Brook within Highland Park.

STORET Stations

Data collected by some sampling programs and from certain sites are input into EPA's national water quality database. These sites are indicated by an asterisk in **Table 6.7** and by an orange circle on **Figure 6l**. It is possible that data from other sites might be available, even if not noted here.

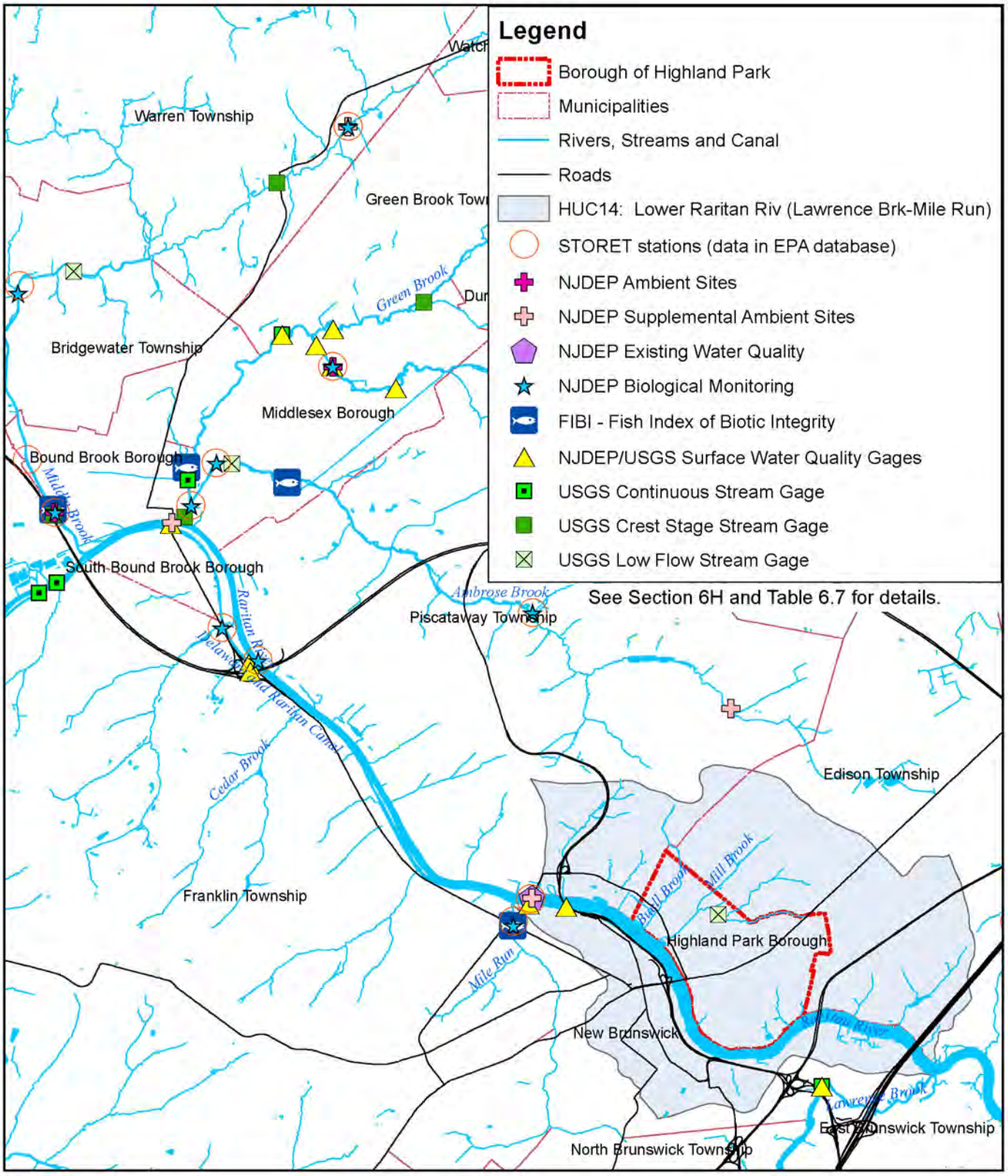

Figure 6I: Surface Water Quality and Flow Monitoring

Borough of Highland Park ERI 2012
Prepared by Kratzer Environmental Services

Data Sources: See Appendix B.
Note: Map accuracy is limited to the accuracy and scale of the original data sets; see Appendix B.
Disclaimer: This map was developed using NJDEP GIS digital data, but this secondary product has not been verified by NJDEP and is not NJDEP authorized.

Table 6.7: Surface Water Monitoring Stations

Program Name	Station ID	Name	Municipality	Data Collected
In Highland Park				
Lowflow	177	Mill Brook at Highland Park, NJ (inactive)	Highland Park	Stream flow
In HUC 14				
EWQPOI	01404170*	Raritan River on Landing Lane in Johnson (County) Park near Rutgers University	Piscataway/New Brunswick	Water quality
SASMN	01404170*	Raritan River on Landing Lane Bridge in Johnson Park	Piscataway/New Brunswick	
WQGage	1460595	D&R Canal at Landing at New Brunswick, NJ	New Brunswick	
WQGage	1460600	D&R Canal at New Brunswick, NJ	New Brunswick	
Nearest upstream sites, not in HUC 14				
SWPTS	01403300	Raritan River at Queens Bridge	Bound Brook/South Bound Brook/Middlesex	Water quality
SWPTS	01403190	Middle Brook at Rt 28 at Bound Brook	Bridgewater/Bound Brook	
SASMN	01403300	Raritan River on Queens Bridge, South Main Street	Bound Brook/South Bound Brook Boro	
BIOPTS	ANO428*	Raritan River at Fieldville Dam (I 287)	Franklin/Piscataway	Macroinvert-ebrates & habitat
BIOPTS	ANO427*	Unnamed tributary to Raritan at Rt 527	Franklin	
BIOPTS	ANO429	Mile Run at Rt 527	Franklin/New Brunswick	
FIBI	FIBI015*	Mile Run at Route 527	Franklin/New Brunswick	Fish Index of Biotic Integrity
FIBI	FIBI072	Middle Brook at Talmadge Ave	Bridgewater/Bound Brook	
FIBI	FIBI091	Green Brook at Rt 28 (aka Union Ave)	Bound Brook/Middlesex	
FIBI	FIBI071	Ambrose Brook at Melrose Ave and Seneca Ave	Middlesex	
WQGage	1404100	Raritan River near South Bound Brook, NJ	Franklin	Water quality and stream flow
WQGage	1403360	Raritan River on Queens Bridge, South Main Street	Bound Brook/South Bound Brook Boro	
WQGage	01400500	Raritan River At Manville, NJ (not shown on map)	Manville	
WQGage	1460590	D&R Canal at 5-mile lock at South Bound Brook, NJ	Franklin	
Streamgage	91	Raritan River at Bound Brook, NJ (discontinued)	Bridgewater/Franklin	Stream flow (continuous)
Streamgage	92	Raritan River below Calco Dam at Bound Brook, NJ	Bridgewater/Franklin	
Streamgage	100	Bound Brook at Bound Brook, NJ (discontinued)	Bound Brook/Middlesex Boro	
Creststage	01404171	Raritan River At State Route 18, At New Brunswick, NJ (not shown on map)		Stream flow
Creststage	88	Middle Brook at Bound Brook, NJ	Bridgewater/Bound Brook	
Creststage	95	Bound Brook at South Bound Brook, NJ (discontinued)	Bound Brook/Middlesex	
Creststage	94	Green Brook at Dunellen, NJ (discontinued)	Middlesex/Green Brook	
Creststage	93	Green Brook at Rock Ave at Plainfield, NJ	Green Brook/Plainfield	
Lowflow	176	Ambrose Brook at Middlesex, NJ (inactive)	Middlesex	
Lowflow	172	East Branch Middle Brook at Martinsville, NJ (inactive)	Bridgewater	

Discontinued or inactive sites are shown in gray

*Data from these program sites are input into STORET, EPA's water quality database.

Sources: NJDEP BFMB, October 2007 November 2008, November 2010, December 2010a, December 2010b; USGS, 2002a, 2002b, 2002c, 2002d

Table 6.8: Macroinvertebrate and Habitat Scores

Site Code	Site Name	Parameter*	Date Sampled		
			7/11/1990	7/8/1999	7/8/2004
ANO428	Raritan River, Bakelite Park (Fieldville Dam), Edison Township	NJIS	18** Moderately Impaired	24 Non-impaired	18* Moderately Impaired
		Habitat	-	161 Optimal	135 Sub-optimal

* Parameter:
NJIS (New Jersey Impairment Score): A composite of 5 scores based on family level taxonomy. **N=Non-impaired**: score of 24 to 30; benthic community comparable to other undisturbed streams within the region; community characterized by a maximum taxa richness, balanced taxa groups, and good representation of intolerant individuals. **M=Moderately Impaired**: score of 9 to 21; macroinvertebrate richness reduced, in particular, EPT taxa; reduced community balance and number of intolerant taxa. **S= Severely Impaired**: score of 0 to 9; benthic community drastically different from those in less impaired situations; macroinvertebrates dominated by few taxa, but with many individuals; only intolerant individuals present.

HABITAT SCORES: **O=OPTIMAL**= 160 – 200; **S=SUB-OPTIMAL**=110 – 159; **M=MARGINAL**= 60 – 109; **P=POOR**= < 60. Parameters evaluated included in-stream substrate, channel morphology, bank structural features, and riparian vegetation for the sample site and its immediate surroundings (usually 100-200 foot radius).

*Comment 1990 & 2004: paucity of clean water organisms.

Sources: NJDEP BFBM, July 1995, June 2000 and February 2008

J. Fish Consumption Advisories

When toxic pollutants are present in surface water, they are consumed by the organisms that live in the water. The process of *bioaccumulation* is when there is an increase in concentration of certain fat-soluble chemicals, such as DDT and PCBs, in successively higher trophic levels of a food chain or web. For example, insects living in contaminated sediments may have accumulated a certain amount of a toxin. Fish, by eating many of these insects, then ingest the toxin into their own bodies. Anything that eats that contaminated fish, including humans and other predators, will absorb the toxin. When the concentration of toxin becomes high enough, the individual's health will be impacted.

The NJDEP samples fish for certain toxic pollutants and, when necessary, issues state and regional *fish consumption advisories*, to reduce exposure to dioxin, PCBs and mercury. This information is intended to help individuals make an informed choice on the number of meals of fish to consume. The 2010 fish consumption advisories for fish caught anywhere in the state are listed in **Table 6.9**. One of the sampling sites is just south of Highland Park, at the Route 1 Bridge across the Raritan River (site Mid1). See the **Internet Resources** for more information, such as fish preparation guidelines and annual updates.

Table 6.9: 2010 Fish Consumption Advisories – Statewide Freshwaters

LOCATION	SPECIES	ADVISORY/PROHIBITION	
		General Population [1] Range of Recommended Meal Frequency	**High-Risk Individuals [2]**
		DO NOT EAT MORE THAN:	**DO NOT EAT MORE THAN:**
STATEWIDE ESTUARINE & MARINE WATERS	Striped Bass	One meal per month	Do not Eat
	Bluefish (greater than 6lbs / 24 inches)	Six meals per year	
	Bluefish (less than 6lbs / 24 inches)	One meal per month	
	American Eel	Four meals per year	
	American Lobster	Do Not Eat the Green Gland (aka tomalley or hepatopancreas)	
RARITAN BAY COMPLEX Includes Raritan Bay, tidal Raritan River (to the Rt.1 bridge) & tidal portion of all tributaries to the head of tide.	American Lobster	One meal per week Do not eat green gland (hepatopancreas) Discard cooking liquid	
	Weakfish	One meal per month	Do not eat
	Striped Bass		
	Winter Flounder		One meal per month
	Porgy		
	American Eel	One meal per year	Do not eat
	Summer Flounder	One meal per week	One meal per week
	White Perch (Raritan Bay)	One meal per year	Do not eat
	Blue Crab	One meal of seven (7) crabs per month. Do not eat green gland (hepatopancreas); Discard cooking liquid	
Raritan River upstream of Route 35 Bridge and the South River (tidal portion)	White Catfish	Four meals per year	Do not eat
	White Perch		
New Jersey Statewide – All water bodies except those listed separately	Freshwater species not listed below	One meal per week	One meal per month
	Trout (brown, brook, rainbow)		One meal per week
	Largemouth bass		One meal per month
	Smallmouth Bass		
	Chain Pickerel		
	Yellow bullhead	No restrictions	One meal per month
	Brown Bullhead		
	Sunfish [3]		One meal per week

[1] Eat only the fillet portions of the fish. Use proper trimming techniques to remove fat, and cooking methods that allow juices to drain from the fish (e.g., baking, broiling, frying, grilling, and steaming). See web site for full description. One meal is defined as an eight-ounce serving.

[2] High-risk individuals include infants, children, pregnant women, nursing mothers and women of childbearing age.

[3] Sunfish includes bluegill, pumpkinseed, and redbreast sunfish.

Source: NJDEP Division of Science and Research, 2010 http://www.state.nj.us/dep/dsr/njmainfish.htm

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Internet Resources: Surface Water

General Water Resources Protection
Home*A*Syst: Evaluate your home and property for pollution and health risks (USDA):
http://www.nj.nrcs.usda.gov/partnerships/homeasyst/

SEEDS: The NJ Environmental Education Directory Website: http://www.state.nj.us/dep/seeds/index.html

Basic Watershed Information (Division of Watershed Management):
http://www.state.nj.us/dep/watershedmgt/basicinfo.htm

The Clean Water Book: Choices for Watershed Protection:
http://www.state.nj.us/dep/watershedmgt/cleanwaterbook/waterbook_tble.htm

Water Quality Fact Sheets and Bulletins (NJ Agricultural Experiment Station Rutgers Cooperative Research & Extension): http://njaes.rutgers.edu/pubs/subcategory.asp?cat=6&sub=50&order=LastRevised

Floodplains & Riparian Zone
Highland Park Riparian Buffer Ordinance §230-194 et seq.: http://www.ecode360.com/15557017

Flood Hazard Area Program (NJDEP Land Use Regulation) http://www.state.nj.us/dep/landuse/se/se.html

Floodsmart: The Official Site of the National Flood Insurance Program: http://www.floodsmart.gov

Wetlands
Freshwater Wetlands Program (NJDEP Land Use Regulation) http://www.state.nj.us/dep/landuse/fww/fww.html

Freshwater Wetlands Program: Before You Buy – Before You Build presentation
http://www.state.nj.us/dep/enforcement/wetland-training/ontheroad/

Guide to New Jersey's Stream Encroachment Permitting Program (NJDEP Land Use Regulation):
http://www.state.nj.us/dep/landuse/forms/GUIDETOS.pdf

TMDL
Total Maximum Daily Load (TMDL) (NJDEP) http://www.nj.gov/dep/watershedmgt/tmdl.htm

NJDEP Integrated Water Quality Monitoring & Assessment Report (includes 305(b) Report and 303(d) List)
http://www.state.nj.us/dep/wms/bwqsa/generalinfo.htm

Point Source Pollution
NJPDES Permitting:
http://datamine2.state.nj.us/DEP_OPRA/OpraMain/categories?category=NJPDES%20Permitting

Non-Point Source Pollution / Stormwater:
NJDEP's Stormwater Website (includes links to all of the following, and more): http://www.njstormwater.org/
- NJDEP Municipal Stormwater Regulation Program: http://www.state.nj.us/dep/dwq/msrp_home.htm
- Tier A Municipal Stormwater Permit: http://www.state.nj.us/dep/dwq/tier_a.htm
- Stormwater Best Management Practices Manual: http://www.njstormwater.org/bmp_manual2.htm
- Clean Water NJ: http://www.cleanwaternj.org/index.htm
- Multimedia Resources: http://www.cleanwaternj.org/multimedia.html

USEPA Nonpoint Source Pollution http://www.epa.gov/OWOW/NPS/

Surface Water Quality and Flow
Benthic Macroinvertebrate Sampling http://www.nj.gov/dep/wms//bfbm/downloads.html#rar

National Oceanic and Atmospheric Administration (NOAA) Tide website for the New Brunswick Station: http://tidesandcurrents.noaa.gov/noaatidepredictions/NOAATidesFacade.jsp?Stationid=8531463)

National Weather Service Advanced Hydrologic Prediction Website
Raritan River Water Level at Bound Brook: http://water.weather.gov/ahps2/hydrograph.php?wfo=phi&gage=bdkn4

New Jersey Water Supply Authority: http://www.njwsa.org/

Raritan Basin Watershed Management Project: http://www.raritanbasin.org

Sustainable Raritan River: http://www.blueraritan.org/

USEPA STORET Database: http://www.epa.gov/storet

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USGS Real-time flow data index of NJ sites: http://waterdata.usgs.gov/nj/nwis/current/?type=flow

USGS Water Data Mapper (enter year & navigate to location): http://wdr.water.usgs.gov/adrgmap/index.html

Fish Advisories & Guides
NJ Division of Science & Research Fish Advisories Home Page: http://www.state.nj.us/dep/dsr/njmainfish.htm

Fish Smart Eat Smart: http://www.state.nj.us/dep/dsr/fishsmart.pdf

NJDEP Regulations:
NJDEP Rules & Regulations, current and proposed: http://www.state.nj.us/dep/rules

Phone Contacts:
NJ Drought Hotline: 1-800-4-ITS DRY (1-800-448-7379)

NJ Environmental Incident Hotline (hazardous spill, fire, explosion, illegal dumping, wildlife problem): 1-877-WARNDEP / 1-877-927-6337 (toll-free, 24 hours)

NJDEP Land Use Enforcement: 1-609-292-1240

NJDEP Land Use Regulation (Flood Hazard Areas): 1-609-984-0162 or download the forms at http://www.nj.gov/dep/landuse/forms/index.html

NJDEP Land Use Regulation (Wetlands): 1-609-777-0454 or download the forms at http://www.nj.gov/dep/landuse/forms/index.html

7: BIOLOGICAL RESOURCES

A. Dominant Vegetation (Land Cover)

The New Jersey Comparative Risk Project (March 2003) listed habitat fragmentation and habitat loss as the highest ranking stressors of Statewide ecological quality. Certain species that require large expanses of intact habitat are becoming less common. Other factors that impact ecological health include exotic species (e.g. the hemlock wooly adelgid, an insect that causes the decline and death of hemlock trees) and exotic diseases, overpopulations of deer and geese, and pollution.

The 2007 Land Use/Land Cover (LU/LC) data layer was created by a consultant to NJDEP by comparing the 2002 LU/LC layer to 2007 color infrared imagery (2002 and 2007 aerial photos are shown in **Figure 1d** and **Figure 1e** (in Section 1: Introduction), respectively) and delineating and coding areas of change with a 1 foot pixel resolution. The classification system used was a modified Anderson Classification System (USGS, 2010) that provided the parameters for proper and consistent coding of the LU/LC feature classes and subclasses. It should be noted that 1) changes since 2007 are not shown, and 2) the method is not 100% accurate. In addition, since it is based on interpretation of aerial photographs, it cannot provide information about the particular species found in an area. The land cover classifications are shown in **Figures 7a, 7b and 7c**. The number of acres of each within Highland Park, including several changes observed by the Highland Park Environmental Commission[31] are noted on the maps and included in the acreage figures in **Table 7.1** (NJDEP, 2010; Highland Park Environmental Commission, 2011).

The largest portion of land in Highland Park is *Residential, High density or Multiple Dwelling* (32.4% of the borough), followed by *Residential, Single Unit, Medium Density* (16.7%), and *Other Urban or Built-up Land* (7.1% of the borough). Together, these top three land uses make up 56.2% of the borough (NJDEP, 2010).

B. Wildfire Fuel Hazard

The New Jersey Forest Fire Service (NJFFS), a division of NJDEP, assessed *Wildfire Fuel Hazard* (WFH) throughout New Jersey (see **Figure 7d**). The purpose is to provide information for NJ Forest Fire Service personnel, government agencies, and others interested in assessing WFH throughout New Jersey. Modified Anderson Land Use/Land Cover Classifications from the 2002 Land Use/Land Cover dataset were assigned Wildfire Fuel Hazard Rankings (0 = Water, 1 = Low, 2 = Moderate, 3 = High, 4 = Very High, 5 = Extreme, 6 = Urban, 7 = Agriculture, 8 = Barren Land). Areas with 30% or greater slope and Wildfire Fuel Hazard 1 to 4 were increased by 1 (e.g. Low became Moderate, etc.).

Fire risk and its frequency is promoted by infestation of non-native invasive plant species (Highland Park Environmental Commission, 2011).

The majority of Highland Park is Urban, followed by Low Wildfire Fuel Hazard. Forested areas (mainly Rutgers Ecological Preserve and the Meadows) have Very High WFH and scattered areas have High and Moderate WFH.

[31] Changes 2007-2011: Cenacle property (4.9 acres of Mixed Forest →Residential-High Density); Midland Ross property (7.4 acres Industrial→Transition Area); YMHA property (3.2 acres Urban→Transition Area); School (1.8 acres Transition Area→School); Storage Facility (1.6 acres Transition Area→Commercial); Area on Sullivan Way adjoining Donaldson Park (0.9 acres Other Urban →Old Field); The Meadows (1.5 acres Other Urban→Old Field; Johnson Park (2.0 acres Natural Lake→Artificial Lake).

Table 7.1: Land Use/Land Cover (Anderson Classification) in Highland Park

Code	Description	Acres*	Percent
Urban Land Use Type:			
1110	Residential, High Density Or Multiple Dwelling	508.3	43.4
1120	Residential, Single Unit, Medium Density	126.0	10.8
1130	Residential, Single Unit, Low Density	12.4	1.1
1140	Residential, Rural, Single Unit	4.8	0.4
1200	Commercial/Services	122.8	10.5
1300	Industrial	14.7	1.3
1400	Transportation/Communication/Utilities	3.7	0.3
1420	Railroads	8.3	0.7
1700	Other Urban Or Built-Up Land	33.4	2.9
1800	Recreational Land	58.6	5.0
1804	Athletic Fields (Schools)	8.0	0.7
	Total of all Urban Land Uses (excludes urban & built-up wetlands)	**901.0**	**77.0**
Forest Land Use Type:			
4110	Deciduous Forest (10-50% Crown Closure)[32]	12.0	1.0
4120	Deciduous Forest (>50% Crown Closure)	56.8	4.9
4322	Mixed Forest (>50% Deciduous With >50% Crown Closure)	6.7	0.6
4410	Old Field (< 25% Brush Covered)	2.6	0.2
4420	Deciduous Brush/Shrubland	14.9	1.3
4440	Mixed Deciduous/Coniferous Brush/Shrubland	47.3	4.0
	Total of all Forested Land Uses	**140.3**	**12.0**
Water Land Use Type:			
1419	Bridge Over Water	0.01	0.0
5100	Streams And Canals	0.5	0.0
5200	Natural Lakes	2.0	0.2
5300	Artificial Lakes	2.9	0.3
5410	Tidal Rivers, Inland Bays, And Other Tidal Waters	1.4	0.1
	Total of all Water Land Uses	**6.8**	**0.6**
Wetland Land Use Type:			
1741	Phragmites Dominate Urban Area	1.1	0.1
1850	Managed Wetland In Built-Up Maintained Recreation Area	76.2	6.5
6141	Phragmites Dominate Coastal Wetlands	1.2	0.1
6210	Deciduous Wooded Wetlands	32.8	2.8
6231	Deciduous Scrub/Shrub Wetlands	2.3	0.2
6240	Herbaceous Wetlands	0.3	0.0
6241	Phragmites Dominate Interior Wetlands	3.6	0.3
	Total of all Wetlands Land Uses	**117.5**	**10.0**
Barren Land Use Type:			
7500	Transitional Areas (sites cleared of vegetation, under development)	4.4	0.4
	Total of all Barren Land Uses	**4.4**	**0.4**
All Land Uses		**1,170.01**	**100.0**

* Acreage from the GIS data varies from acreage calculated based on tax maps.

Source: NJDEP, 2010 (GIS data 2007 Land use/Land Cover); Highland Park Environmental Commission, 2011 (changes between 2007 and 2011); USGS 2010 (definitions of land uses)

[32] Crown closure is the percentage of a forest area occupied by the vertical projections of tree crowns. Crown closure percentages provide a reasonable estimate of stand density (USGS, 2010).

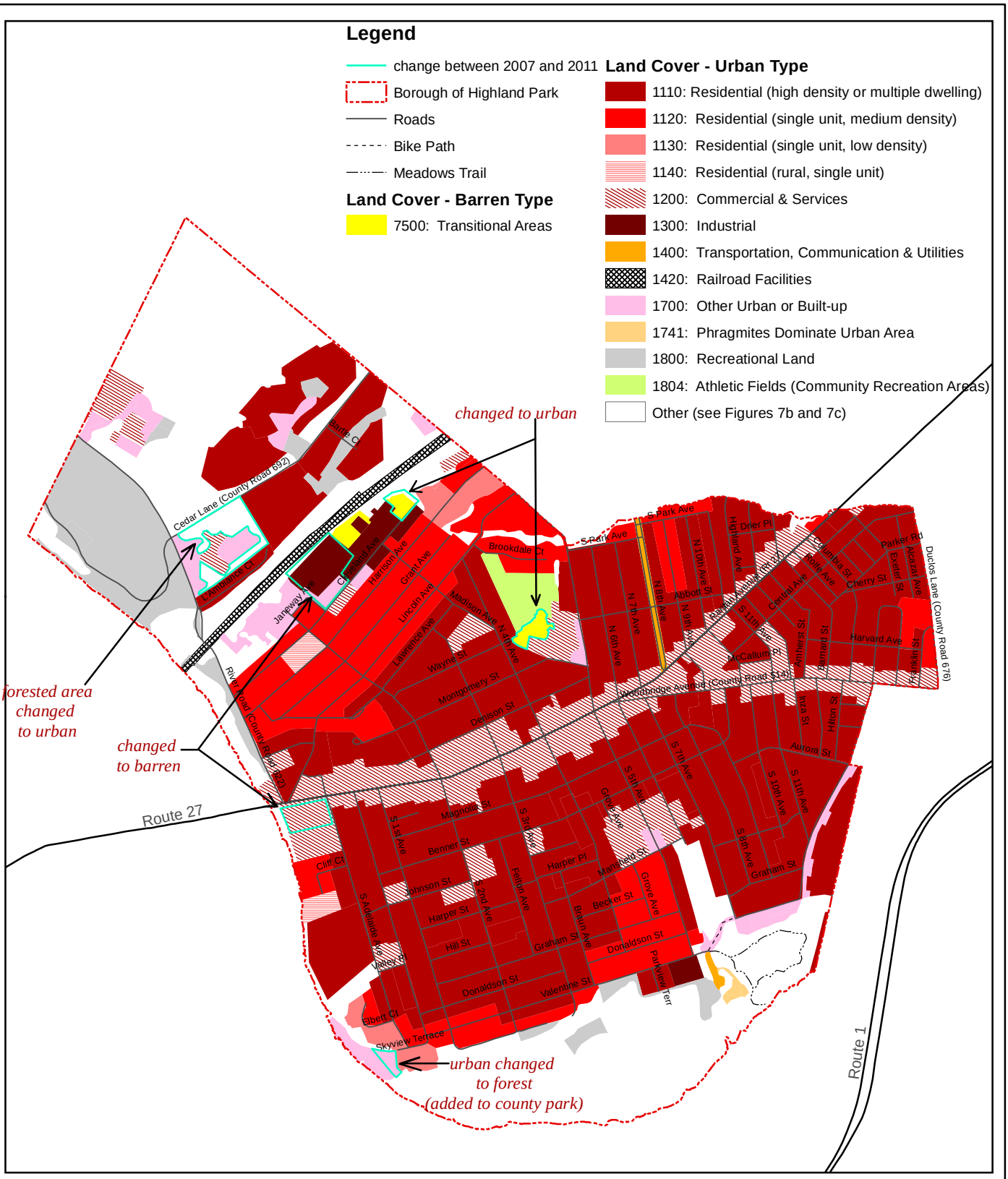

Figure 7a: Land Cover Urban and Barren Types

N
W E
S

0 0.125 0.25 0.5 Miles
0 500 1,000 2,000 Feet

Borough of Highland Park ERI 2012
Prepared by Kratzer Environmental Services

Data Sources: See Appendix B.
Note: Map accuracy is limited to the accuracy and scale of the original data sets; see Appendix B.
Disclaimer: This map was developed using NJDEP GIS digital data, but this secondary product has not been verified by NJDEP and is not NJDEP authorized.

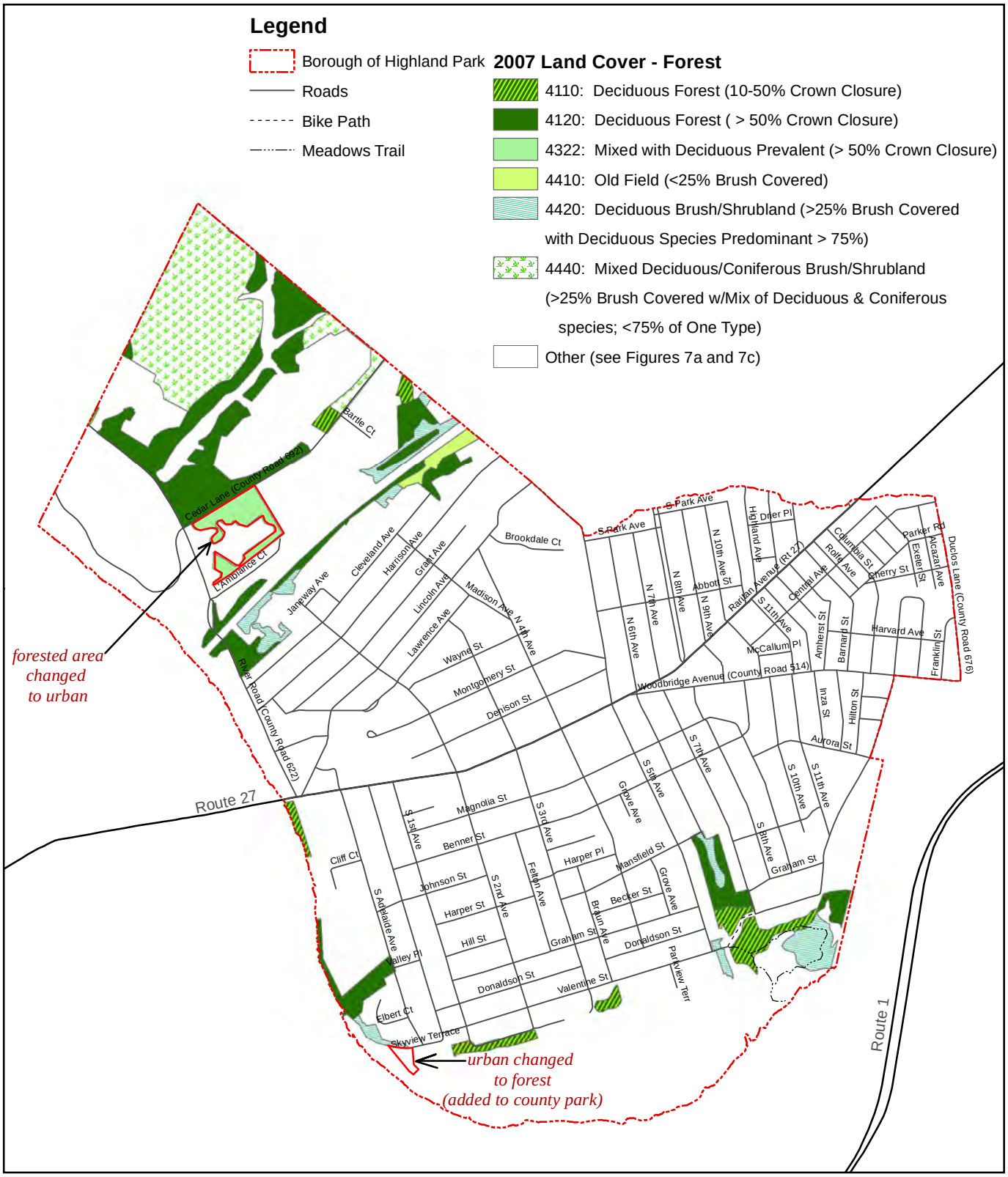

Figure 7b: Land Cover: Forest Types

Borough of Highland Park ERI 2012
Prepared by Kratzer Environmental Services

Data Sources: See Appendix B.
Note: Map accuracy is limited to the accuracy and scale of the original data sets; see Appendix B.
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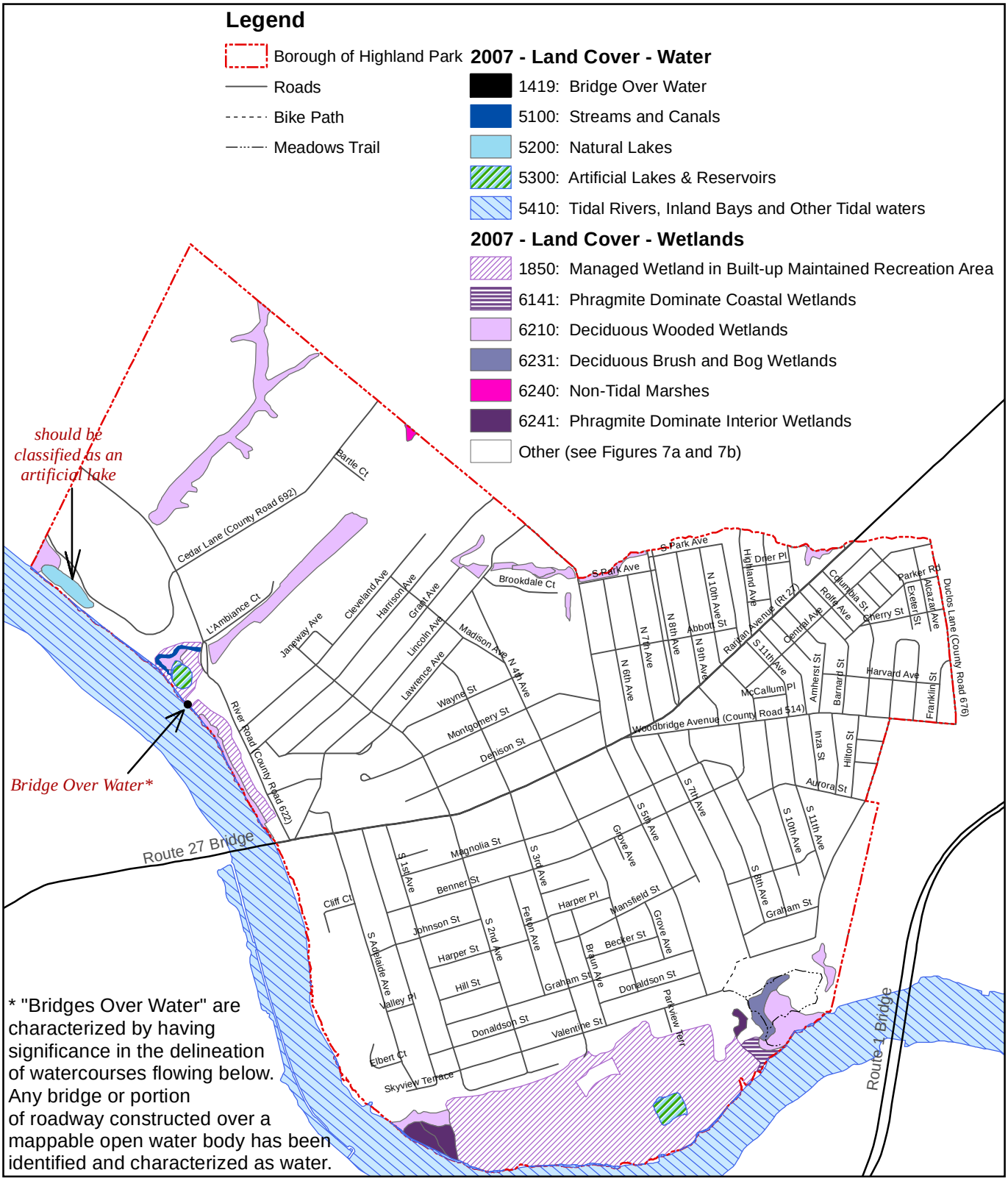

Figure 7c: Land Cover Water & Wetlands

N
W E
S

0 0.125 0.25 0.5 Miles
0 500 1,000 2,000 Feet

Borough of Highland Park ERI 2012
Prepared by Kratzer Environmental Services

Data Sources: See Appendix B.
Note: Map accuracy is limited to the accuracy and scale of the original data sets; see Appendix B.
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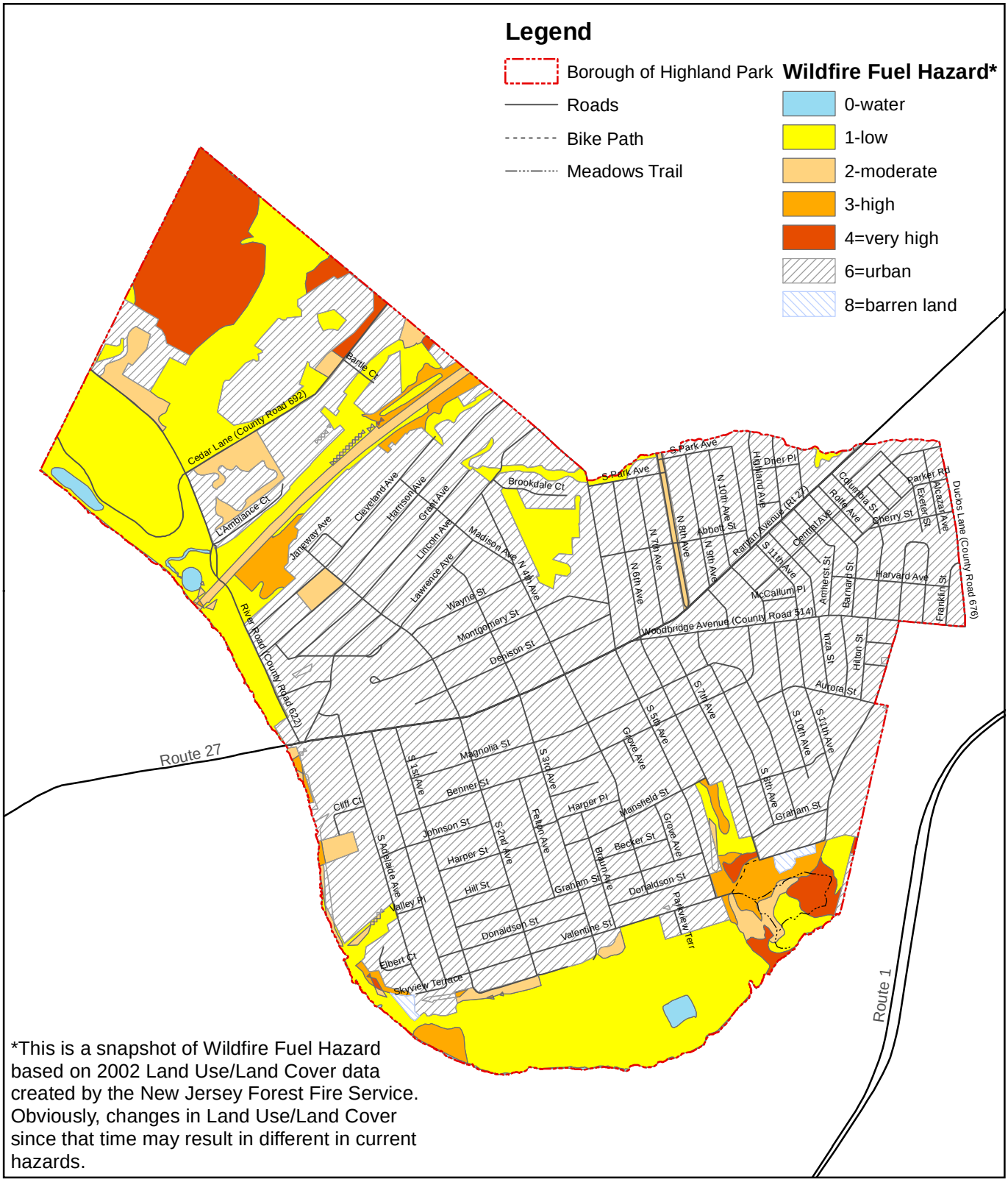

*This is a snapshot of Wildfire Fuel Hazard based on 2002 Land Use/Land Cover data created by the New Jersey Forest Fire Service. Obviously, changes in Land Use/Land Cover since that time may result in different in current hazards.

Figure 7d: Wildfire Fuel Hazard

N
W E
S

0 0.125 0.25 0.5 Miles
0 500 1,000 2,000 Feet

Borough of Highland Park ERI 2012
Prepared by Kratzer Environmental Services

Data Sources: See Appendix B.
Note: Map accuracy is limited to the accuracy and scale of the original data sets; see Appendix B.
Disclaimer: This map was developed using NJDEP GIS digital data, but this secondary product has not been verified by NJDEP and is not NJDEP authorized.

C. Native Plants and Street Trees

According to the Native Plant Society of New Jersey (NPSNJ), a native species is one that historically occurred or currently occurs in a particular ecosystem, other than as a result of an introduction. In New Jersey, this means those species existing here prior to European settlement in the 1600's. Native plants have evolved over thousands of years to be adapted to the local climate, soils, pollinators and other animals, and are a crucial part of a healthy ecosystem (NPSNJ, 2011; BHWP, 2011).

Native plants have been planted in the borough's Native Plant Reserve and in The Meadows. Members of the NPSNJ and the Highland Park Environmental Commission have assembled a list of native plants currently growing in Highland Park gardens (see **Appendix C.1**).

In 1998, the Highland Park Shade Tree Advisory Committee inventoried some of the borough's street trees. Highland Park's diversity of trees includes at least 44 species of trees, both native and non-native. The inventory has been updated in 2011 by the Environmental Commission and street tree locations were mapped with GPS (see **Figure 7e** and **Table 7.2**). A few trees are located further into the property but clearly visible from the street.

The Borough has a Tree Removal and Protection Ordinance (§388).

D. Wildlife

New Jersey hosts 323 bird species, 89 mammal species, 44 reptile, 35 amphibian, 85 freshwater fish and over 300 marine finfish species. This high diversity in such a small state is partly due to New Jersey's geographic position where northern ecosystems reach their southern limit and where southern ecosystems reach their northern limit. In addition, the state provides a wide variety of habitats including mountains, valleys, rolling hills, wetlands, pinelands, beaches, estuaries and rivers (NJDEP, 2011).

The NJDEP website offers checklists for the birds, mammals, reptiles and amphibians of New Jersey, with notes on the status of each (e.g. common or rare) (see **Internet Resources**). A variety of plant and animal species enjoy Highland Park's diversity of habitat types. Catalogues of bird and plant species have been developed, but may be revised with additional sightings and surveys. Lists of mammals, herptiles and fish are not available specifically for either Middlesex County or the Borough.

Canada Goose

The Canada goose (*Branta canadensis*) is one of New Jersey's most easily recognized birds, with its black head and neck, white cheek patch and undersides, brown back and large size (2'-3' tall, 10-12 lbs.). There are two distinct populations in NJ, migratory geese that visit the state in the winter and non-migratory geese, that nest in the state.

Donaldson Park by Pond with Canada Geese

Sources estimate the NJ population of resident Canada geese at approximately 83,000 to 96,800 (USDA, January 2003; NJDEP, March 2001).

While many people enjoy the sight of a few geese, this high population of non-migrating geese can cause the following problems:

Table 7.2: Significant Street Trees

Map ID	Common Name	Scientific Name	Address
1	Ailanthus (tree of heaven)	*Ailanthus altissima*	224 S. 11th Ave, left
2	Apple	*Malus*	609 S. 5th Ave (n=3)
3	Beech, American	*Fagus grandifolia*	Opposite 55 Lawrence Ave in Median
4	Beech, Copper (European beech)	*Fagus sylvatica*	31 N. 5th Ave (Library) on right
5	Catalpa	*Catalpa*	265 S. 8th Ave
6	Cedar	*Juniperus virginiana*	239 Volkert Street, left
7	Cherry, Kwanzan (Japanese flowering cherry)	*Prunus serrulata*	Corner of Valentine and 802 1st Ave
8	Dawn Redwood	*Metasequoia glyptostroboides*	53 Cleveland Ave
9	Dogwood, Flowering	*Cornus florida*	Corner of S. 4th and Raritan Ave
10	Dogwood, Japanese	*Cornus kousa*	Side of bank on S 4th and Raritan Ave
11	Eastern Redwood		Senior Center, S, 6th Ave
12	Elm, American	*Ulmus americana*	10 Alcazar Street
13	Ginkgo	*Ginkgo biloba*	Lower Raritan Ave, bridge to S. Adelaide (n=8)
14	Hemlock, Canadian (eastern hemlock)	*Tsuga canadensis*	102 N 3rd Ave
15	Horsechestnut, red (red buckeye)	*Aesculus pavia*	Magnolia St around corner from 31 S 2nd
16	Locust, Black	*Robinia pseudoacacia*	202 Duclos Lane (n=3)
17	Locust, Honey	*Gleditsia triacanthos*	155-179 Exeter Street (n=5)
18	Magnolia	*Magnolia*	N. 8th Ave between Abbot & S. Park Ave
19	Magnolia, Saucer	*Magnolia × soulangiana*	N 2nd at Raritan (Baptist church property)
20	Maple, ash-leaved (boxelder)	*Acer negundo*	258 S. 7th Ave
21	Maple, Japanese	*Acer palmatum*	713 S 2nd Ave
22	Maple, Norway	*Acer platanoides*	N 5th and Raritan Ave
23	Maple, Sugar	*Acer saccharum*	35 S.5th Ave
24	Oak, Black	*Quercus velutina*	144 Duclos Lane
25	Oak, English	*Quercus robur*	225 Benner Street (n=2)
26	Oak, Pin	*Quercus palustris*	402-414 S. 1st Ave
27	Oak, Sawtooth	*Quercus acutissima*	306 S 2nd Ave
27	Oak, Sawtooth	*Quercus acutissima*	420 Mansfield opposite Bartle School
28	Oak, Scarlet	*Quercus coccinea*	251 S. 8th Ave, left
29	Oak, White	*Quercus alba*	144 Duclos Lane
30	Parrotia (Persian parrotia)	*Parrotia persica*	55 Cleveland Ave
31	Pear	*Pyrus*	308 S 2nd Ave
32	Pine, white	*Pinus strobus*	235 Hilton
32	Pine, white	*Pinus strobus*	Corner of Benner St & S 4th
33	Plane, London	*Platanus hybrida*	N. 8th Ave between Raritan Ave & Abbot St
34	Plum, flowering	*Prunus triloba*	221 Harper Street
35	Redbud	*Cercis canadensis*	212 S. 10th
36	Scholar	*Sophora japonica*	35 S 3rd Ave
37	Seven Sons Flower Tree	*Heptacodium miconioides*	55 Cleveland Ave
38	Smoketree	*Cotinus*	216 Cleveland Ave
39	Sourwood	*Oxydendrum arboreum*	Rear of bank on corner S 4th and Raritan Ave
40	Spruce, Norway	*Picea abies*	201 S 2nd Lafayette condos
40	Spruce, Norway	*Picea abies*	201 S 2nd Lafayette condos
41	Sweet Gum	*Liquidambar styraciflua*	209 Columbia
41	Sweet Gum	*Liquidambar styraciflua*	45 Cleveland Ave
42	Sycamore	*Platanus occidentalis*	1800 Park Street
43	Tulip tree	*Liriodendron tulipifera*	Madison Ave between Cleveland Ave & Harrison Ave, west side of street
44	Zelkova	*Zelkova serrata*	425 S 3rd Ave, left
Source: Highland Park Environmental Commission, 2011			

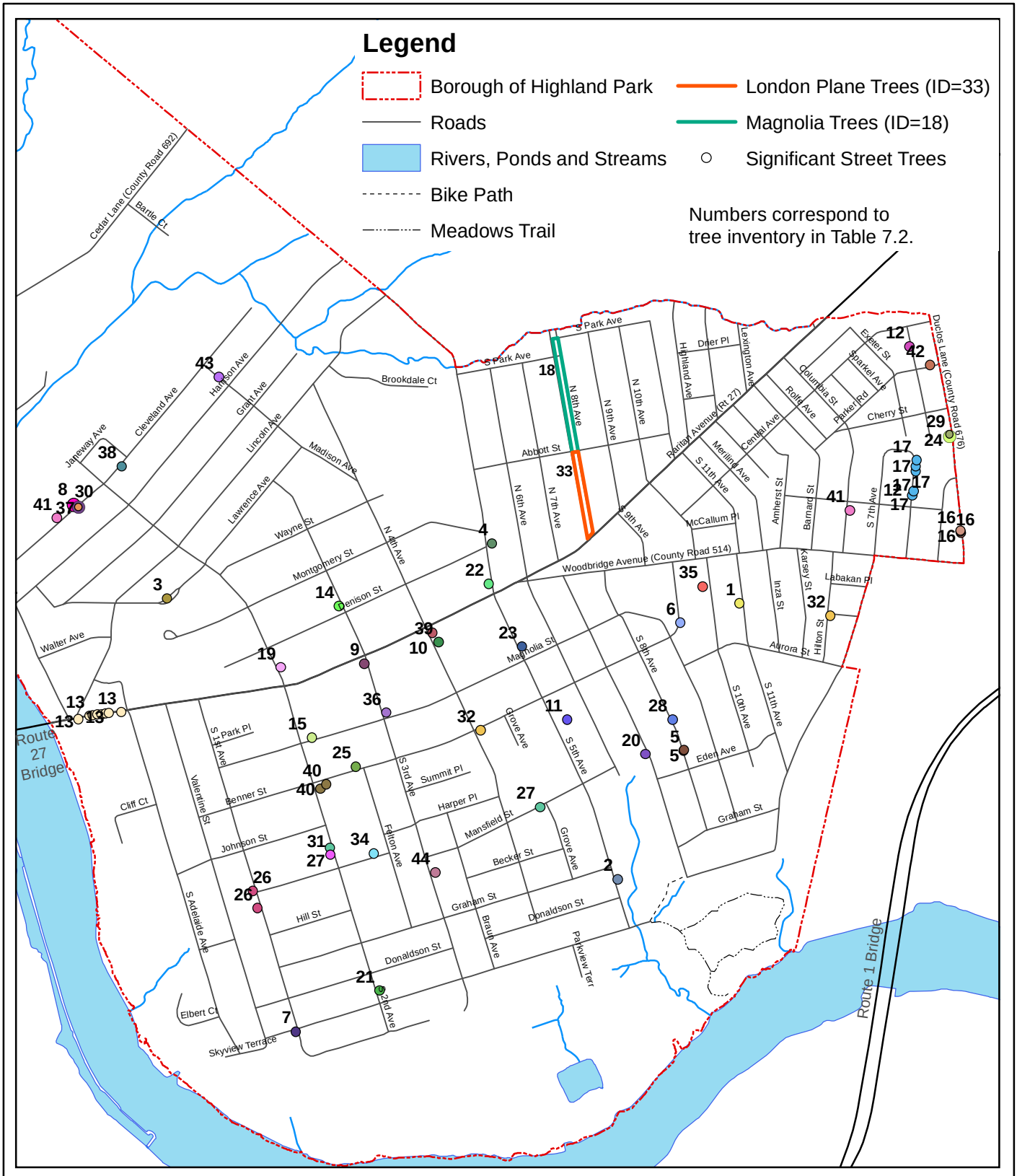

Figure 7e: Significant Street Trees

Borough of Highland Park ERI 2012
Prepared by Kratzer Environmental Services

Data Sources: See Appendix B.
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Disclaimer: This map was developed using NJDEP GIS digital data, but this secondary product has not been verified by NJDEP and is not NJDEP authorized.

- overgrazing of lawns and athletic fields, which impacts aesthetics and causes erosion
- damage to cropland, increasing erosion hazard and crop losses
- accumulations of feces on land, creating a health risk from disease-causing organisms
- degradation of water quality, from fecal bacteria, nitrogen and phosphorous
- hazards to aircraft at airports
- aggression and attacks on humans
- noise (USDA, January 2003; NJDEP, March 2001).

As migratory game species, Canada geese are afforded federal and state protection. Therefore, any management techniques involving handling nests, eggs or birds require a permit (USDA Animal and Plant Health Inspection Service, January 2003).

The ponds, river's edge and wide, grassy spaces at Johnson and Donaldson Parks support populations of Canada geese and have the potential for human/goose conflicts. In general, the Canada geese have adapted to man and threatening behavior only occurs when the birds are on nests or have young goslings present; and even this is a relatively rare behavior (Highland Park Environmental Commission, 2011).

White-tailed Deer

The white-tailed deer (*Odocoileus virginianus*), the largest herbivore living wild in New Jersey, is seen frequently in Highland Park. Although the deer is a large animal, individuals tend to stay in a one square mile or less home range, one of the smallest ranges among wild ruminants (Burnett, 2004).

Biologists have estimated that before the arrival of European settlers, there were about 8-11 white-tailed deer per square mile. By the early 1900's, New Jersey's deer herd was reduced to a handful by unregulated hunting. However, efforts to protect the deer herd were so successful that deer were considered over-populous by the 1920's (Latham et al, 2005). In addition, deer have been able to adapt to human-altered habitats. Studies have shown that deer densities of over 10-15 per square mile have negative impacts on the diversity of understory vegetation and on the native songbird and wildflower populations that depend on a diverse understory, while deer populations in excess of 20 per square mile prevent tree regeneration (Latham et al, 2005).

Where deer are overabundant, this results in excessive damage to agricultural crops, gardens and residential landscaping; an increased incidence of deer/vehicle collisions; prevention of forest regeneration (which impacts plants and animals dependent on the forest); and the potential for reduced deer health due to inadequate nutrition and the spread of disease (Honachevsky, 2000; Latham et al, 2005; Native Plant Society, 2003; Sauer, 1998). Despite these impacts, deer remain a natural part of the ecosystem, and are not solely responsible for diversity loss and habitat degradation.

Documentation of deer population numbers is not available for Middlesex County or Highland Park, therefore it is unknown whether the population exceeds either the number that can be sustained over an extended period (*ecological carrying capacity*) or the number that can coexist compatibly with local human populations (*cultural carrying capacity*) (NJDEP, 1999). Herds of deer of about 15 animals have been observed in both Donaldson and Johnson Parks in the last two years (Highland Park Environmental Commission, 2011).

In the last 4 years (2007-2010) there have been 10 automobile accidents involving deer, which have occurred on River Road past the railroad tunnel or Cedar Lane, which are adjacent to the Rutgers Ecological Preserve Source (Highland Park Police Department via Highland Park Environmental Commission, 2011).

There are no areas open to hunting in the Borough.

Birds

Of New Jersey's 323 species of birds, 300 have been sighted within Middlesex County. In the report, Birds of Middlesex County , Wheeler states, "The last 25 years have brought an ecological recovery that would have once seemed impossible, thanks largely to stronger environmental laws, a local corporate shift away from heavy industry, and an active citizenry befitting one of the oldest settled areas in the United States. While Middlesex County will never be mistaken for a pristine Eden, we are setting a model for post-industrial ecological recovery, as we transform former industrial brownfields into vibrant greenfields of wildlife habitat and hiking trails." (Wheeler, 2007)

The Raritan River and the Rutgers Ecological Preserve are identified as birding hotspots within Highland Park. The tidal Raritan River provides opportunities to view bald eagle, osprey, peregrine falcon and a wide range of gulls, among others. Access points within the Borough include Johnson Park, the Native Plant Reserve, Donaldson Park and The Meadows). Over 150 bird species have been sighted within the Rutgers Ecological Preserve's old-growth forests, including various woodpeckers, owls and hawks (Wheeler, 2007). The WCTC tower in Donaldson Park is a favorite perch of red-tailed hawks, peregrine falcon, and even bald eagle (Williams, 2011).

Since 2001, experienced birders in Highland Park have identified 200 species of birds within the Borough (Williams, 2011). A list is provided in **Appendix C.3**. Sightings of endangered, threatened and special concern birds are discussed in **Section 7E**.

Since the publication of the last Highland Park Natural Resource Inventory (NRI) (Townplan Associates, 1992), a number of species that were considered very rare in Highland Park have become more common. The bald eagle, in 1992, was extremely rare. Now it is seen 10 to 12 times a year. The osprey was relatively rare; now it is seen almost daily during the summer along the Raritan. Sightings of the turkey and black vulture, previously relatively rare, are now a daily occurrence. In 1992, the double crested cormorant was seen only occasionally along the Raritan River; it is now seen daily in spring, summer and fall along the Raritan. Groups as large as 78 have been seen in Johnson Park. The great cormorant is now seen frequently along the Raritan in the winter. The red-bellied woodpecker was rarely seen or heard in 1992 and now is a common visitor to backyards and in the borough's parks and forest (Highland Park Environmental Commission, 2011).

Wildlife

With the exception of the bird list discussed above, there are no species lists specific for either the Borough of Highland Park or for Middlesex County. Links to species lists for the state can be found in **Internet Resources**. Highland Park's 1992 NRI (Townplan Associates, 1992) provided a list of mammals potentially found in the borough, which is updated below in **Table 7.3**. **Table 7.4** provides a list of reptiles and amphibians with ranges that include Highland Park (based on NJDEP Division of Fish and Wildlife, 2007). Species sightings within Highland Park that have been confirmed by the Highland Park Environmental Commission are noted in the tables. Other species listed may occur in suitable habitat within the borough and sightings might be confirmed in the future.

Table 7.3: Mammals of Highland Park

COMMON NAME	SCIENTIFIC NAME	HABITAT	RANGE in NJ	Confirmed in Highland Park?
BATS				
Little Brown Myotis	*Myotis lucifugus*	caves	north	✓
Big Brown Bat	*Eptesicus fuscus*	caves, buildings	state	
Red Bat	*Lasiurus borealis*	trees	state	

COMMON NAME	SCIENTIFIC NAME	HABITAT	RANGE in NJ	Confirmed in Highland Park?
Hoary Bat	*Lasiurus cincrcus*	evergreens	state	
Evening Bat	*Nycticeius humeralis*	hollow trees, buildings	south	
Silver-haired Bat	*Lasionycteris noctivagan*	trees, cracks, buildings	state	
Eastern Pipistrelle	*Pipistrellus subflavus*	caves, mines	state	
RODENTS				
Black Rat	*Rattus rattus*	mainly buildings, docks	state	✓
Norway Rat	*Rattus norveglcus*	buildings, farm fields	state	✓
Marsh Rice Rat	*Oryzomys palustris*		central, south	
Eastern Woodrat	*Neotoma floridana*	rocky areas	north	
Muskrat	*Ondatra zibethlcus*	water areas	state	✓
House Mouse	*Mus musculus*	buildings, farm fields	state	✓
Meadow Jumping Mouse	*Zapus hudsonius*	moist fields-dense woods	state	
White Footed Mouse	*Peromyscus leucopus*	brushy areas	state	
Wood Mouse	*Peromyscus sp.*		state	
Short-tailed Shrew	*BIarina brevicauda*		state	
Least Shrew	*Cryptotis parva*	grassy areas	state	
Masked Shrew	*Sorex cinereus*	moist fields-dry woods	state	
So. Red-backed Vole	*Clethrionomys gapperi*		state	
Meadow Vole	*Microtus pennsylvanicus*	also woodland glades	state	
Woodland Vole	*Microtus pinetorum*	pine forests	state	
So. Bog Lemming	*Synaptomys cooperi*	meadows	state	
OTHER MAMMALS				
Eastern Mole	*Scalepus aquaticus*	loose soil	state	✓
Starnosed Mole	*Condylura cristata*	occasionally lawns	state	✓
Opossum	*Didelphis virginiana*	also farmlands	state	✓
Striped Skunk	*Mephitis mephitis*		state	✓
Raccoon	*Procyon lotor*	streams	state	✓
Long Tail Weasel	*Mustein frenata*	likes farms & streams	state	
Mink	*Mustela vison*	streams	state	
Eastern Cottontail	*Sylvilagus florldanus*	thickets & brush piles	state	✓
New Eng. Cottontail	*Sylvilagus transitionalis*	brushy areas	state	
European Rabbit	*Oryctolagus cuniculus*	open fields	state	
Groundhog	*Marmota monex*	fields	state	✓
Eastern Chipmunk	*Tamias striatus*	wood piles & stone walls	state	✓
Eastern Gray Squirrel	*Sciutus carolinensis*		state	✓
Black Squirrel (melanistic subgroup of Eastern Gray Squirrel)	*Sciutus carolinensis*		state	✓
Fox Squirrel	*Sciutus niger*	pine forests	south	
Red Squirrel	*Tamiasciurus hudsonicus*	pine forests	state	
Southern Flying Squirrel	*Glaucomys volans*	hickory, oak, beech, maple	state	
Red Fox	*Vulpes vulpes*	farms	state	✓
Gray Fox	*Urocyon cinereoargenteu*	farms	state	
Coyote	*Canis latrans*		state	✓
White-tail Deer	*Odocoileus virginianus*	farms adjacent to woods	state	✓
Source: Townplan Associates, 1992 (From Whitaker, 1980) ; Highland Park Environmental Commission, 2011				

Table 7.4: Reptiles and Amphibians of Highland Park

COMMON NAME	SCIENTIFIC NAME	HABITAT	RANGE in NJ	Confirmed in Highland Park?
TURTLES				
Bog Turtle (E✳)	*Clemmys muhlenbergii*	marshes and fens	state	
Common Map Turtle	*Graptemys geographica*	Rivers and canals, often basking out in the open	Del. & Rar. Riv.	
Common Musk Turtle	*Sternotherus odoratus*	still or slow-moving water	state	
Common Snapping Turtle	*Chelydra serpentina*	fresh or brackish water	state	✓
Eastern Box Turtle	*Terrapene c. carolina*	woods and meadows	state	✓
Eastern Mud Turtle	*Kinosternon s. subrubrum*	shallow slow-moving water w/mud bottoms	Includes Middlesex County	
Eastern Painted Turtle	*Chrysemys p. picta*	Any standing body of water	state	
Red-eared Slider	*Trachemys scripta elegans*	not native to NJ; prefers still water w/mud bottom	state	
Spotted Turtle	*Clemmys guttata*	wooded wetlands	state	
Wood Turtle (T✳)	*Clemmys insculpta*	clean streams through woods, meadows & farm	Includes Middlesex County	
LIZARDS				
Five-lined Skink	*Eumeces fasciatus*	wooded areas	state	
Ground Skink	*Scincella lateralis*	wooded areas	Includes Middlesex County	
Northern Fence Lizard	*Sceloporus undulatus hyacinthinus*	open pine woods	south	
SNAKES				
Black Rat Snake	*Elaphe o. obsoleta*	woodlands, rocky hillsides, meadows, trees	state	
Eastern Garter Snake	*Thamnophis s. sirtalis*	woods, fields & suburban neighborhoods	state	✓
Eastern Hognose Snake	*Heterodon platyrhinos*	habitats with sandy substrate	state	
Eastern Milk Snake	*Lampropeltis t. triangulum*	habitats, barns and buildings with rodents	state	
Eastern Ribbon Snake	*Thamnophis s. sauritus*	slow-moving or quiet waters	state	
Eastern Smooth Earth Snake	*Virginia v. valeriae*	under debris in woods and pitch pine forests	Includes Middlesex County	
Eastern Worm Snake	*Carphophis a. amoenus*	under rocks or rotting logs; burrows in ground	state	
Northern Black Racer	*Coluber c. constrictor*	fields, open woods; occasionally in suburban areas	state	
Northern Brown Snake	*Storeria d. dekayi*	moist areas under debris; unpolluted suburban areas	state	
Northern Copperhead	*Agkistrodon contortrix mokasen*	favors rocky woods, rotting woodpiles, leaves	Includes Middlesex County	
Northern Redbelly Snake	*Storeria o. occipitomaculata*	wooded areas and bogs	state	
Northern Ringneck Snake	*Diadophis punctatus edwardsii*	under logs, stones, even trash in woods and open areas	state	
Northern Scarlet Snake	*Cemophora coccinea copei*	under rocks or rotting logs; burrows in ground	Includes Middlesex County	
Northern Water Snake	*Nerodia s. sipedon*	Near or in water	state	

SALAMANDERS				
Blue-spotted Salamander (E)	*Ambystoma laterale*	woods and wetlands; breeds in vernal pools and wetlands	Includes Middlesex County	✓
Four-toed Salamander	*Hemidactylium scutatum*	wooded swamps and fens with sphagnum moss	state	
Longtail Salamander (T)	*Eurycea l. longicauda*	slow moving streams, fens and swamps	Includes Middlesex County	
Marbled Salamander	*Ambystoma opacum*	under logs & rocks; breeds in vernal pools	state	
Northern Dusky Salamander	*Desmognathus f. fuscus*	under stream-edge debris; near small sources of flowing water	Includes Middlesex County	
Northern Red Salamander	*Pseudotriton r. ruber*	Requires cool, clean, flowing streams	state	
Northern Slimy Salamander	*Plethodon glutinosus*	Moist woodland ravines or hillsides	Includes Middlesex County	
Northern Spring Salamander	*Gyrinophilus p. porphyriticus*	cool mountain streams and shaded seepages	Includes Middlesex County	
Northern Two-lined Salamander	*Eurycea bislineata*	clean streams and under streamside debris	Includes Middlesex County	
Redback Salamander	*Plethodon cinereus*	wooded areas under logs, bark, stones and trash	state	✓
Red-spotted Newt	*Notophthalmus v. viridescens*	adult is aquatic; eft stage prefers moist woods	state	
Spotted Salamander	*Ambystoma maculatum*	Deciduous/ mixed woods; breeds in vernal ponds	Includes Middlesex County	
FROGS AND TOADS				
American Toad	*Bufo americanus*	anywhere from backyards to remote woodlands	Includes Middlesex County	✓
Bullfrog	*Rana catesbeiana*	any permanent body of freshwater	state	✓
Carpenter Frog	*Rana virgatipes*	prefers sphagnum bogs	Includes Middlesex County	
Fowler's Toad	*Bufo woodhousii fowleri*	mainly in sandy habitats	state	
Green Frog	*Rana clamitans melanota*	any body of freshwater	state	
New Jersey Chorus Frog	*Pseudacris triseriata kalmi*	variety of habitats; breeds in swamps & vernal pools	Includes Middlesex County	
Northern Cricket Frog	*Acris c. crepitans*	sunny, shallow, permanent pools or streams	state	
Northern Gray Treefrog	*Hyla versicolor*	in trees in forests; breeds in swamps & vernal pools	state	
Northern Spring Peeper	*Pseudacris c. crucifer*	variety of habitats	state	✓
Pickerel Frog	*Rana palustris*	variety of habitats	state	✓
Southern Leopard Frog	*Rana utricularia*	wetland habitats	state	
Wood Frog	*Rana sylvatica*	moist, wooded areas; breed in vernal pools	state	
E= State endangered; T=State Threatened Sources: NJDEP Division of Fish and Wildlife, 2007; Highland Park Environmental Commission, 2011				

Wildlife of Vernal Pools

Vernal pools are defined as confined depressions, either natural or man-made, that maintain ponded water for part of the year, have no permanent outflow, and are devoid of breeding fish populations. These temporary wetlands provide habitat to many species of amphibians, several of which breed exclusively in vernal pools, as well as a multitude of insects, reptiles, plants, and other wildlife. Certification of a vernal pool may be achieved by documenting breeding activity of obligate vernal pool species (such as wood frogs or spotted salamanders) or by documenting both the presence of facultative species and photographic evidence that the pool goes dry or demonstrating the absence of fish (NJDEP, no date).

There are vernal pools in the section of Buck Woods (see **Figure 8a**) within Highland Park, although these have not yet received NJDEP certification (Highland Park Environmental Commission, 2011).

Fish

Recreational fishing is popular not only along the Raritan River but also in the pond in Donaldson Park, and the ponds in Johnson Park. The parks provide good access to the ponds and the river. As the Raritan is a tidal river, there can be a variety of fish associated both with the ocean and with fresh water streams. Fishermen report catching American eel, bluefish, catfish, carp, striped bass, sea bass, smallmouth bass, largemouth bass, yellow perch, pike, sunfish, trout, fluke, winter flounder and weak fish in the Raritan (see **Table 7.5**) (Highland Park Environmental Commission, 2011). See **Section 6I** for Fish Consumption Advisories.

Table 7.5: Fish Caught in Raritan River in Highland Park

Common Name	Scientific Name	Fresh or Saltwater
American eel	*Anquilla rostrata*	catadromous*
bass, largemouth	*Micropterus salmoides*	freshwater
bass, black sea	*Centropristis striata*	saltwater
bass, smallmouth	*Micropterus dolomieu*	freshwater
bass, striped	*Morone saxatilis*	anadromous•
bluefish	*Pomatomus saltatrix*	saltwater
carp	Cyprinidae family	freshwater
catfish		freshwater
flounder, winter	*Pseudopleuronectes americanus*	saltwater
fluke	*Paralichthys dentatus*	saltwater
Perch, yellow	*Perca flavescens*	freshwater
Pike, northern	*Esox lucius*	brackish & freshwater
sunfish	*Lepomis spp.*	freshwater
trout	Salmonidae family	freshwater
weak fish	*Cynoscion regalis*	saltwater
*Catadromous fish live in fresh water and spawn in salt water. •Anadromous fish live in salt water and spawn in fresh water.		
Source: Highland Park Environmental Commission, 2011		

E. Endangered, Threatened and Special Concern Species

The health of an area's animal and plant populations can be an indicator of the health and sustainability of the environment for people. The decline or disappearance of one (or more) species may signal the deterioration of the habitat. Other species, and human health and welfare, may soon follow. Preserving the future of endangered and threatened species helps preserve our own species, benefiting human health and quality of life by protecting watersheds, preserving

land in its natural state, and restoring wildlife habitat. Many people also place an intrinsic value on all species (Conserve Wildlife Foundation, 2002).

Many species are naturally rare in parts of their range, especially at the periphery. New Jersey often lies at the southern periphery of the range for many "northern" species and at the northern edge of the range of many "southern" species. Therefore, a species considered rare or imperiled within the state of New Jersey is not necessarily in danger of extinction worldwide. In addition, many rare species depend on large tracts of continuous undisturbed habitat to survive. If these habitats are interrupted by developed areas, the patches may become too small to support certain species.

The NJ Endangered Species Conservation Act was signed into law on December 14, 1973 (N.J.S.A. 23:2A-1 - 15), preceding the federal Endangered Species Act by two weeks. This milestone legislation established laws to protect and restore the state's endangered and threatened wildlife whose survival in New Jersey is imperiled by loss of habitat, over-exploitation, pollution, or other impacts. Proposed amendments and changes to the Endangered and Nongame Species rules (N.J.A.C. 7:25) are under consideration as of March 2011 (NJDEP, 2004).

Table 7.6 presents the definitions used by NJDEP in describing the status of species. In order to better document the status or change in status of species, NJDEP solicits information from the general public concerning sightings of endangered, threatened and special concern species. People should use the appropriate reporting forms (see **Internet Resources** and **Appendix C.5 and C.6)**.

Table 7.6: Definitions of Species Status Codes

STATE STATUS	STATE STATUS DEFINITIONS
Animals: Two animal lists provide state status codes after the Endangered and Nongame Species Conservation Act of 1973 (N.J.S.A. 23:2A-13 et. seq.): the list of endangered species (N.J.A.C. 7:25-4.13) and the list defining status of indigenous, nongame wildlife species of New Jersey (N.J.A.C. 7:25-4.17(a)). The status of animal species is determined by the Endangered and Nongame Species Program (ENSP), with the review and approval of the Endangered and Nongame Species Advisory Committee.	
E	**Endangered** applies to a species whose prospects for survival within the state are in immediate danger due to one or several factors, such as loss or degradation of habitat, over-exploitation, predation, competition, disease or environmental pollution, etc. An endangered species likely requires immediate action to avoid extinction within NJ.
T	**Threatened** applies to species that may become Endangered if conditions surrounding it begin to or continue to deteriorate. Thus, a Threatened species is one that is already vulnerable as a result of, for example, small population size, restricted range, narrow habitat affinities, significant population decline, etc.
SC	**Special Concern** applies to species that warrant special attention because of some evidence of decline, inherent vulnerability to environmental deterioration, or habitat modification that would result in their becoming a Threatened species. This category would also be applied to species that meet the foregoing criteria and for which there is little understanding of their current population status in the state.
S	**Stable** (or increasing) applies to species that appear to be secure in NJ and not in danger of falling into any of the preceding categories in the near future.
U	**Undetermined** refers to a species about which there is not enough information available to determine the status.
Plants: Plant taxa listed as endangered are from New Jersey's official Endangered Plant Species List (N.J.A.C. 7:5C – 5.1).	
E	Native New Jersey plant species whose survival in the State or nation is in jeopardy.
FEDERAL STATUS	**FEDERAL STATUS DEFINITIONS**
LE	Taxa formally listed as **endangered.**
LT	Taxa formally listed as **threatened.**
STATE RANK	**STATE ELEMENT RANK DEFINITIONS**

STATE STATUS	STATE STATUS DEFINITIONS
S1	**Critically imperiled in New Jersey** because of extreme rarity (5 or fewer occurrences or very few remaining individuals or acres). Elements so ranked are often restricted to very specialized conditions or habitats and/or restricted to an extremely small geographical area of the state. Also included are elements which were formerly more abundant, but because of habitat destruction or some other critical factor of its biology, they have been demonstrably reduced in abundance. In essence, these are elements for which, even with intensive searching, sizable additional occurrences are unlikely to be discovered.
S2	**Imperiled in New Jersey** because of rarity (6 to 20 occurrences). Historically many of these elements may have been more frequent but are now known from very few extant occurrences, primarily because of habitat destruction. Diligent searching may yield additional occurrences.
S3	**Rare in state** with 21 to 100 occurrences (plant species and ecological communities in this category have only 21 to 50 occurrences). Includes elements which are widely distributed in the state but with small populations/acreage or elements with restricted distribution, but locally abun-dant. Not yet imperiled in state but may soon be if current trends continue. Searching often yields additional occurrences.
S4	**Apparently secure** in the state, with many occurrences.
S5	**Demonstrably secure** in state and essentially ineradicable under present conditions.
SH	Elements of **historical occurrence** in New Jersey. Despite some searching of historical occurrences and/or potential habitat, no extant occurrences are known. Since not all of the historical occurrences have been field surveyed, and unsearched potential habitat remains, historically ranked taxa are considered possibly extant, and remain a conservation priority for continued field work with the expectation they may be rediscovered.
B	Refers to the **breeding** population of the element in the state.
N	Refers to the **non-breeding** population of the element in the state.
REGIONAL STATUS	**REGIONAL STATUS CODES FOR PLANTS AND ECOLOGICAL COMMUNITIES**
LP	Indicates taxa listed by the **Pinelands Commission** as endangered or threatened within their legal jurisdiction. Not all species currently tracked by the Pinelands Commission are tracked by the Natural Heritage Program. A complete list of endangered and threatened Pineland species is included in the NJ Pinelands Comprehensive Management Plan.
HL	Indicates taxa or ecological communities protected by the **Highlands Water Protection and Planning Act** within the jurisdiction of the Highlands Preservation Area.
GLOBAL RANK	**GLOBAL ELEMENT RANK DEFINITION**
G1	**Critically imperiled globally** because of extreme rarity (5 or fewer occurrences or very few remaining individuals or acres) or because of some factor(s) making it especially vulnerable to extinction.
G2	**Imperiled globally** because of rarity (6 to 20 occurrences or few remaining individuals or acres) or because of some factor(s) making it very vulnerable to extinction throughout its range.
G3	Either **very rare and local throughout its range or found locally** (even abundantly at some of its locations) in a restricted range (e.g., a single western state, a physiographic region in the East) or because of other factors making it vulnerable to extinction throughout its range; with the number of occurrences in the range of 21 to 100.
G4	**Apparently secure globally**; although it may be quite rare in parts of its range, especially at the periphery.
G5	**Demonstrably secure globally**; although it may be quite rare in parts of its range, especially at the periphery.
GH	Of **historical occurrence** throughout its range i.e., formerly part of the established biota, with the expectation that it may be rediscovered.
Note: To express *uncertainty*, the most likely rank is assigned and a question mark added (e.g., G2?). A range is indicated by combining two ranks (e.g., G1G2, S1S3).	
Sources: NJDEP Division of Fish and Wildlife, 2008 and NJDEP Division of Fish and Wildlife, 2010	

Endangered, Threatened & Special Concern Animals

The NJDEP Division of Fish and Wildlife, Endangered and Nongame Species Program's (ENSP) mission is: "To actively conserve New Jersey's biological diversity by maintaining and

enhancing endangered and nongame wildlife populations within healthy functioning ecosystems." The program is responsible for the protection and management of New Jersey's wildlife, including 73 species currently listed as endangered or threatened, plus another 69 vertebrate species of special concern (NJDEP, 2004; NJDEP, 2008). For state-wide species lists, see **Internet Resources**.

A US Fish and Wildlife Service study completed in 1997 identified regionally significant habitats and species in the New York Bight watershed and New York-New Jersey Harbor, including most of the Hudson watershed, the watersheds of eastern NJ, and extending 100 miles out to the limit of the continental shelf. In the area called the New York-New Jersey Urban Core, which included the tidal portions of the Raritan River, 395 animal and plant species were designated as "species of special emphasis," some of which may be found in Highland Park (US Fish And Wildlife Service, 1997).

Appendix C.4 includes a list of Middlesex County rare species and natural communities. The species found in nearby locations within the county could be present in Highland Park if suitable habitat is present within the Borough.

A search of NJDEP Division of Parks and Forestry *Natural Heritage Database* in October 2010 revealed the documented presence of 2 special concern animals in Highland Park (see **Tables 7.6** for code definitions and **Table 7.7** for a list)**.** Special concern animal species, which warrant concern due to evidence of decline or vulnerability, include one reptile, the eastern box turtle, and one bird, the breeding population of the great blue heron. The Natural Heritage Database has no records of endangered or threatened species in Highlands Park.

Table 7.7: Natural Heritage Database Animal Species in Highland Park

Common Name	Scientific Name	Federal Status	State Status	Global Rank	State Rank	Habitat
Vertebrates, birds:						
great blue heron	*Ardea herodias*		SC/S	G5	S3B.S4N	Wetlands, shores
Vertebrates, reptiles:						
Eastern box turtle	*Terrapene carolina carolina*		SC	G5T5	S3	Woods, meadows
Note: For status and rank definitions, refer to **Table 7.6**.						
Sources: NJDEP ONLM, October 2010; Schwartz, 2002						

Although not recorded in the Natural Heritage Database, many endangered, threatened and special concern bird species have been sighted within Highland Park. Bird species found on the NJ endangered, threatened and special concern species lists that have been sighted by skilled birders in Highland Park (Williams, 2011) are listed in **Table 7.8**. A total of 8 endangered, 6 threatened and 33 special concern birds have been sighted in the Borough between 2001 and 2010.

Endangered, Threatened & Special Concern Plants

The Endangered Plant Species List Act (N.J.S.A. 13:1B-15.151) was enacted in 1989, defining endangered plants as "any native plant species whose survival in the State or the nation is in jeopardy... and any species having five or fewer extant populations within the State." The Division of Parks and Forestry has the responsibility of creating the list of NJ endangered plant species (N.J.A.C. 7:5C–1.1). While the rule does not provide any protection for officially listed species, several regulatory agencies within NJDEP responsible for protecting plant habitat have incorporated the Endangered Plant Species List into their criteria for review of permits (NJDEP, 2007).

Table 7.8: Sightings of NJ Threatened and Endangered Birds in Highland Park

Common Name	Species Name	Breeding Status	Non-Breeding Status
Bald Eagle	*Haliaeetus leucocephalus*	Endangered	Threatened
Black Skimmer	*Rynchops niger*	Endangered	Threatened
Least Tern	*Sterna antillarum*	Endangered	Endangered
Northern Goshawk	*Accipiter gentilis*	Endangered	Special Concern
Northern Harrier	*Circus cyaneus*	Endangered	Special Concern
Peregrine Falcon	*Falco peregrinus*	Endangered	Endangered
Pied-billed Grebe	*Podilymbus podiceps*	Endangered	Special Concern
Red-shouldered Hawk	*Buteo lineatus*	Endangered	Threatened
Black-crowned Night Heron	*Nycticorax nycticorax*	Threatened	Special Concern
Cooper's hawk	*Accipiter cooperii*	Threatened	Threatened
Osprey	*Pandion haliaetus*	Threatened	
Red-headed Woodpecker	*Melanerpes erythrocephalus*	Threatened	Threatened
Savannah Sparrow	*Passerculus sandwichensis*	Threatened	
Yellow-crowned Night Heron	*Nyctanassa violaceus*	Threatened	
American Kestrel	*Falco sparverius*	Special Concern +	Special Concern +
Cattle Egret	*Bubulcus ibis*	Special Concern +	Special Concern
Horned lark	*Eremophila alpestris*	Special Concern +	Special Concern
American Oystercatcher	*Haematopus palliatus*	Special Concern	Special Concern
Black-billed Cuckoo	*Coccyzus erythropthalmus*	Special Concern	Regional Priority
Blackburnian Warbler	*Dendroica fusca*	Special Concern	Regional Priority
Black-throat. Blue Warbler	*Dendroica caerulescens*	Special Concern	Stable
Black-throat. Green Warbler	*Dendroica virens*	Special Concern	Stable
Blue-headed Vireo	*Vireo solitarius*	Special Concern	Stable
Broad-winged Hawk	*Buteo platypterus*	Special Concern	Regional Priority
Brown Thrasher	*Toxostoma rufum*	Special Concern	Regional Priority
Canada Warbler	*Wilsonia canadensis*	Special Concern	Regional Priority
Caspian Tern	*Sterna caspia*	Special Concern	Regional Priority
Cliff Swallow	*Petrochelidon pyrrhonota*	Special Concern	Special Concern
Common Nighthawk	*Chordeiles minor*	Special Concern	Special Concern
Common Tern	*Sterna hirundo*	Special Concern	Regional Priority
Eastern Meadowlark	*Sturnella magna*	Special Concern	Special Concern
Glossy Ibis	*Plegadis falcinellus*	Special Concern	Regional Priority
Great Blue Heron	*Ardea herodias*	Special Concern	Stable
Hooded Merganser	*Lophodytes cucullatus*	Special Concern	Regional Priority
Hooded Warbler	*Wilsonia citrina*	Special Concern	Regional Priority
Least Flycatcher	*Empidonax minimus*	Special Concern	Stable
Little Blue Heron	*Egretta caerulea*	Special Concern	Special Concern
Nashville Warbler	*Vermivora ruficapilla*	Special Concern	Stable
Northern Parula	*Parula americana*	Special Concern	Stable
Semipalmated Plover	*Calidris pusilla*	N/A	Special Concern
Semipalmated Sandpiper	*Accipiter striatus*	Special Concern	Special Concern
Snowy Egret	*Egretta thula*	Special Concern	Regional Priority
Spotted Sandpiper	*Actitis macularia*	Special Concern	Regional Priority
Veery	*Catharus fuscescens*	Special Concern	Regional Priority
Winter Wren	*Troglodytes troglodytes*	Special Concern	Stable
Wood Thrush	*Hylocichla mustelina*	Special Concern	Regional Priority
Yellow-breasted Chat	*Icteria virens*	Special Concern	Regional Priority
+ Proposed change to Threatened status in Docket Number 15-10-12 on January 18, 2011 (pending adoption)			
Sources: Williams, 2011; NJDEP, 2008; NJDEP, March 2004; NJDEP, January 18, 2011			

Information on the special plants of NJ is tracked in the *Natural Heritage Database* by the NJDEP Office of Natural Lands Management (ONLM). A search of the Natural Heritage Database in October 2010 revealed the documented presence of 5 special concern plants in Highland Park (see **Table 7.6** for code definitions and **Table 7.9** for the species list)**.** These include 3 imperiled plants (6 to 20 occurrences in the state), 1 rare plant (21 to 100 occurrences in the state) and 1 historical occurrence (not found recently) (NJDEP ONLM, October 2010).

F. Projecting Endangered, Threatened and Special Concern Species

Wildlife Action Plan

NJDEP Division Fish and Wildlife prepared a Wildlife Action Plan (WAP) in 2008, required by the US Fish and Wildlife Service in order to qualify for future federal funds through the State Wildlife Grants program. This program provides federal funds to states for the conservation of species that are endangered, threatened, or have special conservation needs. A 25% match, provided by citizen contributions, is required. NJ has received approximately $1.2 million dollars of State Wildlife Grants funding each year (NJDEP, January 23, 2008).

The report states,

> "The greatest threats to NJ's natural resources include habitat loss, destruction, alteration, and fragmentation. This has been a recurring theme within NJ for years as it is the most densely populated state in our nation with an annually increasing population requiring additional homes, roads, commercial buildings, schools, etc. Additional threats include, but are not limited to, invasive species (flora and fauna, aquatic and terrestrial), pollution, and unsustainable land management practices." (NJDEP, January 23, 2008)

A WAP specific to each region identifies habitats, wildlife of greatest conservation need, and threats. Conservation goals and actions are identified and prioritized, and potential partnerships are outlined with landowners, the public and conservation organizations, wildlife professionals and local, state and federal agencies. Highland Park is in the Raritan Bay and North Atlantic Coast region.

The Landscape Project

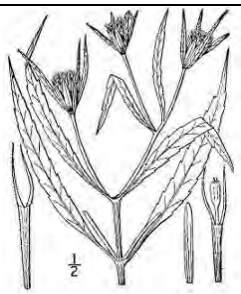
According to then-NJDEP Commissioner Bradley Campbell, (Beans, 2003), the NJ Endangered Species Conservation Act has done a good job of protecting listed species that occur in wetlands and in the Pinelands area, but has often failed to protect species found elsewhere. The state's *Landscape Project* (see **Figure 7f**) is intended to protect habitats.

The Landscape Project is a pro-active, ecosystem-level approach to the long-term protection of rare species and their important habitats in New Jersey. Its goal is to protect New Jersey's biological diversity by maintaining and enhancing rare wildlife populations within healthy, functioning ecosystems. It provides users with peer reviewed, scientifically sound wildlife data that is easily accessible and can be used by state, county, and local governments, as well as nongovernmental conservation organizations and private land owners for planning, open space acquisition, and land-use regulation (Niles et al, 2004).

The NJDEP, Division of Fish and Wildlife, Endangered and Nongame Species Program is responsible for the Landscape Project. Version 2.1 was released in 2008. The dataset was created by intersecting endangered, threatened and priority species data with the 2002 Land Use/Land Cover GIS layer, which was derived from aerial photography. The resulting data layer identifies, delineates and ranks (based on the conservation status of species present) critical habitat statewide. **Table 7.10** lists rank definitions. Each habitat patch is coded for the number of special concern, state threatened, state endangered and federally listed species present.

Table 7.9: Natural Heritage Database Plant Species in Highland Park

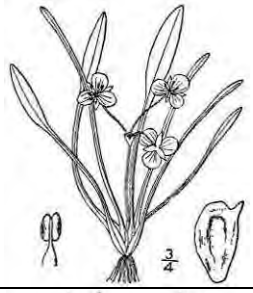
Scientific Name	Common Name	Federal Status	State Status	Regional Status	Global Rank	State Rank	Last Observed
Bidens bidentoides	Estuary burr-marigold			HL	G3G4	S2	1918
Description: Annual plants are 4-36" height; leaves are narrowly oval, sharp pointed, serrated; $^1/_4$" yellowish flowers bloom in summer to fall; Aster family (Asteraceae); usually occurs in borders of streams and estuaries. Also known as Southern Estuarine beggar-ticks or Delmarva beggar-ticks.							



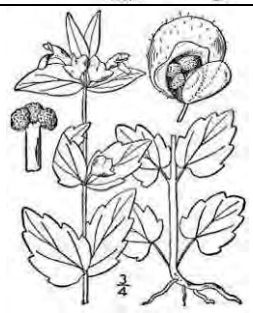
Scientific Name	Common Name	Federal Status	State Status	Regional Status	Global Rank	State Rank	Last Observed
Micranthemum micranthemoides	Nuttall's mudwort		E	LP, HL	GH	SH	1918
Description: This aquatic plant grows to 12" height, leaves are small. It may be extirpated in the wild, but is used in the aquarium trade. Figwort family (Scrophulariaceae), obligate wetland species. Also known as Nuttall's mudflower.							

Scientific Name	Common Name	Federal Status	State Status	Regional Status	Global Rank	State Rank	Last Observed
Sagittaria calycina var. spongiosa	Tidal arrowhead			HL	G5T4	S3	198?
Description: Annual herbs, often stranded by low tide in brackish to freshwater tidal mud flats and salt marshes; leaves emerge from water, broad-rounded with narrow base, or rarely arrow shaped; flowers in whorl of 1-4 in summer to fall. Water plantain family (Alismataceae) , obligate wetland species.							

Scientific Name	Common Name	Federal Status	State Status	Regional Status	Global Rank	State Rank	Last Observed
Sagittaria subulata	Awl-leaf arrowhead			HL	G4	S2	1918
Description: Perennial herb of tidal muds exposed during low tides, to 16" height, long narrow leaves submersed or, rarely, floating, 1/4 to 1/2" flowers in racemes of 2-7, floating, in summer to fall; Water plantain family (Alismataceae), obligate wetland species.							



Scientific Name	Common Name	Federal Status	State Status	Regional Status	Global Rank	State Rank	Last Observed
Scutellaria nervosa	Veined skullcap			HL	G5	S2	1916
Description: Plants are 6-24" height; leaves oval or round, toothed, rounded at base; $^1/_4$" purplish flowers solitary in axils, irregular petals, blooms in spring-summer; Mint family (Lamiaceae).							



Note: For status and rank definitions, refer to **Table 7.6.**

Sources: NJDEP ONLM, October 2010; illustrations from USDA-NRCS PLANTS Database / Britton and Brown, 1913; descriptions from Clemants & Gracie, 2006, Millar, 2011 and Flora of North America, 2008.

Figure 7f illustrates the Landscape Project Version 2.1. Highland Park contains areas of Rank 2 forest, forested wetlands and emergent wetlands habitats, for the presence of priority species, but the borough does not have any Rank 3, 4 or 5 habitats.

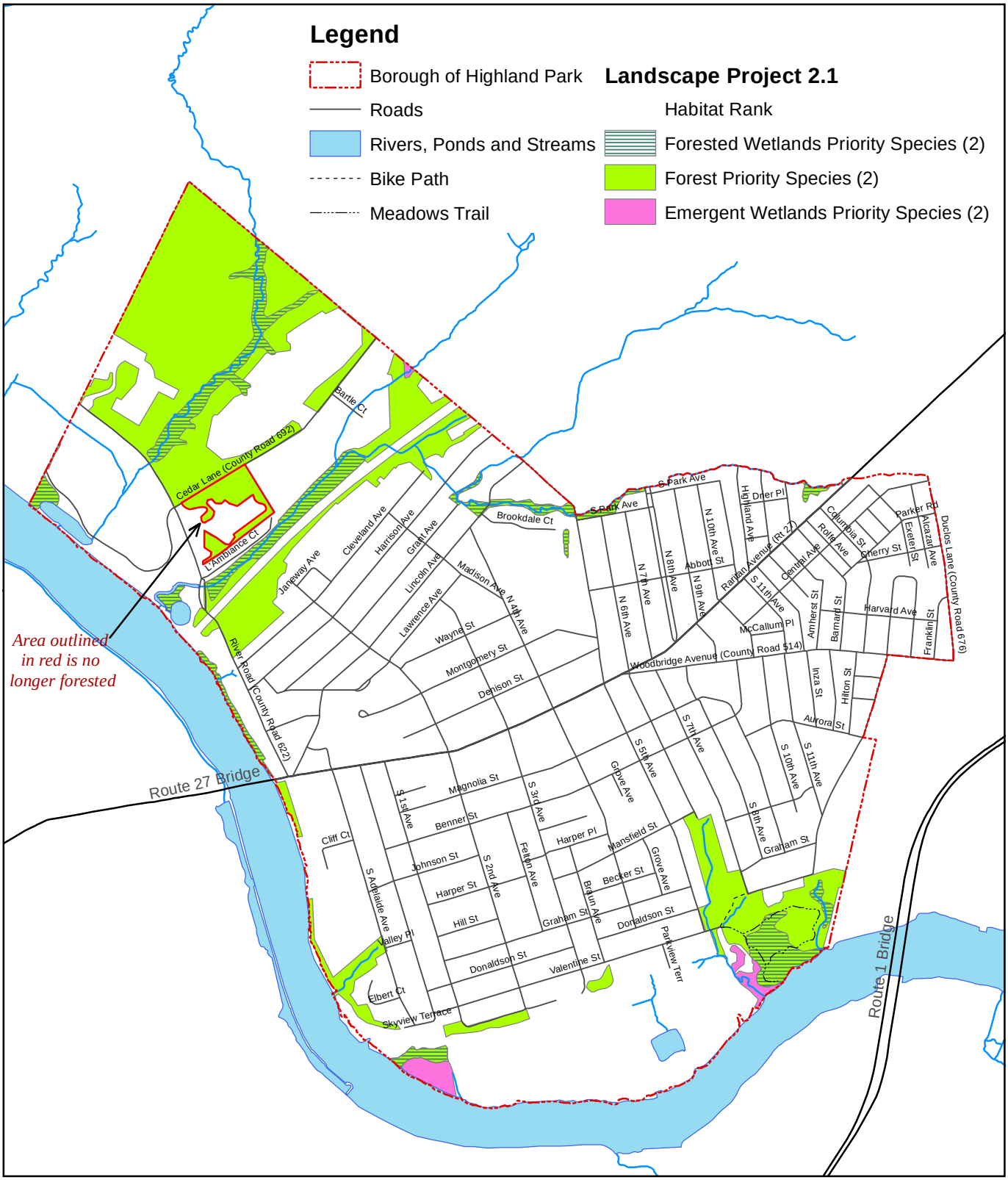


Figure 7f: Landscape Project version 2.1 (July 2008)

A species-based patch approach to rare and imperiled wildlife habitat mapping.

N
W E
S

0 0.125 0.25 0.5 Miles
0 500 1,000 2,000 Feet

Borough of Highland Park ERI 2012
Prepared by Kratzer Environmental Services

Data Sources: See Appendix B.
Note: Map accuracy is limited to the accuracy and scale of the original data sets; see Appendix B.
Disclaimer: This map was developed using NJDEP GIS digital data, but this secondary product has not been verified by NJDEP and is not NJDEP authorized.

Table 7.10: Landscape Project Habitat Rank Definitions

Rank	Definition
1	**Suitable Habitat** – Rank 1 is assigned to patches that meet habitat-specific suitability requirements such as minimum size criteria for endangered, threatened or priority wildlife species, but that do not intersect with any confirmed occurrences of such species.
2	**Special Concern** – Rank 2 is assigned to patches containing one or more occurrences of species considered to be species of special concern
3	**State Threatened** – Rank 3 is assigned to patches containing one or more occurrences of State threatened species.
4	**State Endangered** – Rank 4 is assigned to patches with one or more occurrences of State endangered species.
5	**Federally Listed** – Rank 5 is assigned to patches containing one or more occurrences of wildlife listed as endangered and threatened pursuant to the Federal Endangered Species Act of 1973.
Sources: Niles et al, 2008	

Natural Heritage Grid and Priority Sites

The NJDEP Office of Natural Lands Management (ONLM) has developed the *Natural Heritage Grid Map* (see **Figure 7g**), which provides a general representation of the locations of rare plant species and natural communities, including both historically and recently documented habitat. The purpose of the Grid Map is to document rare plant species and natural community habitats to inform decision-makers who need to address the conservation of natural resources. The species found (or historically found) in the grids are listed in **Table 7.11**. The map identifies potentially sensitive areas, and indicates where custom database searches are needed for land use decision-making. The Grid Map does not include habitat for animal species, and not all areas have been surveyed (NJDEP ONLM, November 2009).

Table 7.11: Natural Heritage Grid Descriptions

Grid Id.*	Precision*	Species Name	Habitat	State Rank◈
12080	M	Estuary burr-marigold *(Bidens bidentoides)*	Estuarine; Palustrine	S2
	M	Nuttal's mudwort *(Micranthemum micranthemoides)*	Estuarine; Palustrine	SH
12081	M	Narrow-leaf Fireweed *(Epilobium angustifolium ssp. circumvagum)*	Palustrine; Terrestrial	SH
12082	M	Narrow-leaf Fireweed *(Epilobium angustifolium ssp. circumvagum)*	Palustrine; Terrestrial	SH
12250	M	Estuary burr-marigold *(Bidens bidentoides)*	Estuarine; Palustrine	S2
	M	Nuttal's mudwort *(Micranthemum micranthemoides)*	Estuarine; Palustrine	SH
	S	Tidal arrowhead *(Sagittaria calycina var. spongiosa)*	Palustrine	S3
	M	Awl-leaf arrowhead *(Sagittaria subulata)*	Estuarine; Palustrine	S2
12420	M	Estuary burr-marigold *(Bidens bidentoides)*	Estuarine; Palustrine	S2
	M	Nuttal's mudwort *(Micranthemum micranthemoides)*	Estuarine; Palustrine	SH
	M	Awl-leaf arrowhead *(Sagittaria subulata)*	Estuarine; Palustrine	S2
	M	Veined skullcap *(Scutellaria nervosa)*	Terrestrial	S2
12421	M	Veined skullcap *(Scutellaria nervosa)*	Terrestrial	S2
12591	M	Veined skullcap *(Scutellaria nervosa)*	Terrestrial	S2

Notes:
*Grid Id. corresponds to grid numbers on **Figure 7g**.
*Precision: **M**=Documented location known within 1.5 miles; **S**=Documented location known precisely
◈For state rank definitions, refer to **Table 7.3**. For more descriptions and illustrations of the species, see **Table 7.6**.

Source: NJDEP ONLM, November 2009

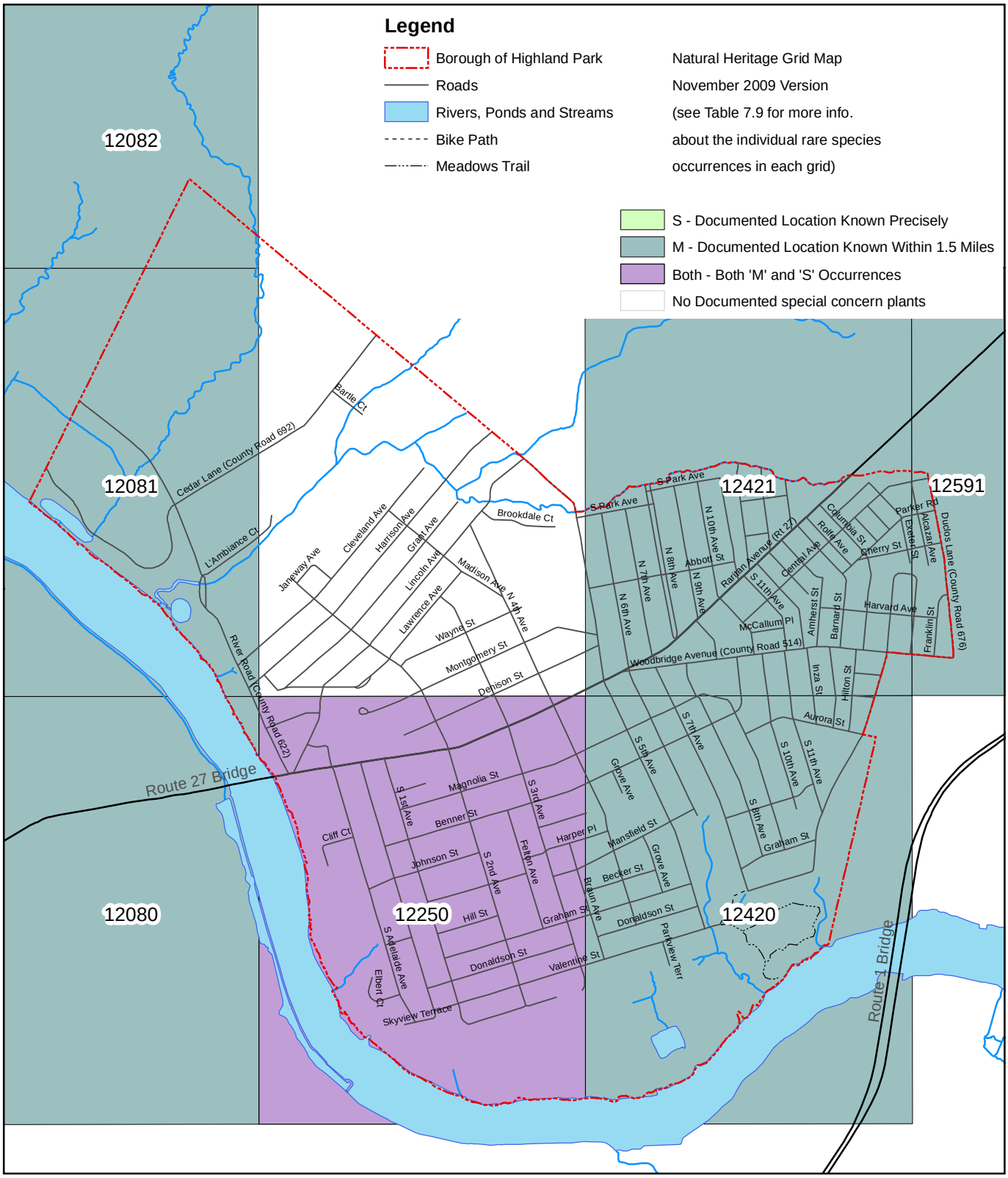


Figure 7g: Natural Heritage Grid

Generalized locations of rare plant species and ecological communities (Nov. 2009)

Borough of Highland Park ERI 2012

Prepared by Kratzer Environmental Services

Data Sources: See Appendix B.
Note: Map accuracy is limited to the accuracy and scale of the original data sets; see Appendix B.
Disclaimer: This map was developed using NJDEP GIS digital data, but this secondary product has not been verified by NJDEP and is not NJDEP authorized.

Natural Heritage Priority Sites have been identified by the ONLM as areas critically important for preservation of New Jersey's biological diversity. These are considered some of the best and most viable occurrences of endangered and threatened plant species and natural communities, but other occurrences of endangered and threatened plant species may exist. There are no Natural Heritage Priority Sites in Highland Park (NJDEP ONLM, 2007).

G. Invasive Nonindigenous and Problem Species

Nonindigenous species (also called alien, exotic or introduced species) are those species that have been introduced outside their natural geographic range as a result of human actions, whether intentionally (e.g. as sources of food, for landscaping purposes or the release of unwanted pets) or unintentionally (e.g. in the ballast of a ship or in a load of lumber). *Invasive nonindigenous species* are those non-native species that rapidly and aggressively invade natural plant communities. The most problematic of these displace native species, contribute to local elimination of species or even extinctions, alter the community structure, and may eventually disrupt ecosystem processes (Snyder et al, 2004). Preliminary research in NJ has documented over 1,200 species of nonindigenous plant species, or as much as 62% of the state's total vascular flora (Snyder et al, 2004).

Native plants can be susceptible to introduced diseases, which they have not evolved resistance to. The chestnut blight fungus was an accidental introduction that destroyed all mature chestnut trees, once one of the dominant trees in the New Jersey landscape. Another introduced fungus, Dutch elm disease, destroyed the American elm.

In addition, native plants may have little resistance to certain introduced insects, and/or these insects may have no natural enemies in their new surroundings, allowing them to rapidly reach pest proportions. Introduced insects, which may be impacting the Highland Park's trees, include the hemlock wooly adelgid and gypsy moth (NJ Forest Service, 2010). They weaken their host trees, which often succumb to successive years of infestation, to diseases carried by the insect pests, such as bacterial leaf scorch, or other environmental stresses.

For these reasons, the Final Report of the New Jersey Comparative Risk Project, which evaluated the relative risks of environmental problems to the people and ecosystems of New Jersey identified invasive species (including plants, insects, and other organisms) as one of the state's top environmental problems (Steering Committee of the New Jersey Comparative Risk Project, 2003).

Some of the most problematic invasive exotic species in Highland Park include phragmites, mugwort, barberry, stiltgrass, autumn olive and multiflora rose. While there is no official invasive species list for New Jersey, An Overview of Nonidigenous Plant Species in New Jersey (Snyder et al, 2004) profiles 27 nonindigenous plant species that aggressively invade natural plant communities in New Jersey, which are summarized in **Table 7.12**.

Phragmites in Donaldson Park

Phragmites australis

A familiar species in Highland Park, the common reed (*Phragmites australis)*, is often included in lists of invasive nonindigenous plant species. Evidence, (including phragmites remains found in 3,000-year-old peat cores from Connecticut and early botanical literature reporting the species' abundance) proves it to be a native North American

species (Snyder et al, 2004). Genetic studies, however, have identified nonindigenous strains of the plant, one of which is highly competitive and invasive. It is this strain that is aggressively expanding its range and spreading to habitats not previously occupied by the species (Snyder et al, 2004).

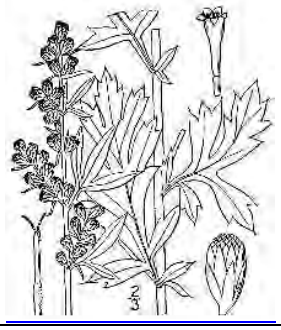
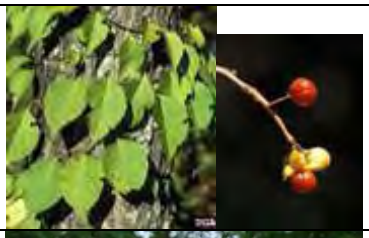
Common reed forms dense stands, excluding other plants including the native phragmites subspecies, alters wetland hydrology, increases the potential for fire and reduces and degrades wildlife habitat, such as suitability of wetlands for marsh-nesting birds (Swearingen et al, 2002; NJDEP, January 23, 2008). However, Richard Kane of NJ Audubon indicates that the prejudice against phragmites is unjustified, since research shows that phragmites is used by many bird species, including endangered, threatened and special concern birds, for nesting, roosting, windbreak, cover and forage areas (Kane, 2001).

Wild Grape

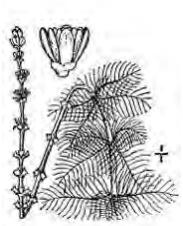
The wild grape (this common name encompasses several species, including fox grape *Vitis labrusca*; summer grape, *Vitis aestivalis*; riverbank grape, *Vitis riparia*; and frost grape, *Vitis vulpina*), while native to the area, has become a threat to the small number of forests (shown in **Figure 7b**) in the Borough and trees growing on the boundaries of lots. This non-invasive vine eventually covers the tree canopy with its own leaves and prevents the trees' leaves from receiving light, ultimately killing the tree. Additionally, during the winter the branches of the vines catch sufficient snow to frequently cause the underlying tree branches to break, thus stressing or killing the trees. The wild grape is a problem in the Meadows, Buck Woods, forest areas of Donaldson and Johnson Parks and the Rutgers Ecological Preserve (Highland Park Environmental Commission, 2011).

Table 7.12: Invasive Nonindigenous Plants

Scientific Name	Common Name	Problems Caused	Illustration	Illus. Source
Acer platanoides	Norway maple	Dispersed seeds easily sprout in shade, crowding out native plants. Canopy produces deep shade and roots produce a toxic substance preventing growth of wildflowers and other trees under its canopy.		Jan Samanek, State Phytosanitary Administration, Bugwood.org
Ailanthus altissima	tree of heaven	Aggressive in disturbed areas, crowding out native plants.		Britton and Brown, 1913, Vol. 2: 446.
Alliaria petiolata	garlic mustard	Aggressive in shady habitats, crowding out native plants.		Deborah J. Kratzer

Scientific Name	Common Name	Problems Caused	Illustration	Illus. Source
Artemisia vulgaris	Mugwort or common wormwood			Britton & Brown
Berberis thunbergii	Japanese barberry	Can grow so thick in the understory of open forests that it shades out indigenous understory plants. Affects soil properties, particularly pH, which can affect plant establishment. Can form nearly impenetrable thorny thickets that impact the recreational value of natural lands.		Deborah J. Kratzer
Celastrus orbiculatus	Oriental bittersweet	The vine twines around surrounding plants, impeding sap flow. Also makes host plants too heavy, increasing wind, snow & ice damage.		James H. Miller, USDA Forest Service, Bugwood.org
Cirsium arvense	Canada thistle	Competes with crops and degrades pastures (inedible to livestock).		Deborah J. Kratzer
Dipsacus fullonum	wild teasel	Highway mowing equipment and discarded dried teasel heads from flower arrangements can lead to the establishment of new colonies, often forming a monoculture that displaces native communities.		Steve Dewey, Utah State University, Bugwood.org
Elaeagnus umbellate	autumn olive	Sprouts vigorously in disturbed areas, produces shade, preventing sprouting of native trees.		Deborah J. Kratzer

Scientific Name	Common Name	Problems Caused	Illustration	Illus. Source
Euonymus alatus	burning bush	Grows well in many sites, especially upland forests and pastures, crowding out native plants.		James H. Miller, USDA Forest Service, Bugwood.org
Hedera helix	English ivy	Grows vigorously in deep shade, inhibiting growth of native woodland plants. Vines up tree trunks, adding to weight, and increasing likelihood of wind damage.		Deborah J. Kratzer
Ligustrum vulgare	common privet	Crowds out more desirable native plants.		USDA PLANTS Database, Bugwood.org
Lonicera japonica Thunberg	Japanese honey-suckle	Spreads aggressively in disturbed habitats, crowding out native plants. Aggressive roots can decrease the growth of native trees and vines. Vines engulf small trees and shrubs, causing them to collapse. Leafs out very early in spring, which could inhibit flowering by spring ephemerals.		Chuck Bargeron, University of Georgia, Bugwood.org
Lythrum salicaria	purple loosestrife	Spreads aggressively in wetlands, eliminating open water habitats and crowding out native plants. Contributes to the loss of wildlife that depend on native wetland plants.		John D. Byrd, Mississippi State University, Bugwood.org
Microstegium vimenium	Japanese stiltgrass	Spreads aggressively in disturbed, moist, shady areas, crowding out native plants. May raise pH and reduce organic soil horizon.		Deborah J. Kratzer

Scientific Name	Common Name	Problems Caused	Illustration	Illus. Source
Myriophyllum spicatum L.	Eurasian water-milfoil	An aquatic plant that begins growing earlier in spring than most indigenous aquatic plants, it quickly overtops, outshades, and outcompetes surrounding vegetation.		Britton and Brown, 1913, Vol. 2: 614.
Miscanthus sinensis	Chinese silver grass	Escapes from ornamental plantings and can form large clumps along disturbed areas, crowding out native vegetation. It is also extremely flammable and increases fire risks where it grows.		James H. Miller, USDA Forest Service, Bugwood.org
Phyllostachys aurea	Golden bamboo	Forms dense monocultural thickets that crowd out other plants. Difficult to eradicate once established.		Chuck Bargeron, Univ. of Georgia, Bugwood.org
Polygonum cuspidatum	Japanese knotweed	Spreads aggressively in disturbed, sunny areas, especially river banks and wetlands, crowding out native plants.		Tom Heutte, USDA Forest Service, Bugwood.org
Potamogeton crispus L.	curly leaf pondweed	An aquatic plant that begins growing earlier in spring than most indigenous aquatic plants, it quickly overtops, outshades, and outcompetes surrounding vegetation. Can form dense mats that disrupt boating, swimming, and fishing.		Mohlenbrock , 1995
Rosa multiflora	multiflora rose	Spreads everywhere, except standing water, crowding out native plants and degrading pastures.		James H. Miller, USDA Forest Service, Bugwood.org

Scientific Name	Common Name	Problems Caused	Illustration	Illus. Source
Rubus phoenicolasius	wineberry	Forms an extensive, nearly impenetrable understory layer in favorable locations such as moist soils in forests over dolomite, marble, shale, diabase, and traprock, crowding out native plants.		Jil M. Swearingen, USDI National Park Service, Bugwood.org
Viburnum plicatum	Japanese viburnum	Shade tolerant shrub considered highly threatening to native plant communities.		Richard Webb, Self-employed horticulturist, Bugwood.org
Vinca minor	periwinkle	Spreads in shady forests, crowding out native plants.		Jil M. Swearingen, USDI National Park Service, Bugwood.org
Wisteria floribunda and W. sinensis	Japanese and Chinese Wisteria	Aggressive climbing vines that girdle tree trunks and branches. Dense canopies weigh down branches and shade underlying areas.		Ted Bodner at USDA-NRCS PLANTS Database
Sources: Snyder & Sylvan, 2004; Swearagain et al., 2002; Courtney, 1997; Center for Invasive Species and Ecosystem Health (bugwood.org), 2010; Britton and Brown, 1913; Mohlenbrock , 1995; Ted Bodner at USDA-NRCS PLANTS Database				

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- New Jersey Audubon Society: http://www.njaudubon.org/SectionBackyardHabitat/Welcome.aspx
- NJDEP Outdoor Classroom links: http://www.state.nj.us/dep/seeds/syhart/outclass.htm
- USDA Natural Resources Conservation Service: http://www.nrcs.usda.gov/feature/backyard/

Cornel Lab of Ornithology, All About Birds: http://www.birds.cornell.edu/AllAboutBirds/BirdGuide/

Highland Park Environmental Commission: http://www.leoraw.com/hpenv/

Native Plants:

- Bowman's Hill Wildflower Preserve: http://www.bhwp.org
- Native Plant Society of NJ: http://www.npsnj.org/
- USDA Plants Database: http://plants.usda.gov

NJDEP:

- Checklists for birds, mammals, reptiles and amphibians of NJ: http://www.state.nj.us/dep/fgw/chklists.htm
- Conserve Wildlife Foundation of New Jersey: http://www.conservewildlifenj.org/
- Division of Fish and Wildlife Home Page: http://www.njfishandwildlife.com/wildlife.htm
- Environmental Rules: http://www.nj.gov/dep/rules/nj_env_law.html
- Endangered and Nongame Species Program Home Page: http://www.state.nj.us/dep/fgw/ensphome.htm
- NJ Wildlife Action Plan: http://www.state.nj.us/dep/fgw/ensp/wap/wap_outline.htm
- Rare Plants & Communities: http://www.state.nj.us/dep/parksandforests/natural/index.html

Rare Wildlife Sighting Form: http://www.njfishandwildlife.com/ensp/rprtform.htm

Rare Plant Report Form: http://www.state.nj.us/dep/parksandforests/natural/heritage/natherrareplantspeciesreportform1_2008.doc

Invasive Species

Invasive Species – New Jersey: http://www.invasivespeciesinfo.gov/unitedstates/nj.shtml

Native Plant Society of New Jersey – Invasive Species: http://www.npsnj.org/invasive_species_0103.htm

New Jersey Invasive Species Strike Team (NJISST): http://www.njisst.org/

8: OPEN SPACE & RECREATION

A. Introduction

Open space can be defined in several ways and its scope and scale varies depending on its setting. For the purposes of this report the Environmental Commission defines open space as land that is valued for its ecological functions and for the ecosystem benefits and services it provides to the community.

Stream in Rutgers Ecological Preserve

Open space can include sites that are valued for aesthetic or historic significance, or for the ways in which they shape the character and quality of a community and its sustainability. Open space may be land that is protected or unprotected, public or private. Such lands typically include forested areas, parks, stream and river corridors, and other undeveloped sites. But within the setting of an urban community such as Highland Park, small areas that might not be considered open space in a rural setting become significant simply because there is much less land that is typically characterized as open space.

Examples of such areas include fringe areas around public and private buildings, transportation corridors, easements and right-of-ways, and other undeveloped sites. While the scale at which these small areas function ecologically is proportionately lower, in an urban setting they provide significant ecosystem benefits both individually and collectively.

EXAMPLES OF ECOSYSTEM BENEFITS AND SERVICES:

- Conservation of natural, scenic, or historic resources/values
- Stream and water supply protection
- Passive recreation opportunities
- Plant pollination and seed dispersal
- Climate stabilization
- Water and air cleansing
- Moderation of weather extremes and their impacts
- Drought and flood mitigation
- Protection from harmful ultraviolet radiation
- Nutrient cycling and transport
- Protection of stream and river channels from erosion
- Waste decomposition

B. Preservation Purposes & Funding

The purposes of open space preservation include:

- provide adequate active and passive recreation;
- provide recreational and open space opportunities on an equal and accessible basis for all citizens;
- maintain water quality and groundwater recharge areas;
- protect sensitive environmental features;
- protect historic areas;

- maintain biodiversity;
- minimize erosion or damage from flooding;
- maintain community character (ANJEC, no date).

Funding for open space comes from a variety of sources, including municipal, county, state and federal sources and private land trusts. Private land trusts are non-profit organizations that "can often act faster and be more creative in their real estate transactions than established government agencies" according to Howe (1989). Landowners are able to reap tax benefits through charitable donations to a land trust. Many successful open space purchases combine a number of funding sources and strategies.

The Garden State Preservation Trust Act provides state funds for land acquisition and park development through the Green Acres program.

Private land trusts working to preserve land in central New Jersey include the Trust for Public Land and the New Jersey Natural Lands Trust and The Nature Conservancy. These organizations and the Association of New Jersey Environmental Commissions (ANJEC) are sources for in-depth information concerning open space preservation through various funding, planning, and zoning techniques (see **Internet Resources**).

C. Greenway Establishment & Maintenance

A *greenway* is a corridor of undeveloped land or open space, which protects environmental features, such as a stream corridor, floodplain, forested ridgeline, or animal migration route, but which can also preserve a scenic view and provide recreational opportunities, such as parks or biking/hiking trails. Greenway corridors also have the potential for positive economic impacts, by creating jobs, enhancing property values, expanding local businesses, attracting new businesses, increasing local tax revenues, decreasing local government expenditures, and promoting a local community. The publication Economic Impacts of Protecting Rivers, Trails and Greenway Corridors outlines procedures for analyzing economic impacts of a greenway project, and provides examples. Decision makers can benefit from recognition of potential economic impacts as well as intrinsic values of greenways in support of decisions that enhance the well-being of the community (National Park Service, 1995).

Garden State Greenways is an online planning tool designed for all those involved in conserving open space, farmland, and historic areas in New Jersey. It uses GIS to identify *hubs* **(**larger areas of undeveloped land with important natural resource values) and linear *connectors* between these hubs. The goal of the program is to help coordinate efforts of both private groups and government agencies (NJ Conservation Foundation, 2005).

Local governments often use a variety of planning and zoning techniques for establishing greenways, including creating a greenway map and adopting it as part of the Master Plan, creating a Greenway Overlay District, cluster zoning and Transfer of Development Rights. These strategies can be combined with land preservation, private land trusts, and conservation easements to meet the Borough's open space and recreation goals (Howe, 1989).

Before a greenway is established, issues of maintenance, public access and monitoring of easements must be addressed to ensure long-term success of the project (Howe, 1989).

The Borough and Middlesex County are currently working to implement a continuous greenway along the Raritan riverfront. Highland Park's Master Plan (Orth-Rodgers & Associates, Inc., 2003) recommends that the river and the greenway should be integrated into community planning efforts, and that the Raritan River and greenway should be recognized as an important natural, recreational and educational resource within the Borough.

The proposed Greenway would connect Johnson Park and the Native Plant Reserve/Eugene Young Environmental Education Center to Donaldson Park. The proposed route of the Greenway would be along the MCUA easement adjacent to the Raritan River (see **Figure 2e** in Section 2: Local and Regional Conditions) from Rt. 27 to Ayres Beach then into Donaldson Park via Skyview Terrace, Valentine Street and South 2nd Avenue.

D. Open Space & Recreation in Highland Park

Highland Park's Conservation, Open Space and Recreation Element of the Master Plan (Orth-Rodgers & Associates, Inc., 2003) identifies the various state, county and municipal parks and recreation facilities located within the Borough. In addition, it outlines the Borough's conservation, open space and recreation strategies, recommended actions, and recommendations for acquisition of parks and recreational facilities. Similarly, the 2010 Reexamination of the Master Plan (Schectel Planners, LLC, 2010) updates the inventory and the Borough's open space and recreation objectives.

The Highland Park Environmental Commission's website includes a virtual tour of the open space (see **Internet Resources**, below). In several of the larger open space areas partially or entirely within Highland Park, a variety of active and passive recreation opportunities are available. Some of these are described in the paragraphs below.

An updated inventory of the preserved open space & recreation properties within the Borough is presented in **Table 8** and **Figure 8a**. Using the GIS acreage files a total of approximately 275 acres are preserved or held by municipal or county governments, Rutgers University, or privately owned by with conservation easement. Buck Woods (4.2 acres) is privately owned. Open space is approximately 24% of the borough.

Creation or maintenance of vegetated buffers and open space along river margins can help prevent or reduce erosion and water pollution by slowing and filtering polluted runoff. Approximately 78% of Highland Park's 2.4 miles of Raritan River front is preserved open space or recreation land.

Rutgers Ecological Preserve

Rutgers Ecological Preserve and Natural Teaching Area is a 316 acre natural area, 68 acres of which is within Highland Park. The land was formerly farmed (see 1930 aerial photos in **Figure 1b**) and became a World War II army base, Camp Kilmer. The preserve, now owned by Rutgers, the State University of NJ, was created in 1976 by the Rutgers Board of Governors.

Trees in Rutgers Ecological Preserve

The land includes old growth forest and land in various stages of succession, with miles of scenic hiking trails available for hiking, jogging, mountain biking and dog walking. The preserve is bordered on the north by the Rutgers Livingston Campus.

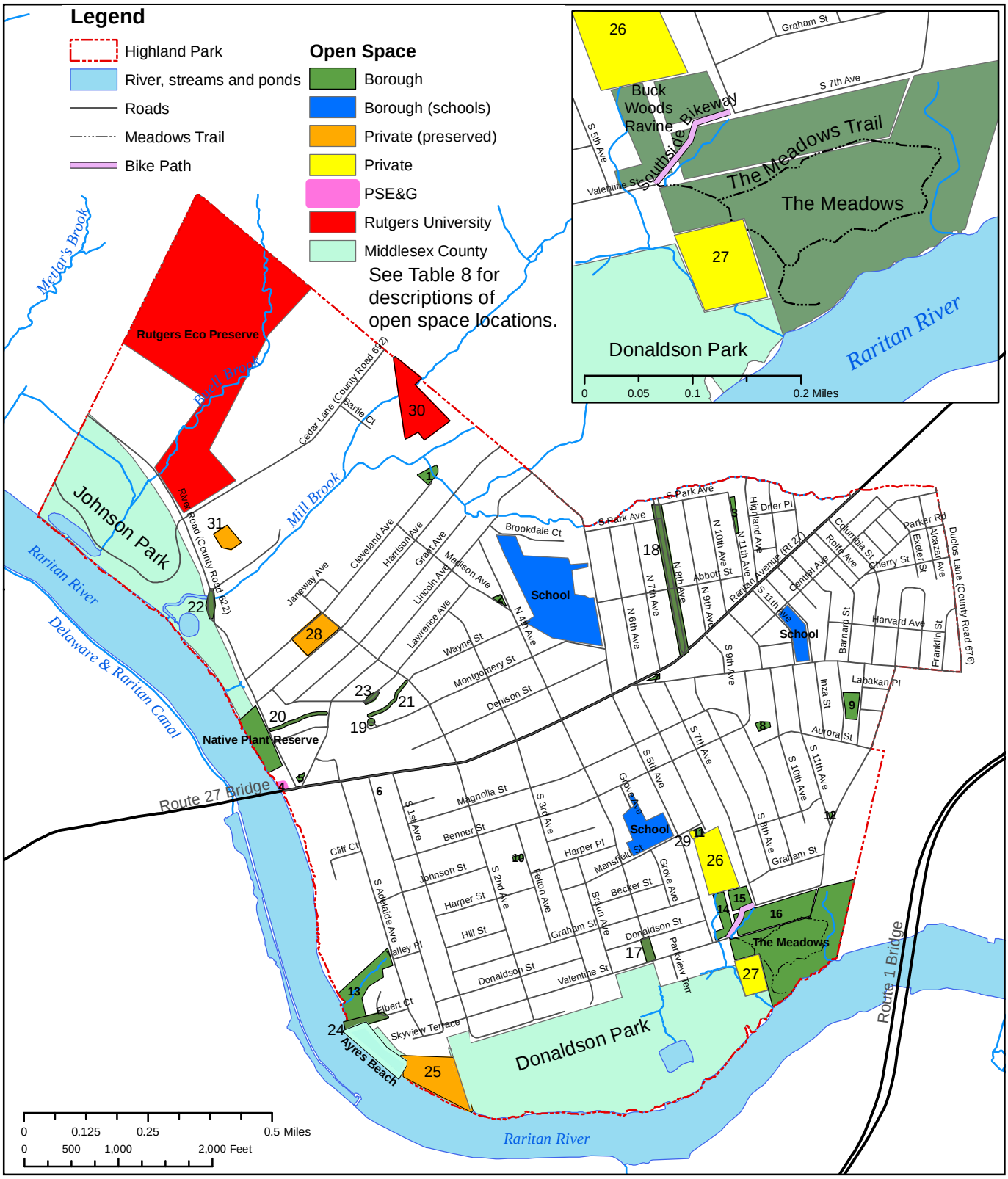

Figure 8a: Open Space

Inset: Bicycle path between Valentine Street and South 7th Avenue and the Meadows Trail

Borough of Highland Park ERI 2012
Prepared by Kratzer Environmental Services

Data Sources: See Appendix B.
Note: Map accuracy is limited to the accuracy and scale of the original data sets; see Appendix B.
Disclaimer: This map was developed using NJDEP GIS digital data, but this secondary product has not been verified by NJDEP and is not NJDEP authorized.

Johnson Park

Johnson Park is a 473 acre Middlesex County Park, about 50 acres of which is within Highland Park (the remainder is in Piscataway Township). This park occupies the land between River Road and the Raritan River. Active recreation resources include 8 tennis courts, one baseball field, two softball fields, one soccer field, three playgrounds, two cricket pitches, and a 2.5 mile bike/walkway. Passive recreation opportunities include 5 reservable picnic groves, two open picnic groves, animal have, three ponds, and East Jersey Olde Towne Village (Middlesex County, 2011; Environmental Commission, 2011).

The pond in the Highland Park section of Johnson Park with new observation decks and spillway

In 2010-2011, the park underwent a major improvement project. The two major ponds were dredged (because of silting). New spillways and observation decks were built for both ponds. The improvements include new bike paths, safety crosswalks, and many new trees and shrubs.

The Native Plant Reserve/Environmental Education Center

The Native Plant Reserve is a Borough-owned three acre parcel along River Road adjoining the southern end of Johnson Park. It was established in 1994 under the Urban Forestry Program and protected as Green Acres open space (Orth-Rodgers & Associates, Inc., 2003).

Eugene Young Environmental Education Center

The reserve is managed by volunteers. Soil improvement and plantings of native flowers, shrubs, vines and trees were made possible by matching grants from the Middlesex County Urban Forestry Advisory Committee (1994) and the Green Communities grant of the NJ Department of Environmental Protection, Division of Parks and Forestry (1997-1998) and cooperative efforts from the municipality and utility agencies (owners of underground pipelines). Informational signs identify the native plants and encourage further use of native plants on private lands. For fitting viable natural spaces into urban settings, the Native Plant Reserve won an Environmental Quality Award from US EPA (Region II) in 2000 (Highland Park Environmental Commission, 2011).

Completed in 2007, the Eugene Young Environmental Education Center was constructed as a focal point to the Raritan River Greenway. The building hosts environmental programs and demonstrates sustainable building concepts; glass walls provide passive-solar energy (and allow

visitors to see into exhibits, even when the building is closed), and a green roof of growing plants (sedums) (Highland Park Environmental Commission, 2011). The benefits of a green roof include absorbing rainwater, providing insulation, creating a habitat for wildlife, and helping to lower urban air temperatures and combat the heat island effect (Wikipedia, April 8, 2011).

Valley Place Ravine and Ayres Beach Natural Area

The municipally owned Valley Place Ravine and the county owned Ayres Beach Natural Area (formerly Red's Marina) encompass approximately 5 acres along the Raritan River. The trail on the property can be accessed from South Adelaide Avenue at Valley Place (illustrated in the 2007 aerial photo below).

Valley Place Ravine, Ayres Beach and Barwood Marsh Area

picnic groves, two playgrounds, a boat ramp, a pond and a dog park. Paths are enjoyed by walkers, joggers and bicyclists (Middlesex County, 2011).

Views of the Raritan River, including the mudflats exposed at low tide, offer opportunities for bird watching (see **Section 7D**). The WCTC radio tower between Donaldson Park and The Meadows is a favorite perch of red-tail hawks, peregrine falcons, turkey and black vultures, and, occasionally, even a bald eagle.

Ayres Beach Area

An area of privately owned land separates the County's Ayres Beach Natural Area and Donaldson Park. Known as the Barwood Marsh, it contains a remnant of natural riverfront woods and represents Highland Park's only sizable freshwater marsh (Highland Park Environmental Commission, 2011).

Donaldson Park

Donaldson Park is a 90 acre Middlesex County park located in the southern end of Highland Park bordered by the Raritan River. Active recreation facilities include four tennis courts (with lights), two basketball courts, three baseball fields, three softball fields, four soccer fields, four reservable picnic groves, two open

Marsh Area at Eastern End of Donaldson Park

A self-guided nature trail connects to The Meadows. Along the stream, plantings of native spicebush[33], blackhaw, and highbush blueberry make a flowery transition between the path and the naturally occurring streamside trees, shrubs and vines. Red maple, sweetspire and cedar have been planted to screen the Department of Public Works fence and parking area. As these native trees and shrubs mature and fill out, the path will become essentially a woodland lane between walls of native greenery and blooms. Metal name tags identify the native plant species and additional educational signs are being added (Highland Park Environmental Commission, 2011).

The Meadows

Beginning of Meadows Loop Trail

The Meadows is the largest municipally owned natural area in Highland Park. Bordered by Edison to the east (downstream), the Raritan River to the south, and Donaldson Park to the west (upstream), its 18 acres include forested areas, open meadow, wetlands, open streams, and important floodplain areas along the Raritan River. It includes the former municipal landfill, the Southside Bikeway, and several paper streets[34] (Valentine, Donaldson, Graham, and South Sixth) (Orth-Rodgers & Associates, Inc., 2003).

An 8 acre portion of The Meadows was used as a borough landfill from 1940 to 1977 and the debris remaining from that use is visible in many locations. But like similar sites in other urbanized areas, The Meadows is now a recovering environment and its ecological functions and value continue to improve. In addition to being a valuable resource for the community in general, The Meadows is also important for native plants and wildlife. Listed as part of a significant habitat complex by the US Fish and Wildlife Service (US Fish and Wildlife Service, 1997), The Meadows boasts a diverse array of wildlife and serves as an important part of the Raritan River migration corridor (Highland Park Environmental Commission, 2011).

Southside Bicycle Path

In 2001, a consultant conducted a biological survey of The Meadows and made recommendations for its restoration (Thonet Associates, 2001). The project included a multi-season survey of existing flora and

[33] Scientific names of the species mentioned: spicebush (*Lindera benzoin*), blackhaw (*Viburnum prunifolium*), and highbush blueberry (*Vaccinium corymbosum*), red maple (*Acer rubrum*), sweetspire (*Itea virginica*), and cedar (*Juniperus virginiana*).

[34] A paper street is a street that appears on maps but does not exist in reality (note the white lines appearing on **Figure 8a**, where no roads exist).

fauna, including threatened, endangered, and rare species, mapping, tagging of selected tree specimens, and specific recommendations. Restoration concepts included locations of small, achievable projects; suggested species to introduce; and areas for removal of invasive exotic species.

The Highland Park Environmental Commission created a loop trail using a National Recreational Trails Grant and is currently involved in projects such as invasive plant removal and trail improvements. In 2011 the lower part of the loop trail has been moved out of the flood plain to higher ground with a spur trail to the river (Highland Park Environmental Commission, 2011; Schectel Planners, 2010).

Centennial Park

Centennial Park was constructed in 2006 at the triangle formed by Raritan Avenue and River Road. This "gateway" park was created in honor of the Borough's 100th anniversary The 0.1 acre site includes a "rain garden" that will allow storm runoff to be held and partly taken up by a field of native plants (Highland Park Environmental Commission, 2011).

Gardens

There are several gardens in the borough associated with Highland Park's school system, which allow students to grow vegetables and to observe plant biology. A garden in Donaldson Park allows many residents of apartment complexes to grow some of their own vegetables. These gardens are shown in **Figure 8b.**

Table 8: Preserved Open Space & Recreation Areas

Map ID*	Block	Lot	Property Location**	Owner	Acres
Ayres Beach	75 4	16-17 2	Ayres Beach (former Red's Marina)	Middlesex County	2.6
Johnson Park	186 186 186 187 187 188	13 14 15 2 3 4-11	Johnson Park	Middlesex County	51.4
Native Plant Reserve/EEC Complex	186	6-12	Native Plant Reserve and Eugene Young Environmental Education Center	Borough (Conservation), Green Acres	3.1
Rutgers Ecological Preserve	189	9	Rutgers Ecological Preserve	Rutgers University (Conservation)	66.0
The Meadows	75	6	The Meadows – Land Below Landfill	Borough (Conservation)	17.0
Donaldson Park	75	11	Donaldson Park	Middlesex County	85.1
Schools			Board of Education (BOE) combined	Borough	20.6
1	192 154	1 5	Property At The Dead End of Cleveland Avenue Overlooking Mill Brook	Borough	0.24
2	149	1	Garden Triangle Madison and North 4th Avenue	Borough	0.1
3	133 133	49 54	North 11th Avenue	Borough	0.1
4	186	16	Rt. 27 Bridge Abutment and Electrical Equipment	PSE&G	0.0
5	183	1	Centennial Park	Borough	0.1
6	8	8	Cedar Avenue	Borough	0.0
7	87	26	Veterans Park	Borough (rented)	0.7

Map ID*	Block	Lot	Property Location**	Owner	Acres
8	61 62 62	25 4 11	Vokert/South 9th Ave.	Borough	0.4
9	71 71 71 71	18 19-28 31 32-41	Molimock Graff Park (formerly Karsey Street Park)	Borough	1.0
10	24	30.01	Tot Lot Between Felton Ave. and South 2nd Ave.	Borough	0.1
11	43	3-5	Municipal Land at Head of Buck Woods	Borough	0.1
12	66	2	Crowell Road and South 11th Ave.	Borough	0.0
13	2 3 3	15 2 39	Valley Place Ravine	Borough, Green Acres	3.9
14	47	76-81	Buck Woods Ravine Block 47 Bikeway Lower Portion	Borough	1.3
15	48	30-33	Block 48 Bikeway Upper Portion	Borough	1.0
16	49	41-56	The Meadows – Plateau of Landfill	Borough	4.7
17			Paper South 4th Ave. (between Donaldson and Valentine)	Borough	0.3
18			North 8th Ave. Median	Borough	1.0
19			Montgomery Circle	Borough	0.0
20			Parkway (Between River Road and Lincoln Ave.)	Borough	0.4
21			Parkway (Between North 2nd Ave. and Montgomery Street)	Borough	0.5
22			River Road Median	Middlesex County	0.1
23			Lawrence Median	Borough	0.1
24			Paper Donaldson	Borough	0.5
25	75	15.02	Barwood Marsh	Private (Conservation)	5.2
26	47	27-75	Buck Woods	Private	4.0
27	75	8	WCTC tower	Private	2.0
28	180	3,4	Livingston House	Private	1.9
29	43	2	South 6th and Mansfield St – Head of Buck Woods	Private	0.1
30	190	11,12	Rutgers Property off Cedar Lane	Rutgers	4.2
31	34	190	Public Park at Overlook at Highland Park (River Road)	Private	0.6
Notes: *Map ID refers to numbers or names on **Figure 8a**. There are no state owned open space properties within Highland Park					
Sources: Middlesex County, 2011; NJDEP Green Acres Program, 2011; Highland Park Environmental Commission, 2011					

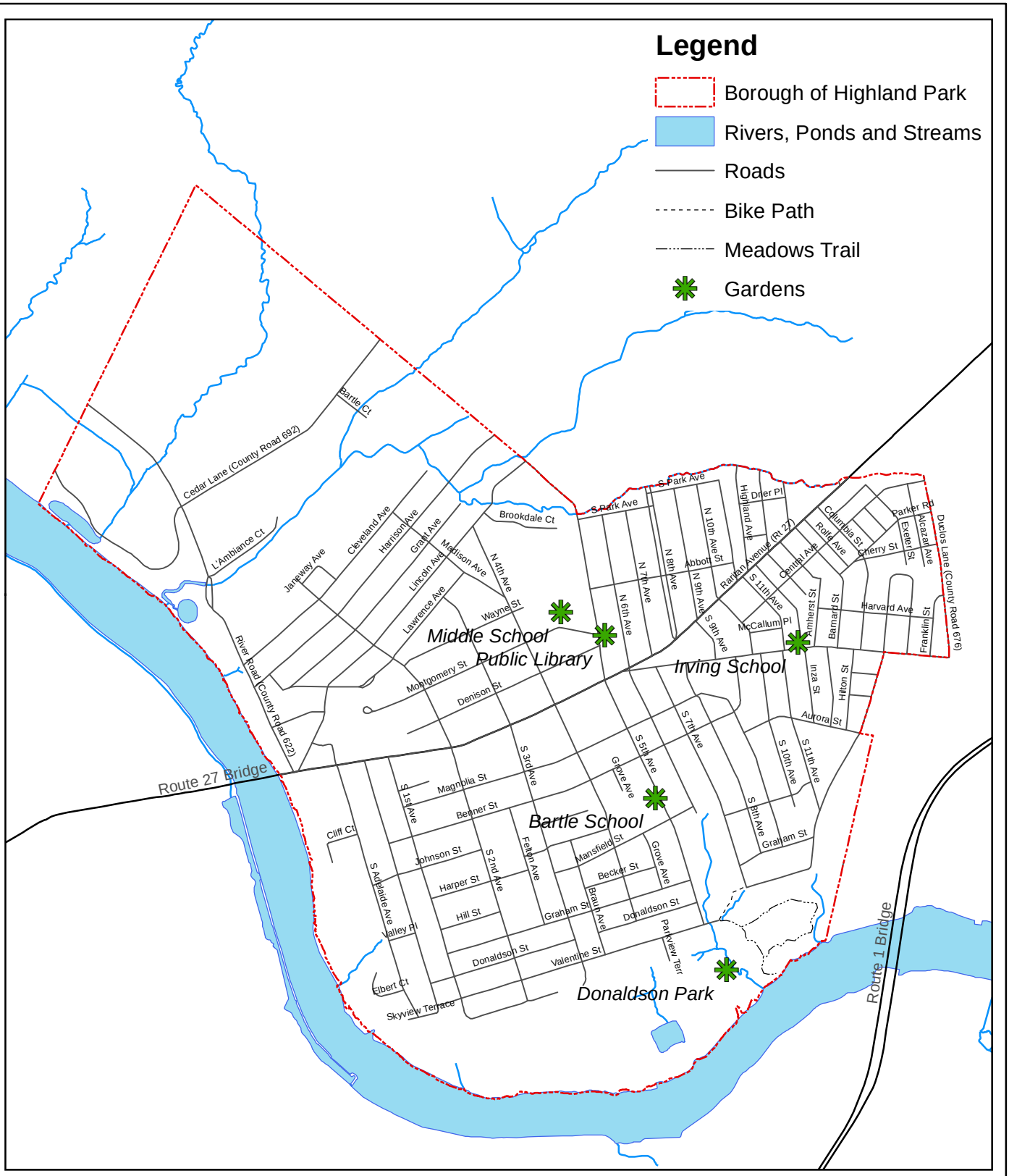

Figure 8b: County and Municipal Gardens

Borough of Highland Park ERI 2012
Prepared by Kratzer Environmental Services

Data Sources: See Appendix B.
Note: Map accuracy is limited to the accuracy and scale of the original data sets; see Appendix B.
Disclaimer: This map was developed using NJDEP GIS digital data, but this secondary product has not been verified by NJDEP and is not NJDEP authorized.

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Wikipedia. April 8, 2011. Green roof.

Internet Resources: Open Space

Garden State Greenways http://www.gardenstategreenways.org

Highland Park Environmental Commission's Virtual Tour: http://www.leoraw.com/hpenv/biod/tour.htm

Native Plant Society of New Jersey: http://www.npsnj.org

NJ Natural Lands Trust: http://www.njnlt.org/

Parks:

- Donaldson Park information: http://www.co.middlesex.nj.us/parksrecreation/donaldson.asp
- Donaldson Park Map: http://www.co.middlesex.nj.us/parksrecreation/Donaldson%20Park%20map.pdf
- Rutgers Ecological Preserve brochure: http://advgeo2008.rutgers.edu/brochure.pdf

Johnson Park information: http://www.co.middlesex.nj.us/parksrecreation/johnson.asp
Johnson Park map: http://www.co.middlesex.nj.us/parksrecreation/Johnson%20Park%20Map.pdf
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Rain Garden Manual: http://www.npsnj.org/rain_garden_home.htm

Rutgers New Jersey Agricultural Experiment Station (NJAES) – information & links for farmers, gardeners, & consumers: http://njaes.rutgers.edu/

The Nature Conservancy:
http://www.nature.org/ourinitiatives/regions/northamerica/unitedstates/newjersey/placesweprotect/index.htm

9: HISTORICAL RESOURCES

A. The History of the Borough of Highland Park[35]

Pre-Colonial Period (12,000 years ago - 1600)

Humans arrived in New Jersey at least 12,000 to 13,000 years ago. This coincides with the end of the last ice age, therefore the climate was much colder, and the landscape consisted of spruce and pine forests. Very little is known about the people of the Paleo-Indian Period (12,000 to 10,000 years ago) and the later Archaic Period (10,000 to 3,000 years ago). The paucity of artifacts suggests a low population density.

The Woodland Period, from 3,000 years ago to the 1600s, is characterized by the appearance of ceramic vessels. Hunting, fishing and seasonal movement to take advantage of seasonally available resources were primary activities, while farming increased in importance. As the Indians became less nomadic, they cleared the forests for village sites and agriculture, and cut wood for fuel, shelters, canoes, tools and other implements. It was also common practice to deliberately set fires for the purpose of driving game and thinning and opening up forests.

In pre-colonial times, the Native Americans of New Jersey were the Lenape Indians, a branch of the Algonquins. At the time the first Europeans arrived in the area, there may have been as few as 2,000 or as many as 12,000 humans living in what is now New Jersey (1.4 persons/mi^2), compared to today's population of 13,982 (7,767 persons/mi^2) now living in the Borough of Highland Park and 8,791,894 (1,008 persons/mi^2) in New Jersey.

1600 - 1700

Since pre-historical times, the geography of the area, particularly the Raritan River, has significantly defined the pattern of colonization and development in the Highland Park area. The location of the ford across the Raritan, which is very shallow at low tide, was a key factor in the development of the area in colonial times. The aptly named Mill Brook provided waterpower for grain mills early in the history of the area and for later industries.

The Lenape had trails throughout the Middlesex County area. The Assunpink Trail, which started in the vicinity of Newark, traveled south and passed through the area which was to became Highland Park, and traveled farther south through the Millstone River Valley, on to Princeton, and ended at the Delaware River. Within Highland Park, the trail traveled south on what is now Woodbridge Avenue, on to Montgomery Street, then to the Madison Avenue, then paralleled the Mill Brook, and forded the Raritan just north of the current railroad bridge.

One of the earliest documented European settlers (1675) in the Highland Park area was Henry Greenland, who owned approximately 300 acres of land along the Raritan near the current railroad bridge and operated an inn/tavern along the Mill Brook section of the Assunpink Trail. It is thought that part of the foundation of the Belleview/Cenacle house is from this inn (see **Table 9.5**).

John Inian bought land on both shores of the Raritan River in 1685 and built landings on both sides of the river (where the current Route 27 bridge is located). He established a ferry service and the previous main road was redirected to lead straight to the ferry landing. This river crossing was run by generations of different owners until a wooden toll bridge replaced the ferry

[35] History of the Borough was adapted from the following sources: Bzdak et al., 1993; The Cultural Resource Consulting Group, 1997; DeAngelo, June 2007; Kolva in Borough of Highland Park website, accessed 9/21/11; Kolva and Pisciotta, 1999; Kolva and Pisciotta, 2005; Highland Park Historical Society website, accessed 9/28/11; Robichaud and Anderson, 1994; Townplan Associates, 1992; US Census, 2010

in 1795. The main route from Newark to Trenton used this ferry, with stagecoaches dropping passengers at the ferry, who crossed the river, and boarded a second stagecoach traveling farther south. It took about five days to travel from Newark to Trenton.

In 1694, the new owner of the Greenland Tavern had dammed the Mill Brook and constructed a mill. This set a pattern of using the Mill Brook for industrial use for the next several hundred years.

By the early 1700s, wealthy European settlers had divided the areas into large farmsteads from the Mill Brook to the brook along the eastern border of the future Highland Park. These farmsteads had narrow frontage on the river and extended up into the hilly sections of the area, thus assuring each farmstead access to the river for water and transportation, while maintaining the upland sections for farmland. This pattern of development continued for the next 150 years.

The Assunpink Trail became the main route of commerce through the area and was continually widened into a major road.

1700 - 1900

During the American Revolution, the area of Highland Park was actively involved. In December of 1776, the British under Lord Cornwallis took the forts situated along the bluffs above the Raritan River opposite New Brunswick and seized the village. The British forces then crossed the Raritan and seized New Brunswick. Outnumbered, General Washington retreated to Trenton.

As many as 6,000 Hessian troops were stationed along the bluffs of the Raritan River. There were many canons in redoubts flanking the main road (now Raritan Avenue) to the north and south. There was an earthwork fort at the location of the old Meyer/YMHA property for the 28th Hessian Regiment. The 35th Hessian regiment had another fort on the bluff between Walter Street and Harrison Avenue. The wooden barns of the village were ripped down to build a temporary bridge across the Raritan River. In June 1777 the British troops evacuated from the New Brunswick area.

While most of the continent east of the Mississippi River was continuous woodlands in colonial times, "By the time New Jersey became a state in 1778, no extensive areas of land well suited to farming remained wooded in the central part of the state" (Robichaud and Anderson, 1994). The remaining forests were frequently and repeatedly cut for cordwood.

The river crossing ferry continued to provide the primary means of crossing the Raritan until a permanent wood plank toll bridge (first Albany Street bridge) replaced the ferry in 1795.

Robert Livingston House
81 Harrison Avenue c.1830
Listed on both the NJ and National Registers of Historic Places (Table 9.3, Item 11)

The bridge was dismantled in 1848 and reconstructed in 1853. The present day stone arch road bridge was built in 1892. It became part of the Lincoln Highway (Route 27) in 1914 and was widened in 1925.

In 1809, the Reverend John H. Livingston, then newly selected head of Queen's College (now Rutgers University), purchased a 150-acre plot of land, which would henceforth be known as the Livingston Manor (see **Figures 9a and 9b**). The area is now bound by Cleveland, Lincoln, Madison Avenue (see **Figure 9f**). Into the early 1800s the development of Highland Park was mostly restricted to the area along the river and up the bluffs.

The Delaware and Raritan Canal and the New Jersey Railroad were constructed in the 1830s. The New Jersey Railroad and Transportation Company built a rail line that terminated on the Highland Park side of the Raritan in 1836. The Camden and Amboy Railroad built a bridge across the Raritan River in 1838. The two-tier, wooden railroad bridge carried pedestrians and wagons on its lower level. It was destroyed by fire in 1878. An iron truss bridge was quickly built upon enlarged stone piers, which in turn was replaced in 1902 by the current 12-span stone arch railway bridge.

Even with the arrival of the canal and the railroad in the 1830s, Highland Park's land remained primarily agricultural. Limited development began in the 1860s with several of South Adelaide Avenue's large homes and more modest houses constructed on Cedar, First, and Second Avenues and somewhat later as on the newly constructed cross streets of Magnolia, Benner, and Johnson. Many of the homes built from this time period still remain. In 1870 Highland Park was annexed to the newly formed Raritan Township (now Edison). The extent of development is shown in **Figure 9a** (1876 map of Highland Park).

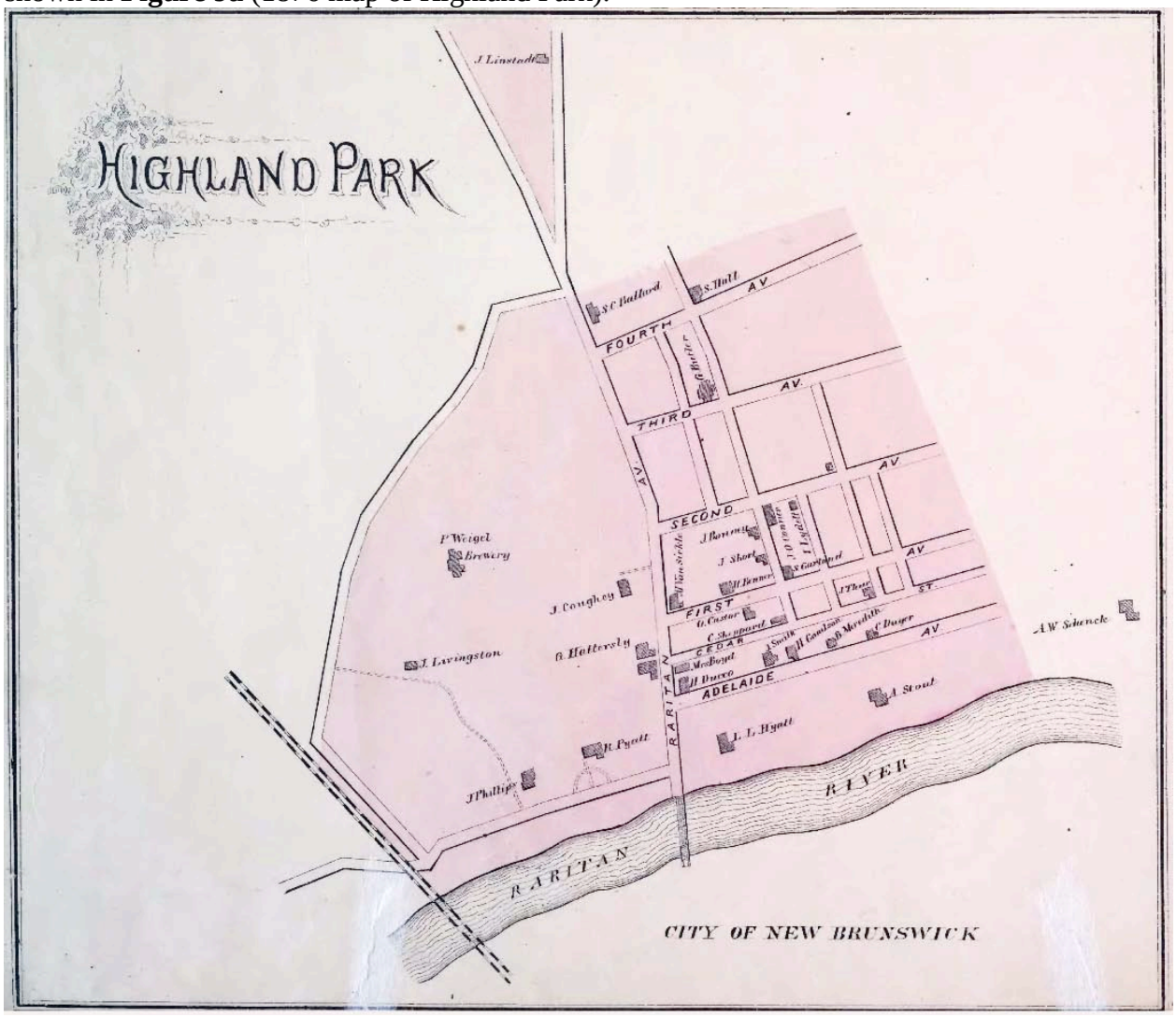


Figure 9a: Historical Map (1876) (source: Everts and Stewart, 1876)

In the 1860s, the hamlet was beginning to attract some industry. In 1867, a brewery was built by one Martin Klein in the area of the Montgomery Street apartments in part because of a small stream, which no longer exists. The stream was used to dispose of the brewery's waste.

By the mid 1880s, the Raritan Township officials had granted the formation of Highland Park's own school district and on March 23, 1886, a one-story Queen Anne style schoolhouse opened at the corner of Benner Street and South Second Avenue. This was a forerunner of Highland Park becoming an independent borough.

The Borough of Highland Park separated from Raritan Township in 1905 and became an independent borough. Important factors contributing to the movement to incorporation were the desire for an independent school system and a related dispute over school taxes. The Fire Department, which had formed in 1899, also wanted more local control over its affairs.

1900 - present

Development of Highland Park into a bedroom community of New Brunswick began at the turn of the 20th century when large farm and estate lands were divided into small parcels and residential lots. Watson Whittlesey initiated the Livingston Manor development in 1906. The Livingston Manor District was added to the U.S. National Registry of Historic Places and the NJ Registry of Historic Places in 2004. There were many other tract developments such as the Viehmann Tract, also on the north side, Riverview Terrace on the south side, and Raritan Park Terrace in the triangle between Raritan and Woodbridge Avenues, and East New Brunswick Heights in the Orchard Heights neighborhood (see **Figure 9b,** 1910 map).

By the mid 1920s, most of Highland Park's land had been sub-divided and its streets mapped (see **Figure 9c,** 1922 map). The population of Highland Park was approximately 500 in 1905 and grew to 4,866 by 1920. Further minor changes to roads have occurred through the years and additional construction of residential homes and apartment buildings combined to create the current largely residential borough (see **Figure 9d,** 1959 map).

Woodbridge & Raritan Avenues,
Doughboy Statue
(Table 9.3, Item 44)

In 1937, Johnson Park, a Middlesex County Park, was developed as a Works Progress Administration (WPA) project. Donaldson Park, was also developed and became a Middlesex County Park in 1946.

The Castle, 433 River Road, c.1930
(Table 9.3, Item 27)

Highland Park's industrial development in the late 19th and 20th centuries has included such businesses as Johnson & Johnson, The John Waldron Machine Company, and the Janeway & Carpenter Wallpaper factory. Commercial zones along both Raritan and Woodbridge Avenues were filled with many small family operated businesses.

At the present time, virtually all of the earlier large industries have moved from Highland Park but the Borough has continued to adapt and change in the late 20th and 21st century.

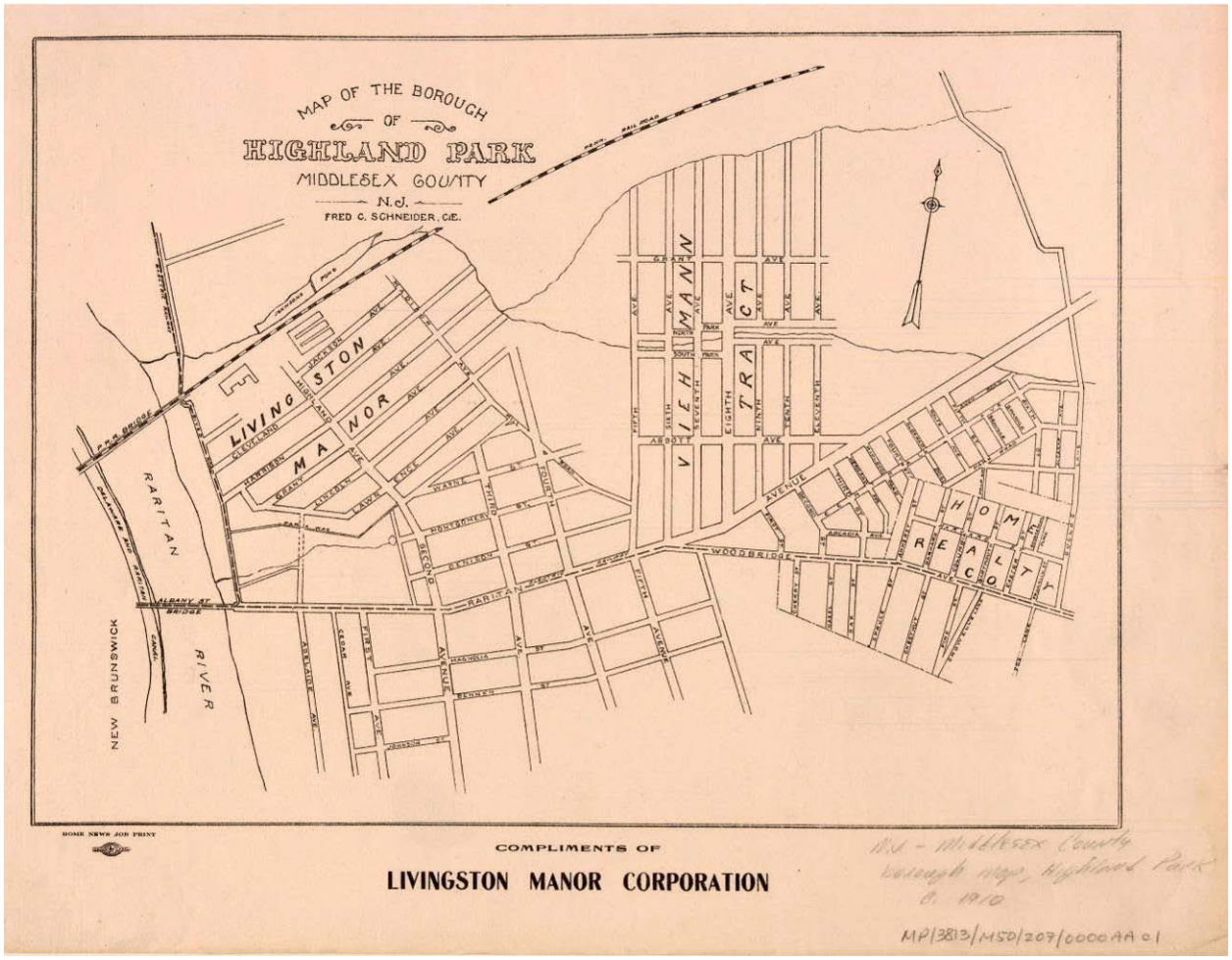


Figure 9b: Historical Map (1910)

(Source: Schneider, Fred C. (surveyor), Livingston Manor Corporation, circa 1910)

235 Lincoln Avenue,
Livingston Manor District
(Table 9.3, Item 7)

310 Grant Avenue,
Livingston Manor District
(Table 9.3, Item 1)

143 Raritan Avenue c.1901
1st firehouse in Highland Park
(Table 9.4, Item 24)

Watson Whittlesey House
35 Harrison Avenue c.1908
(Table 9.3, Item 3)

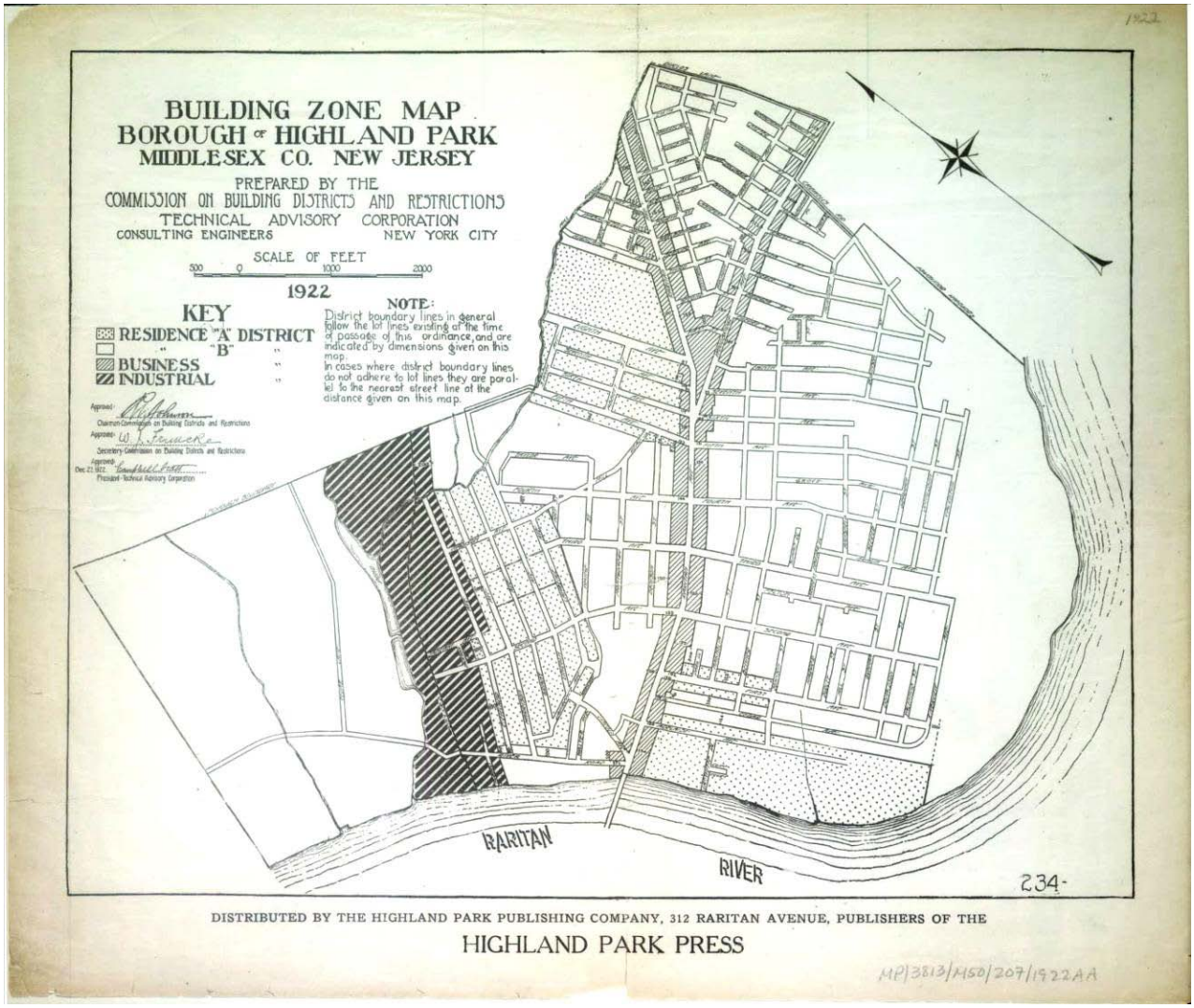


Figure 9c: Historical Map (1922)

(Source: The Commission on Building Districts and Restrictions, 1922)

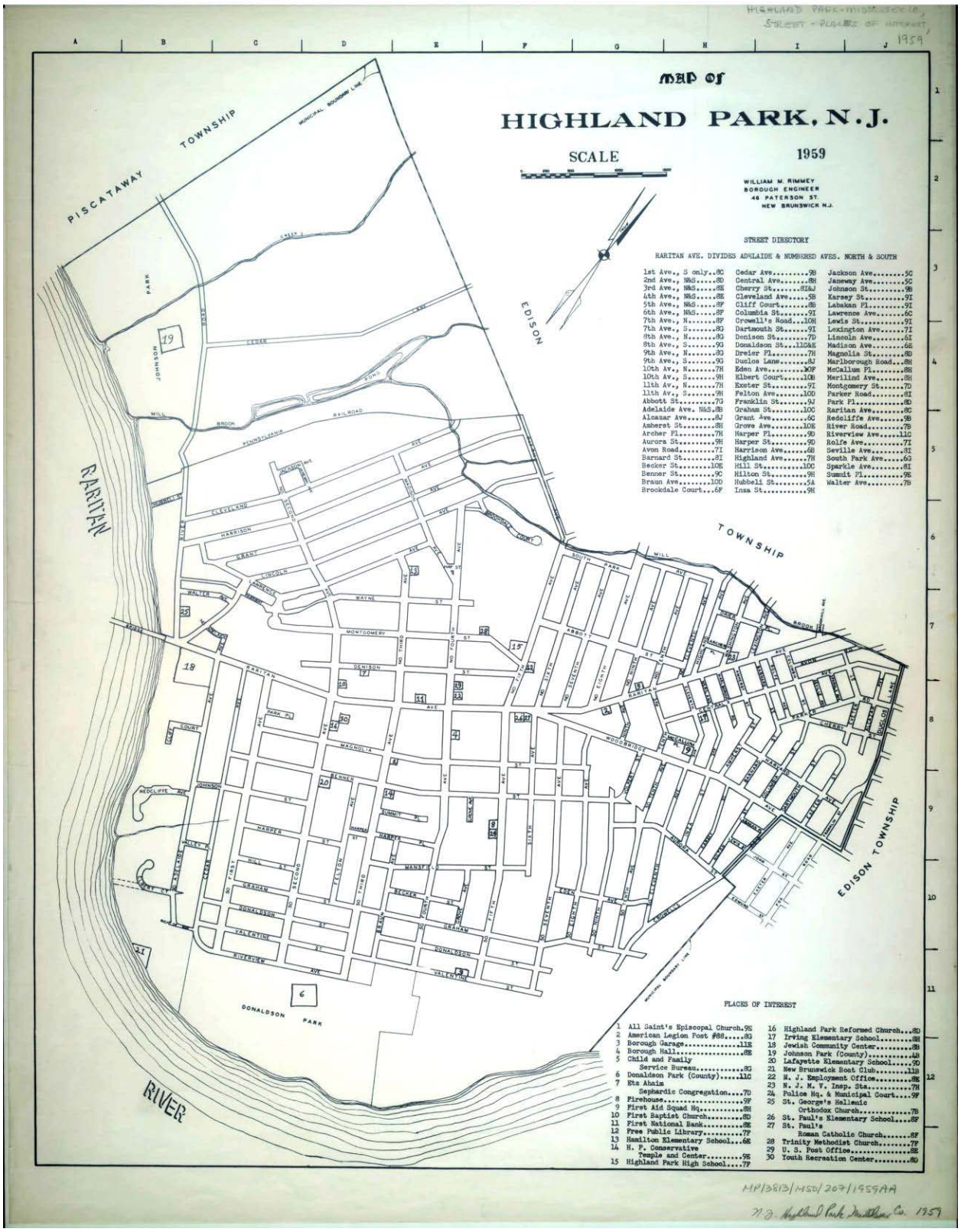


Figure 9d: Historical Map (1959)

(Source: Rimmey, William M. (surveyor), 1959)

B. Historic Preservation

A *Historic site* means any real property, man-made structure, natural object or configuration or any portion or group of the foregoing of historical, archaeological, cultural, scenic or architectural significance. A *Historic District* is one or more historic sites and intervening or surrounding property significantly affecting or affected by the quality and character of the historic site or sites (MLUL, 2002).

Historic preservation is the planned effort to help protect structures, objects and properties of historic importance.

National and State

In 1966, the National Historic Preservation Act created the National Register of Historic Places, which offered the protection of privately owned historic buildings and properties from federal government actions. It established criteria (see **Table 9.1**) for inclusion on the National Register and created a review process for public projects that threatened encroachment or razing of registered properties. It also enabled states to set up similar processes to protect registered properties from municipal, county and state encroachments. New Jersey created its State Register of Historic Places in 1970.

Table 9.1: Criteria for Evaluation for Inclusion in the National Register of Historic Places

The quality of significance in American history, architecture, archeology, engineering, and culture is present in districts, sites, buildings, structures, and objects that possess integrity of location, design, setting, materials, workmanship, feeling, and association, and: A. That are associated with events that have made a significant contribution to the broad patterns of our history; or B. That are associated with the lives of persons significant in our past; or C. That embody the distinctive characteristics of a type, period, or method of construction, or that represent the work of a master, or that possess high artistic values, or that represent a significant and distinguishable entity whose components may lack individual distinction; or D. That have yielded or may be likely to yield, information important in prehistory or history. Note: Properties are usually at least 50 years old to be considered eligible.
Source: National Register of Historic Places, 2011

In addition, the New Jersey Municipal Land Use Law (MLUL) gives municipalities the express authority to zone for the protection of historic resources and to regulate private encroachments on designated historic properties. The MLUL outlines a specific planning process regarding the creation of local historic districts and the review of development activity within the districts (MLUL, 2002).

County

The mission of Middlesex County Cultural and Heritage Commission is to develop county wide programs and promote public interest in local and county history, in the arts, and in the cultural values, goals, traditions of the community, the State and the Nation. The Commission undertakes the restoration, operation, maintenance and preservation of real property acquired by the County. The Commission is authorized to establish museum and cultural programs, exhibits and displays including the fine and performing arts, engage in archaeological, genealogical and historic research, publish reports and engage in such related activities to promote and develop public interest and understanding of historic and cultural matters (Middlesex County Cultural and Heritage Commission, 2011).

Municipal

The Borough of Highland Park has no landmark preservation ordinances.

The Highland Park Historical Society's mission is to promote the maintenance and rehabilitation of Highland Park's historical resources, and to heighten awareness of the Borough's historical and cultural heritage (Highland Park Historical Society, 2011).

C. Historical Inventory

As discussed above in **Section 9A**, the area of Middlesex County now defined as Highland Park has a documented history (with European settlers) going back to 1675, as well as earlier history with the Lenape Indians in pre-colonial times.

One of the first steps of historical preservation is enumeration of an area's history, mapping its sites with archeological or historical potential, and generating a detailed inventory of historical buildings.

The Highland Park Environmental Commission (EC) has commissioned two major studies dealing with the history of Highland Park, which include

- Stage 1a Cultural Resource Reconnaissance Survey, Borough of Highland Park, Middlesex County, New Jersey, Bzdak et al., 1993
- Evaluation of Historical Significance: Livingston Manor, Borough of Highland Park, Middlesex County, New Jersey, The Cultural Resource Consulting Group, 1997

In 1992, the EC commissioned a Natural Resources Inventory (NRI) (with a grant from New Jersey Department of Environmental Protection and Energy, Office of Environmental Services), which also contains an overview of the history of Highland Park and an inventory of buildings and sites of historical interest (Townplan Associates, 1992). The Highland Park Historical Society has produced two books by Kolva and Pisciotta that provide a good review of Highland Park history (Images of America, Highland Park, 1999 and Highland Park, Borough of Homes, 2005).

The information in the current report has been updated and supplemented by the Highland Park Environmental Commission. Photographs of a selection of historical buildings are also included.

Archeological Grid

The NJDEP Historic Preservation Office (HPO) has developed a GIS layer consisting of $^1/_2$ mile grid cells indicating the presence of archaeological sites. It should be noted that other archeological sites may exist that have not yet been identified or documented. Because archaeological sites are particularly sensitive to destruction and vandalism, the grid format protects precise site locations while alerting users of this data to the possible presence of archaeological resources (NJDEP NHR HPO, 2011).

Two grid squares lie partially within Highland Park, encompassing an area near the Raritan River (shown in **Figure 9e**).

Archeological Sites of High Potential

The Stage 1a Cultural Resource Reconnaissance Survey (Bzdak, et al., 1993) study provides a detailed list of sites in Highland Park rated from low potential to high potential for producing historical artifacts. In **Figure 9e** and **Table 9.2** the seven high potential sites are mapped and summarized, respectively.

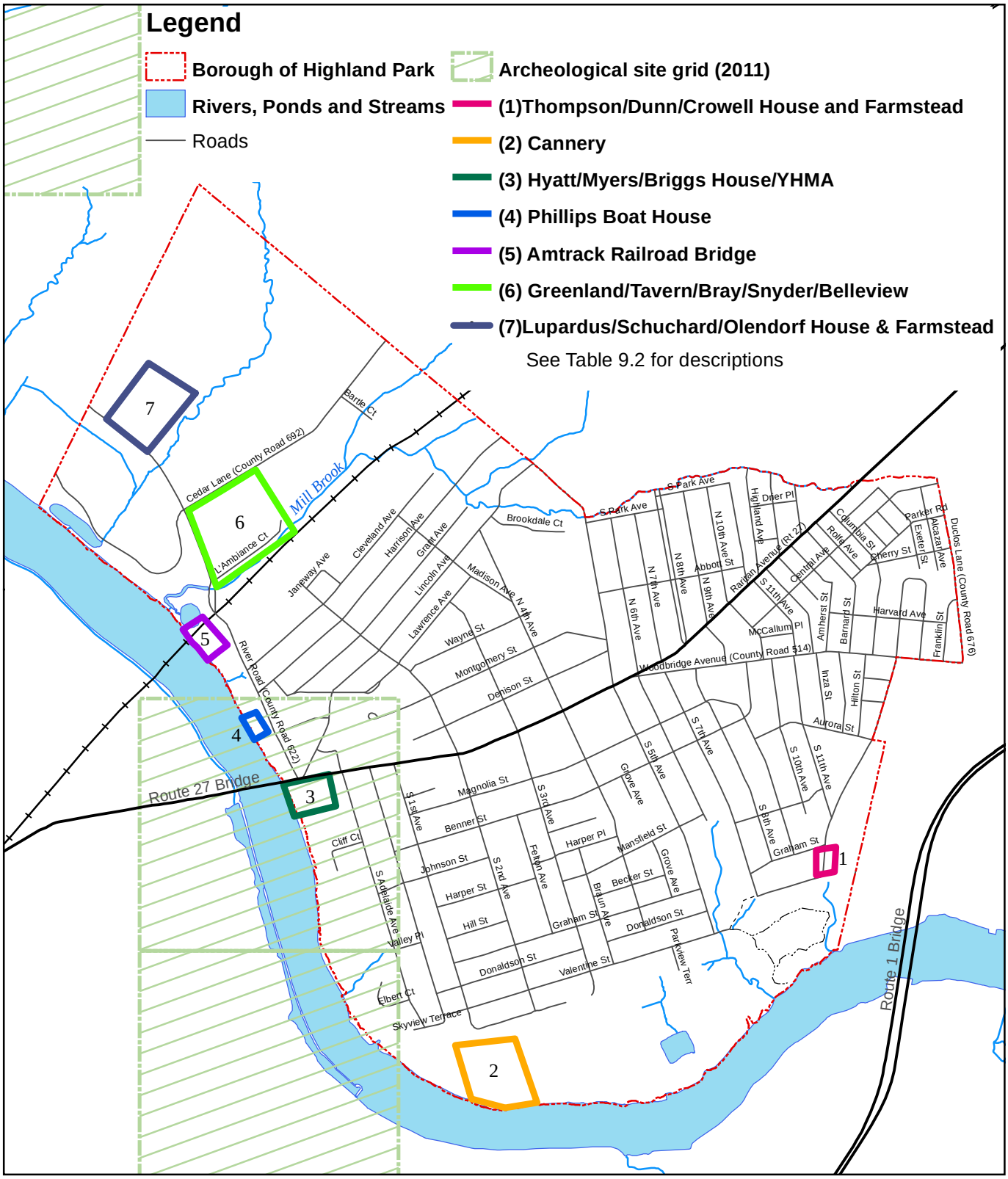


Figure 9e: Archeological Grid and High Potential Archeological Sites

N
W E
S

0 0.125 0.25 0.5 Miles
0 500 1,000 2,000 Feet

Borough of Highland Park ERI 2012
Prepared by Kratzer Environmental Services

Data Sources: See Appendix B.
Note: Map accuracy is limited to the accuracy and scale of the original data sets; see Appendix B.
Disclaimer: This map was developed using NJDEP GIS digital data, but this secondary product has not been verified by NJDEP and is not NJDEP authorized.

Table 9.2: Archeological Sites of High Potential in Highland Park

Item*	Description	Reference**	Location
1	**Thompson/Dunn/Crowell House and Farmstead** – A farmstead that was developed prior to 1745 and had a succession of owners. Most of the area has been covered with apartment buildings.	1207-A41	Crowell Road area
2	**Cannery** – A cannery was built in the late 1860s and was located adjacent to the Raritan River at the west end of Donaldson Park. It was a large three-story building and produced large amount of tin cans: canned corn, pears, raspberries, and squash as well as bottled table oil. The plant was destroyed by fire in 1871.	1207-A3	Donaldson Park
3	In December 1776, Hessian troops built forts on the bluffs along both sides of Raritan River and shelled New Brunswick. The **site of Hyatt/Myers/Briggs House/YMHA** is the only current site that has not been redeveloped and may have artifacts.	See Kolva and Pisciotta, 2005, pages 19-20, in references	South Adelaide Ave
4	**Phillips Boat House –** A boat house along the Raritan River was built prior to 1876. The location is just up river from the Eugene Young Environmental Education Center on River Road in undeveloped area.	1207-A69	River Road
5	**Amtrak Railroad Bridge** – The New Jersey Railroad and Transport Company built tracks to Highland Park in 1836. In 1837, a double-decker wood trestle bridge was built across the Raritan River. In 1878, the bridge was destroyed by fire and was replaced by a temporary bridge two months later. In May 1878, a permanent iron-truss bridge was completed. In 1902, a new stone arch railroad bridge was built across the Raritan. In the 1940s, the stone bridge was covered with cement.	1207-A72	River Road
6	**Greenland House/Tavern/Mercer/Bray/Snyder Mill Property, and Belleview Property** – This site was one of the earliest farmstead sites developed in Highland Park as it was on the Raritan and contained the Mill Brook. The site dates from the 1690s. There has been a succession of owners of the site. The Millbrook was the site of the earliest industrial endeavors in Highland Park. This site now has condo on the Belleview site and condo on Ambiance Court along the Mill Brook.	1207-A75	411 River Road and Ambiance Court
7	**Lupardus/Schuchard/Olendorf House and Farmstead** – This farmstead had been developed by the 1780s and has had a succession of owners. In 1926, the property was redeveloped and Merriwold castle was imported and re-built by J. Seward Johnson (of the J&J family). Until recently there remained a 19th century barn on the property. Much of the property has not been developed.	1207-A77 1207-A78	433 River Road

Notes:
* Item numbers correlate to numbers shown on **Figure 9e.**
**The Reference refers to the identification number in the Stage 1a Cultural Resource Reconnaissance Survey, Borough of Highland Park, Middlesex County, New Jersey (Bzdak et al., September 1993)

Source: Bzdak et al., September 1993

Historical Buildings and Structures

The 1992 Natural Resources Inventory (Townplan Associates, 1992) and the Stage 1a Cultural Resource Reconnaissance Survey (Bzdak et al., 1993) provide an inventory of historical buildings and structures. In general, the latter report includes buildings constructed prior to 1895 and the former includes those built prior to 1925 (with a few exceptions). The locations of the buildings and structures are displayed in **Figure 9f**, which demonstrate the historical development along the river in earliest time followed by further development north of the river.

Information from these two sources has been summarized in **Table 9.3** (from the NRI inventory) and **Table 9.4** (from the Stage 1a Reconnaissance Survey). In those cases in which buildings or structures were listed in both, they are listed in **Table 9.3**. The tables provide the item # which corresponds to the numbered locations on **Figure 9f**, the reference number to the original sources, the location/description of the building or structure and the Block/Lot numbers.

The Livingston Manor Historic District is considered a superb example of early 20th century residential development in Middlesex County and was listed in the National Register of Historic Places and the New Jersey Register of Historic Places in July 2004. It has a wide variety of different architectural styles, which explains its prominence in the three sources (see also **Appendix F: Livingston Manor Historic District**). There were other major tract developments in Highland Park, which were also developed in the beginning of the 20th century.

The Robert Livingston/Waldron House (see **Table 9.3, item 11**) within the Livingston Manor Historic District was listed in the National Register of Historic Places and the New Jersey Register of Historic Places in March 2002.

The Adelaide Avenue District, which was developed early, has many historically interesting homes and buildings.

51 South Adelaide Avenue, c.1900
(Table 9.3, Item 22)

55 South Adelaide Avenue, c.1900-1920
(Table 9.3, Item 23)

202 Raritan Avenue, c.1865
Eligible for New Jersey and National Registers of Historic Places Under Criteria C
(Table 9.3, Item 29)

233 Magnolia Street, c.1880
Eligible for New Jersey and National Registers of Historic Places Under Criteria A
(Table 9.4, Item 15)

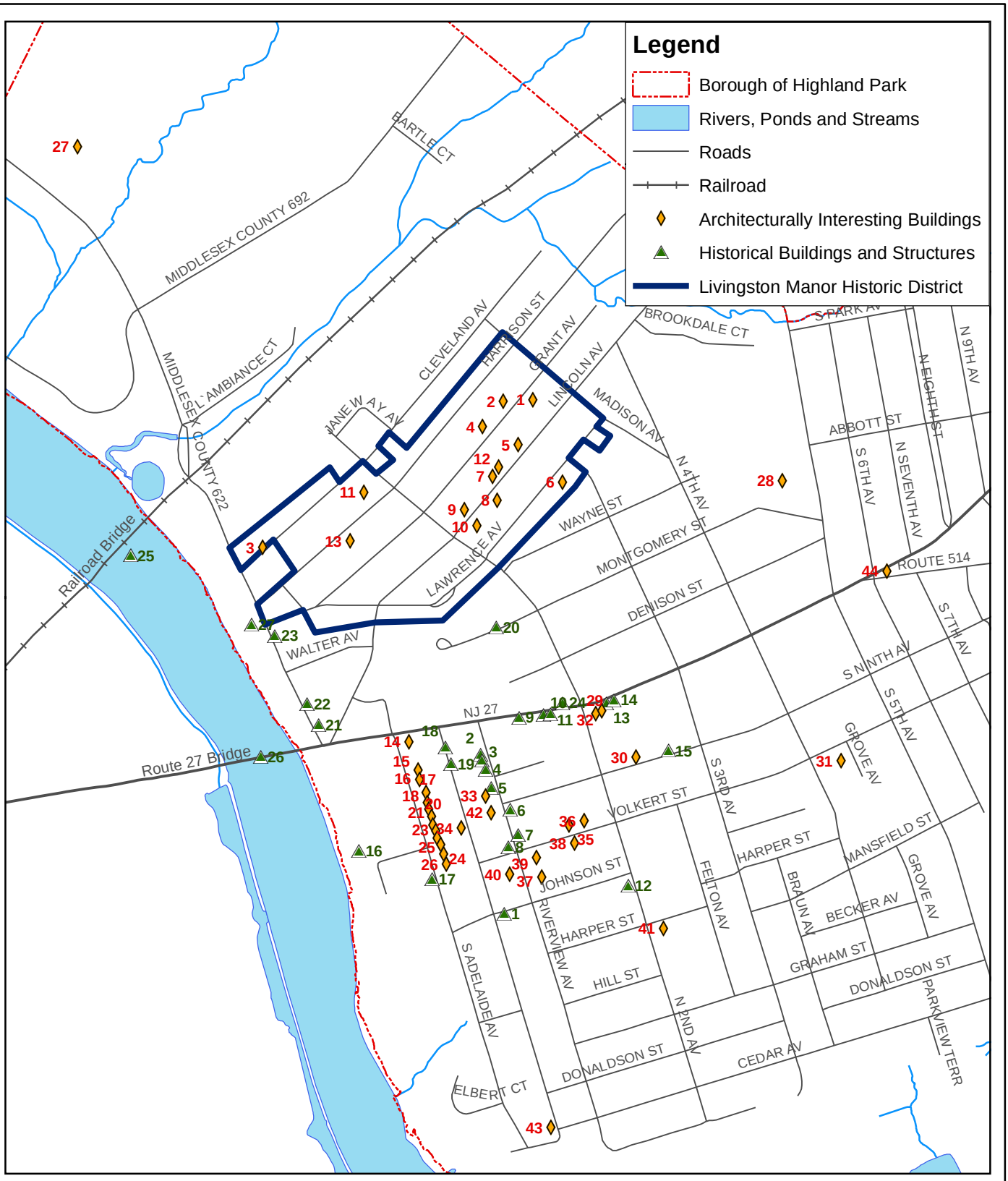


Figure 9f: Historical & Architecturally Interesting Buildings, Structures & District

Borough of Highland Park ERI 2012
Prepared by Kratzer Environmental Services

Data Sources: See Appendix B.
Note: Map accuracy is limited to the accuracy and scale of the original data sets; see Appendix B.
Disclaimer: This map was developed using NJDEP GIS digital data, but this secondary product has not been verified by NJDEP and is not NJDEP authorized.

Table 9.3: Buildings of Architectural and Historical Interest (1992 NRI)

Item	ID #	Location/Description	Bl/Lot
Livingston Manor District			
1	1-A	**310 Grant Avenue**, This is a shingle and clapboard residence with cobbled porch piers and paired wooden columns. It has exposed rafters.	167/44
2	1-B	**305 Grant Avenue**, This is a shingle and clapboard residence.	168/53
3	1-C	35 Harrison Avenue, **Watson Whittlesey House,** c.1908. This is a Mission Revival style house characterized by its tapered Tuscan columned porch. The house is historically significant in that its owner, Watson Whittlesey was a major developer of Highland Park, having subdivided Livingston Manor. The house is currently (2011) being restored and brought back to its historic beauty by its owner.	180/8
4	1-D	**241 Grant Avenue**, This shingled residence has paired wooden porch columns. The exposed rafters have cut-out ends, creating a decorative effect when viewed from the side.	168/56
5	1-E	**257 Lincoln Avenue**, This residence has a front gable, which is a dominant characteristic of the variation of the Shingle style bungalow.	167/22
6	1-F	**254 Lawrence Avenue**, This is a shingled residence with stick brackets and a dominant arched porch with rusticated brick piers. It has exposed rafters and half-timbered dormers.	165/26
7	1-G	**235 Lincoln Avenue**, This shingled residence has pagoda-like window heads and a pedimented entrance porch with Ionic columns.	167/24
8	1-H	**226 Lincoln Avenue**, This residence has a shingled exterior finish.	166/35
9	1-I	**211 Lincoln Avenue**, This shingled residence has twin gabled dormers with notched-end bargeboards, stick brackets and exposed rafters. This residence displays Japanese influences.	167/28
10	1-J	**208 Lincoln Avenue**, This is a clapboard and shingle residence with exposed rafters. The residence displays Japanese influences.	166/32
11	1-K	81 Harrison Avenue, **Robert Livingston House**, c.1830& 1890. This Greek Revival and Colonial Revival style residence is significant due to its location, affording it a view of the Raritan River. The owner of the house, Robert Livingston, also owned the property later subdivided to create Livingston Manor. The house serves as a link between the era of the great river estates and the early suburbanization of Highland Park. It is one of the few high style survivors of its period in Middlesex County. **The house is listed in the New Jersey and National Registers of Historic Places.**	180/4
12	1-L	**237 Lincoln Avenue**, This shingled residence displays Japanese influences.	168/22
13	1-M	**58 Harrison Avenue**, c.1908. This Bungalow/Shingle style residence is considered to be the best example of the blending of the Bungalow and Shingle styles in Middlesex County.	179/5
South Adelaide Street District			
14	2-A	**3-5-7 South Adelaide Avenue**, c.1860. This vernacular Italianate clapboard residence was presumably a four bay building to which a three story and a one story addition were made.	5/39
15	2-C	**17 South Adelaide Avenue**, c.1880. This residence is a Second Empire style structure with a clapboard exterior (some synthetic siding is also present) and a convex mansard roof with four chimneys. Although alterations have been made to the original structure, the residence maintains its dominating scale and massing in the District. It is presently used as a Funeral Home.	5/36
16	2-D	**23 South Adelaide Avenue**, c.1880. This is a Mansard style residence of good architectural integrity. The building is characterized by its bracketed dentate cornice with a paneled frieze and porch with latticed columns.	5/5
17	2-E	**29 South Adelaide Avenue**, c.1860. This is a vernacular Italianate structure. Although alterations have compromised the architectural integrity of the structure, the scale and form contribute to the overall quality of the District. [1207B-6]	5/35
18	2-F	**35 South Adelaide Avenue**, c.1890. This is a Colonial Revival style residence with Queen Anne influences. The clapboard building has a cross gambrel roof with a brick chimney. The front porch has Tuscan columns.	5/34

Item	ID #	Location/Description	Bl/Lot
19	2-G	**39 South Adelaide Avenue**, c.1890- 1900. This Colonial Revival style residence, with Queen Anne influences, has a shingled exterior. The house is significant in its similarity to the Livingston House, leading to the idea that the same architect designed this house as well as the alterations to the earlier house (See item 11).	5/33
20	2-H	**43 South Adelaide Avenue**, c.1900-1920. This is a Georgian Revival style residence with an English bond brick exterior. The style of the residence provides a contrast with the other styles on the street. The home is characterized by a limestone belt course, and slate gabled roof with three gabled dormers.	5/32
21	2-I	**45 South Adelaide Avenue**, This is a Queen Anne style residence with synthetic siding and a slate hip roof with one interior brick chimney.	5/31
22	2-J	**51 South Adelaide Avenue**, c.1900. This is a Georgian Revival style residence with deep overhanging eaves. The roof is asphalt shingled gable with three gableers and one exterior gable-end chimney.	5/30
23	2-K	**55 South Adelaide Avenue**, c.1900-1920. This residence is considered to be one of the better architectural examples in the District. It is a Georgian Revival style building with a gable roof with two exterior gable-end chimneys. The structure is characterized by its cornice, which has unusually long modillions and lunette windows.	5/29
24	2-L	**59 South Adelaide Avenue**, This is a Queen Anne style residence, with Georgian Revival features. The integrity of the house has been maintained, except for the addition of a second entrance and modern steps. The house is characterized by its pedimented porch with round gazebo ends and Tuscan columns. The house has a porte cochere under the second floor wing, which is set on brick piers and Tuscan columns and functions as a continuation of the porch. The broken-up complex massing of the structure is typical of the Queen Anne style.	5/28
25	2-M	**63 South Adelaide Avenue**, This Georgian Revival clapboard residence has both Queen Anne and Colonial Revival influences. The roof is slate gambrel style with three gabled dormers and one interior end brick chimney.	5/15
26	2-N	**69 South Adelaide Avenue**, c.1900. This is a Georgian Revival style shingled residence with a slate gable roof. The roof has two interior brick chimneys. This residence continues the Georgian Revival style found in its immediate area in the District.	5/ 16.01
Other Buildings in Highland Park			
27	3	433 River Road, **the Castle,** c.1930 (brought in pieces from England). This is an excellent example of estate architecture and planning from the early 20th century.	189/4
28	5	**High School,** 1925, (Mill Road and N. 5th Avenue, was built in a Georgian Revival style. The original building was 2 stories 5 bays, U-plan with a hipped slate roof with denticulated wood cornices. It had a central tower with dome. The building is constructed of brick. Originally, it was built as a junior high. It was converted to a high school in the mid 1930s. It has had two 2-story wings added for additional space. In 2009, a separate but linked middle school building was added on the site.	48/18
29	7	**202 Raritan Avenue**, c.1865, was built in a Queen Anne/stick style. The building is a 2 1/2 story, 3 bay dwelling with a cross-gabled roof. The gabled end feature stick-style ornament. A full width porch, gabled at the entry is supported on turned wood posts and embellished with a stick style frieze and balustrade. **The building is eligible for the New Jersey and National Registers of Historic Places under criteria C**. [1207-B34]	22/1
30	8	**215 Magnolia Avenue**, c.1880, was built in a Second Empire style. The building residence is a 2 1/2 story , 3 bay dwelling, Its mansard roof is supported on a bracketed and dentilled wood cornice and punctuated by segmental-arched dormer windows. [1207-B38]	22/22
31	9	**203 S. 4th Avenue,** residence, c.1870-1875, was built in Italianate style. The building is a 2 1/2 story, 5 bay residence that exist today as apartments. Alterations have compromised its architectural integrity [1207-B40]	38/51
32	10	**204 S. 4th Avenue**, c.1865, was built in a Folk Victorian style. The building is a 2 story, 4 bay dwelling with cross gabled roof. A porch wraps around the western end of the main façade and part of the west facade and features Doric wood columns and	22/2

Item	ID #	Location/Description	Bl/Lot
		a shingled balustrade. [1207-B35]	
33	11	**38 S. 1st Avenue**, c.1890, was built in Queen Anne style. The building is 2 1/2 story dwelling with a jerkinhead roof and a large corner tower with conical slate roof. A full-width front porch with turned wood posts, arched spandrels front the building [1207-B18]	8/16
34	12	**54 Cedar Avenue**, c.1890, was built in an Italianate/duplex style. The building is a 2 1/2, 6 bay dwelling (4 bay on the second floor) and is brick structure covered with stucco at the façade and is side gabled with wood eves and a central cross gable residence [1207-B11]	5/13
35	13	**127 Benner Street**, c.1870-1875, was built in the Italianate style. The building is a 2 story dwelling . A full width porch with Tuscan column extends across the façade. residence [1207-B30]	14/19
36	14	**133 Benner Street**, c.1870-1875, was built in the Second Empire style. The building is a 2 1/2 story, 3 bay dwelling. The steep mansard roof is defined by center gables with truss work and bracketed wood cornice. A front porch with bracketed cornice and metal cresting, chamfered wood posts and pierced wood balustrade across the main façade. The building is one of the most elaborate examples of the Second Empire style in Highland Park**. It is eligible for the New Jersey and National Registers under Criteria C**. [1207-B31]	14/13 14/17
37	15	**215 S, 1st Avenue**, residence	15/27
38	16	**126 Benner Street**, c.1880s, was built in an Italianate style. The building is a 2 1/2 story, 5 bay dwelling. An open porch with Tuscan wood columns and wood balustrade extends across the four right bays of the façade. [1207-B29]	15/6
39	17	**205 S, 1st Avenue**, was built in an Italianate/duplex style. The building is a 2 1/2 story dwelling with 3 bays and a cross-gabled roof. A porch extends across the main façade and features denticulated eaves at the open end. [1207-B23]	15/1
40	18	**208 S, 1st Avenue**, c.1885. The original building is obscured by a one story, flat roofed commercial extension. 1207-B24]	9/3.01
41	19	**401 S. 2nd Avenue**, c.1880s. was built in a Second Empire style. The building is a 2 1/2 story 2 bay by 4 bay dwelling with a slate mansard roof. The roof is punctuated by bracketed dormers and rests on a braked cornice with paneled frieze. [1207-B33]	26/18
42	20	**100 S. 1st Avenue,** residence, c.1875, was built in a Queen Anne style. It is a 2 1/2 story dwelling. The roof is cross-gabled and slopes low to form a portion of the porch roof. The porch is supported on chamfered wood post.	8/18
43	21	452 Cedar Avenue, **Schenck House**. c.1885, was built in a Queen Anne style. The building is a 2 1/2 story Queen Anne dwelling with a cross-gabled slate roof and a square corner tower. A wraparound porch features a spindle work frieze and chamfered wood posts. A one story, 2 bay wing extends from the west elevation. This residence has retained a good amount of architectural integrity. **It is associated with several prominent Highland Park residents and meets Criteria B of the New Jersey and US National Register of Historic Places.** [1207-B12]	86/4
44	22	**Doughboy Statue**, 1921. Intersection of Woodbridge Avenue and Raritan Avenue, the World War I memorial is a granite statue of a WWI doughboy watching over Highland Park. The memorial was repaired in 2009.	87/26
Note: Buildings no longer in existence are not listed above, but are documented in **Tables 9.5 and 9.6.**			
Sources: Townplan Associates, 1992 and Bzdak, Meredith, et al., September 1993			

Table 9.4: Buildings of Historical Interest (Stage 1a Reconnaissance Survey, 1993)

Item	Reference*	Location/Description	Bl/Lot
1	1207-B13	**64 Johnson Street**, c.1880, is 2 1/2 story, 5-bay Italianate dwelling with Colonial Revival modifications. **The building is eligible for the New Jersey and US National Register of Historic Places under criteria B for its association with Highland Park's second mayor Lorenz Volker (1908-1913).**	10/47
2	1207-B14	**16 S. 1st Avenue**, c.1885, was built in a Folk Victorian style and is a 2 1/2 story with 4 bays. It has a shed-roofed porch with bracketed and chamfered	8/10

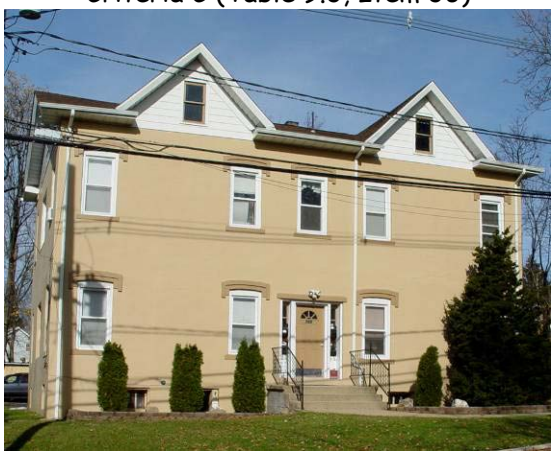
Item	Reference*	Location/Description	Bl/Lot
		posts and a wood deck.	
3	1207-B15	**20 S. 1st Avenue**, c.1890, was built in a Folk Victorian/Queen Anne style. It is a 2 1/2 story, 3 bay building, fronted by a wraparound porch.	8/11
4	1207-B16	**26 S. 1st Avenue**, c.1890. was built in an Italianate style. It is a 2 1/2 story, 3 bay Italianate dwelling with a screen front porch.	8/12
5	1207-B17	**34 S. 1st Avenue,** c.1890, was built in a Queen Anne style. It is a 2 1/2 story, 3 bay dwelling with a cross-gabled roof and scroll and pendant gable ornament. A two story porch, enclosed on the second floor, is support on chamfered posts. A two story addition extends across the rear.	8/15
6	1207-B20	**103 S. 1st Avenue,** c.1890, was built in a Folk Victorian style. It is a 2 1/2 story, 3 bay, L shaped dwelling with a cross-gabled, slate roof. A one story wing is set with the L at the rear of the building. A one story porch is locate on the right bay of the main part of the building (probably of mid 20th century construction). It is identified as being owned by H. Benner in 1875. The Benner brothers were prominent developers of the south side of the Borough.	14/1
7	1207-B21	**115 S. 1st Avenue**, c.1890, was built in a Queen Anne Style. It is an altered 2 1/2 story dwelling with a cross-gabled roof. A two story front porch is enclosed on the second story.	14/26
8	1207-B22	**120 S. 1st Avenue,** c.1890, was built in a Queen Anne Style. It is an altered 2 1/2 story dwelling with three bays. There is a wrap around front porch across the main and south facade.	8/24
9	1207-B26	**118 Raritan Avenue,** c.1885, was built in a Folk Victorian/Queen Anne style. It is 2 1/2 story, 3 bay building with a cross-gabled roof and a two story rear wing.	13/2
10	1207-B27	**130 Raritan Avenue**, c.1885, was built in a Folk Victorian style. It is 2 1/2 story, 3 bay building.	13/8
11	1207-B28	**134 Raritan Avenue,** c.1890, was built in a Folk Victorian style. It is 2 1/2 story, 3 bay front gabled dwelling with an ornamental , paneled vergeboard. An open porch with turned wood posts, pierced wood balustrade fronts the building.	13/6
12	1207-B32	**302 S. 2nd Avenue**, c.1885, was built in a Folk Victorian style. . It is 2 1/2 story, 3 bay dwelling with a steep gabled roof. It has some overtone of gothic revival.	16/12
13	1207-B36	**208 Raritan Avenue**, c.1885. The building has been significantly altered with a one story, flat-roofed commercial extension.	22/3
14	1207-B37	**212 Raritan Avenue**, c.1885. The building has been significantly altered with a two story, hip-roofed commercial extension.	22/4
15	1207-B39	**233 Magnolia Street**, c.1880, was built in a Folk Victorian style is a 2 story, 3 bay dwelling with cross-gabled roof. The roofline is enhanced by scrollwork in the gabled end. It has a hipped roof front porch, partially screened and supported on Tuscan wood columns. **This building meets Criteria A of the New Jersey and US National Register of Historic Places.**	22/17
16	1207-B2	**17 Cliff Court**, c.1865, was built in a Vernacular/Colonial Revival style. It is a 3 story building in an L shape. The base of the L is largely glassed to afford a view of the Raritan River.	11/8
17	1207-B6	**76/78 South Adelaide Avenue**, c.1880s, was built in Italianate style. The building has had significant alterations but gable-front-and-wing form of the building is still visible. The building has been covered in aluminum siding and the front porch enclosed.	12/12
18	1207-B8	**11 Cedar Avenue**, c.1885, was built in a Folk Victorian style. The building is 2 story dwelling with an enclosed porch and has aluminum siding.	8/6
19	1207-B9	**19 Cedar Avenue**, c.1890, was built in a Vernacular/Italianate style. The building is a two story front gabled dwelling. It has a full width porch with Tuscan wood columns on brick bases, a wood desk, and wood balustrade across the main façade.	8/35
20	1207-B41	**105 Montgomery Street**, c.1875 is a 2 story 5 bay stucco (over red brick) apartment building. It was originally constructed as the bottling building for	174/6

Item	Reference*	Location/Description	Bl/Lot
		the Weigel Brewery. The brewery went through several different owners and two fires. Sometime after the turn of the 20th century, most of the brewery was destroyed in a second fire. The bottling area survived and was renovated as a residence. The building was relocated and with second (minor) renovation converted into apartments.	
21	1207-B43	**3 River Road**, c.1890 is a 2 story, 3 bay Folk Victorian dwelling. The front gabled roof is ornamented with scrollwork. It has a flat roofed front porch, which was added about 1910.	183//2
22	1207-B44	**19 River Road**, c.1885, is a 2 1/2 story, 3 bay, side gabled dwelling with open shed-roofed porch supported on iron posts. The building was modernized in the period of 1910-1920.	183/9.0
23	1207-B46	**51 River Road** is a 2 1/2 story cross-gabled dwelling. It has a wraparound porch, recently restored. This site has been occupied since the 1790s. Based on stylistic touches, the house was probably built about 1870.	185/11
24	1207-12	**143 Raritan Avenue** was built in 1901 as a firehouse. The building is a 2 story with a hipped, slate roof with hipped tower with stucco on side elevations. For many years it housed a cleaner; it has recently been renovated with the features maintained. It now has two business.	173/35
25	1207-20	**Amtrak/Northeast Corridor Bridge** over the Raritan River was completed in 1903. It is a twelve-span arched stone bridge, which resembles a roman aqueduct. The bridge's surfaces were covered with concrete in the 1940s. This bridge replaced an earlier iron-trussed structure (1878-1902). There was an earlier wooden double-decker bridge from the 1830 that was destroyed by fire in 1878.	
26	1207-21	**Route 27 /Albany Street Bridge**, the stone arch bridge was built in 1893. It was a replacement for an earlier wooden bridge. In 1924 it was widened and had a concrete extension on the south side. It was further modernized in the 1990s.	
27	1207-17	**Sewer Pumping Station** on River Road (at Native Plant Reserve) is 1 story, 3 bay hipped slate roof structure built c.1915. It was built in Second Renaissance Revival style. It is no longer in use a sewer pumping station.	186/13
*The Reference refers to the identification number in the Stage 1a Cultural Resource Reconnaissance Survey, Borough of Highland Park, Middlesex County, New Jersey (Bzdak, Meredith, et al., September 1993)			
Source: Bzdak et al., 1993			

Schenck House
452 Cedar Avenue, c.1885
Eligible for New Jersey and National Registers of Historic Places under Criteria B
(Table 9.3, Item 43)

64 Johnson Street, c.1880
Eligible for New Jersey and National Registers of Historic Places under Criteria B
(Table 9.4, Item 1)

133 Benner Street, c.1870-1875
Eligible for the New Jersey and National Registers of Historic Places under Criteria C (Table 9.3, Item 36)



105 Montgomery Street, c.1875
Originally constructed as the bottling building for the Weigel Brewery, it is now apartments. (Table 9.4, Item 20)

was closed by the Cenacle Sisters and subsequently sold to a developer. In 2006, development was approved with the condition that the building would be preserved. In 2009, a second developer purchased rights to the properties and to develop 82 units. The building was to be preserved, however the building had deteriorated from its many years of emptiness. In 2011, the developer was given permission to demolish the building. Due to the extensive modifications and deterioration, the building was no longer considered a valuable example of mid-19th

Historical or Architecturally Interesting Buildings Lost Since 1992/1993

A number of structures that were previously listed in the 1992 NRI or the 1993 Stage 1a Cultural Resources Survey have been torn down for re-development. These are summarized in **Table 9.5.**

The two story house at **48/50 River Road** was probably built in 1880 but moved to this site at the turn of the century. The building was torn down due to disrepair in the 1990s and is now open space and is part of the Eugene Young Environmental Education Center/Native Plant Reserve complex. The building was considered neither architecturally nor historically distinguished.

The **Belleview/Cenacle House** at 411 River Road, was originally constructed in the 1840s, although the foundation may date to the late 18th century. This building was a vernacular Greek Revival structure with Colonial Revival renovations. The house was built to take advantage of the view of the Raritan River and was the summer home of Robert Wood Johnson, who helped build Johnson and Johnson into a major corporation. He was also a mayor of Highland Park from 1920-1921. In 1950, the structure became the Cenacle Retreat House of the Cenacle Sisters. The building was extensively modified with additions and the upper floors became dormitories for the nuns. In 2004, the building

The Belleview/Cenacle House
411 River Road c.1840s (Table 9.5, Item 2),
Image taken on the day of demolition

century architecture, and the building was demolished on July 1, 2011. The footprint of the building and its surrounding area will be a public park. There is a commitment to place a plaque in the park outlining the building's history.

Table 9.5: Historical Buildings Lost Since 1992/1993

Item	Location	Block/Lot	Name/Description	Reference*	Status
1	48/50 River Road	186/9	House	1207-B45	Open Space
2	411 River Road	190/4	Belleview/Cenacle House	1207-B47	Public Park at Overlook at Highland Park
3	443 River Road	189/3	Wooden Barn	1207-B48	Parker at Stonegate
4	47 Raritan Ave	173/54	Brody House	NRI	Office Building
5	1 South Adelaide Avenue	1/1.01	Rice-Myer House YMHA	1207-B1	Awaiting redevelopment
6	20 Cedar Avenue	5/5.01	Stone Garage	1207-B10	Driveway
7	212 South First Avenue	9/4	House	1207-B25	Expansion of Congregation Ahavas Achim
*Reference refers to the identification number in the Stage 1a Cultural Resource Reconnaissance Survey, Borough of Highland Park, Middlesex County, New Jersey (Bzdak, Meredith, et al., September 1993)					
Sources: Bzdak et al., 1993; Highland Park Environmental Commission, 2011					

A **wooden barn** at 443 River Road, was the last remaining frame barn from Highland Park's agricultural past. The building dated to before 1875. The barn was torn down as part of the construction of Parker Stonegate (Assisted Living Complex) in the 1990s.

The **47 Raritan Avenue** Brody House, designed by Alexander Merchant, was a white two story building with surrounding porch with white columns. However, it became unoccupied and fell into disrepair. Attempts to preserve the building failed. It was demolished in 1997 and has been replaced by a three story brick office building.

Rice-Meyer Estate/YMHA was located at 1 South Adelaide Avenue. This Italianate structure was built in the 1870s and was significant in its relationship to the rest of the nearby homes. The building was located in an estate setting, in comparison to the small lots that compose the remainder of the area. The building in 1955 became the site of the YMHA. The building was extensively modified and additional structures were attached to the building. In 2007, the YMHA was closed and sold the building to a developer and it was subsequently torn down in 2008. As previously noted, this site has archeological potential.

The stone building at **20 Cedar Avenue** was an Italianate style 2-story front gabled garage/barn with wood eaves and brick corner pilasters. The garage doors are located on the front façade. The second floor had an arched window with stones sills. The building dated to c.1890 but was considered neither architecturally nor historically distinguished.

The only example of the Gothic revival in Highland Park was a $2^1/_2$ story building located at **212 South First Avenue**, which was built about 1860. It was unusual in that it was constructed with a stucco exterior surface. It had been eligible for the NJ and National Register of Historic Places but the building was demolished to accommodate the expansion of Congregation Ahavas Achim.

Historical Buildings Scheduled for Redevelopment

There are two historical buildings along Raritan Avenue whose locations are scheduled for redevelopment (summarized in **Table 9.6**). A $2^1/_2$ story building at **130 Raritan Avenue** was constructed about 1885 in Folk Victorian style. An enclosed porch was added in 1905. Also constructed in the Folk Victorian style, a $2^1/_2$ story building at **134 Raritan Avenue**, was

constructed about 1890. Neither building is considered architecturally or historically distinguished.

Table 9.6: Buildings Scheduled for Redevelopment

Location	Block/Lot	Name/Description	Reference*	Status
130 Raritan Avenue	13/9	House	1207-B27	Awaiting redevelopment
134 Raritan Avenue	13/6	House	1207-B28	Awaiting redevelopment
*The Reference refers to the identification number in the Stage 1a Cultural Resource Reconnaissance Survey, Borough of Highland Park, Middlesex County, New Jersey (Bzdak, Meredith, et al., September 1993)				
Sources: Bzdak et al., 1993; Highland Park Environmental Commission, 2011				

New Jersey and National Register of Historic Places

Properties and historic districts in the Borough of Highland Park that have met all the New Jersey and National Register criteria for significance in American history, archaeology, architecture, engineering or culture, and possess integrity of location, design, setting, materials, workmanship, feeling and association are listed in Table 9.7. The list provides details and reference numbers for these buildings, structures, sites, objects, and districts listed on the New Jersey Register of Historic Places (SR) and the National Register of Historic Places (NR).

Table 9.7: New Jersey and National Register of Historic Places

Livingston Manor Historic District Roughly bounded by Cleveland, Grant, Harrison, Lawrence, Lincoln, Madison and N. 2nd Aves. and River Rd. , Highland Park Borough (525 acres, 234 buildings, 4 objects)	State Register: added 4/1/2004 ID #: 4289 National Register: added 7/7/2004 Reference #: 04000672
Historic Significance:	Person, Architecture/Engineering, Event
Architect, builder, or engineer:	et.al., Hasselman, Francis George
Architectural Style:	Bungalow/Craftsman, Queen Anne
Historic Person:	Whittlesey, Anna W., Whittlesey, Watson
Significant Year:	1909, 1897, 1906
Area of Significance:	Architecture, Community Planning And Development
Period of Significance:	1900-1924, 1875-1899, 1850-1874, 1825-1849
Owner:	Private
Historic Function:	Domestic
Historic Sub-function:	Single Dwelling
Current Function:	Domestic
Current Sub-function:	Single Dwelling
Livingston Homestead Also known as Waldron House 81 Harrison Ave. , Highland Park	State Register: added 12/20/2001 ID#: 3950 National Register: added 3/20/2002 Reference #: 02000215)
Historic Significance:	Architecture/Engineering
Architect, builder, or engineer:	et.al., Whittlesey, Watson
Architectural Style:	Greek Revival, Classical Revival
Area of Significance:	Architecture
Period of Significance:	1900-1924, 1875-1899, 1850-1874, 1825-1849
Owner:	Private
Historic Function:	Commerce/Trade, Domestic
Historic Sub-function:	Business, Single Dwelling
Current Function:	Domestic
Current Sub-function:	Single Dwelling

Raritan Landing Archeological District (Boundary Increase) Address Restricted , Highland Park (80 acres)	National Register: added 1984 ID #: 84002738
Historic Significance:	Information Potential
Area of Significance:	Historic - Non-Aboriginal, Economics, Exploration/Settlement
Cultural Affiliation:	American Coastal
Period of Significance:	1750-1799
Owner:	Local , State
Historic Function:	Domestic
Historic Sub-function:	Single Dwelling
Current Function:	Landscape
Current Sub-function:	Park
Pennsylvania Railroad New York to Philadelphia Historic District	State Register: SHPO Opinion: 10/2/2002 ID #: 4568
Located in: Essex County - Newark; Hudson County - Harrison, Kearny, North Bergen, Secaucus, Union and Weehawken; Mercer County - Hamilton, Lawrence, Trenton and West Windsor: Middlesex County - Edison, Highland Park, Metuchen, New Brunswick, North Brunswick, Plainsboro, South Brunswick and Woodbridge; Union County - Elizabeth, Linden and Rahway.	
Sources: National Register of Historic Places, 2011 and NJDEP, Historic Preservation Office, 2011	

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Note: All of the non-internet references are available at the Highland Park Public Library.

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National Register of Historic Places Home Page: http://www.nationalregisterofhistoricplaces.com

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New Jersey Historic Preservation Office: http://www.state.nj.us/dep/hpo/

10: REGIONAL RELATIONSHIPS

A. Raritan Basin Watershed Alliance

The Raritan Basin Watershed Management Project began in 1999 when the NJDEP funded a partnership of government agencies, nonprofit groups and academia to coordinate watershed activities and to develop a watershed management plan for the Raritan Basin. The project, lead by the New Jersey Water Supply Authority, completed 7 characterization and assessment reports and 2 background reports, which determined a baseline condition for the Raritan Basin against which future degradation or improvement could be compared. Some of the issues examined by the technical reports included population growth, land use, riparian areas, aquatic habitat, water supply, ground water, surface water quality and pollutant loadings. Based on this foundation, the Raritan Basin Watershed Management Plan was completed in December 2002. This plan identified six key issues that must be addressed in order to restore and protect the region's water resources:

- surface water pollution,
- stormwater management,
- ground water recharge losses,
- riparian area (stream corridor) losses,
- biological impairment of streams, and
- water supply limitations (Shallcross and Stanuikynas, 2002).

The *Raritan Basin Watershed Alliance* was formed in 2003 in order to:

- Create public and official support for Plan implementation
- Create coalitions/partnerships for Plan implementation and assist with acquisition of financial and other resources where requested
- Encourage and support implementation efforts and assist with project planning
- Keep the Raritan Plan current and continually improving
- Maintain and enhance technical knowledge and capabilities of the Basin and ensure dissemination to those who need it (New Jersey Water Supply Authority, 2009).

B. Sustainable Raritan River

The *Sustainable Raritan River* is an initiative formed by the Raritan River Collaborative in 2009, which is made up of about 100 organizations, including environmental, historical and cultural organizations, Federal, State and County government, Rutgers University, and businesses. The purpose is to achieve the highest quality for the waters and riparian areas of the Raritan River basin. The project uses a regional approach, supported by state and federal organizations and implemented at the local and county level. Goals include the following:

- Improved water quality and management of water quantity
- Habitat Restoration
- Public Access
- Site Remediation and Pollution Prevention
- Balanced Redevelopment (Ferrer et al, 2010).

C. Water Supply Planning

The goal of statewide water supply planning, mandated by the Water Supply Management Act (N.J.S.A. 58:1A-1), is to make recommendations on the management of the State's surface and ground water supplies to ensure that the State's water supplies could withstand foreseeable drought and that aquifers are not depleted.

One result of the first Statewide Water Supply Plan, developed in 1982, was the rehabilitation of the Delaware & Raritan Canal. The 1996 Statewide Water Supply Plan, a revision of the 1982 plan, recommended improved water resources protection, water supply and water delivery management, and water conservation. To accomplish these goals, NJDEP's Water Quality Planning Rules were developed to ensure that water supply withdrawals do not interfere with the assimilative capacity of our streams, rivers and estuaries. In addition, water purveyors are required to develop water conservation plans that are implemented during periods of drought (NJDEP Division of Watershed Management, 2011).

D. Water Quality Management Planning

Watershed management is the process of managing all of the water resources within the area of a watershed, rather than on a site-specific basis. A watershed management approach is based on three key components: 1) a geographic focus; 2) continuous improvement based on sound science; and 3) partnerships/stakeholder involvement. All of Highland Park is within the Lower Raritan, South River and Lawrence water quality management area (NJDEP Office of Environmental Planning, 1997).

Revisions to the Water Quality Management Planning Rules (N.J.A.C. 7:15) were adopted July 7, 2008. This rule establishes:

- procedures for preparation, adoption, amendment, revision, and certification of the *Water Quality Management (WQM) Plans*;
- procedures for NJDEP's review of projects and activities for consistency with WQM plans;
- adoption of other NJDEP rules, priority systems and project priority lists, sludge management plans, regional stormwater management plans, effluent limitations, wastewater management plans, "201 Facilities Plans"[36], and other documents in WQM Plans;
- coordination of WQM planning with the Highlands RMP, other programs and municipal zoning;
- mechanisms to resolve conflicts;
- procedures for submission, adoption, and updating *wastewater management plans (WMPs)* (wastewater planning responsibility is assigned to counties and requires them to update the WMPs);
- the process for identifying water bodies on the List of Water Quality Limited Segments and establishing total maximum daily loads (TMDLs) (see **Section 6E** for more about TMDLs) (NJDEP, 2011).

[36] "201 Facilities Plans" means the plans for wastewater facilities prepared pursuant to Section 201 of the Clean Water Act.

E. State Development & Redevelopment Plan

The NJ Department of State's Business Action Center Office for Planning Advocacy[37] "coordinates statewide planning to protect the environment and guide future growth into compact, mixed-use development and redevelopment. The office implements the goals of the State Development and Redevelopment Plan to achieve comprehensive, long-term planning; and integrates that planning with programmatic and regulatory land-use decisions at all levels of government and the private sector." (NJ Department of State, December 2011)

The *State Development and Redevelopment Plan* is a dynamic vision of New Jersey's development and conservation patterns, incorporating new data from state agencies, counties and municipalities on a continuing basis. It should be noted that the following information and map are current as of December 2011, but may change in the near future.

The purpose of the 2001 State Plan is to:

> "Coordinate planning activities and establish Statewide planning objectives in the following areas: land use, housing, economic development, transportation, natural resource conservation, agriculture and farmland retention, recreation, urban and suburban redevelopment, historic preservation, public facilities and services, and intergovernmental coordination" (N.J.S.A. 52:18A-200(f)).

The State Plan Policy Map has two major components: Planning Areas, which identify the current natural and built characteristics in each areas, and Centers, where most growth will be accommodated. There are 5 main Planning Areas: Metropolitan, Suburban, Fringe, Rural and Environmentally Sensitive (shown in **Figure 10)**. Highland Park is within the *PA-1 Metropolitan Planning Area*.

The State Plan's goals for the Metropolitan Planning Area are to "Provide for much of the state's future redevelopment; revitalize cities and towns; promote growth in compact forms; stabilize older suburbs; redesign areas of sprawl; and protect the character of existing stable communities" (NJ State Planning Commission, 2001).

Highland Park is identified as a *Center*. According to the State Plan, Centers are areas with concentrated development that will accommodate most of the growth within the state. In contrast with sprawl development, Centers consume less land, deplete fewer natural resources and are more efficient in the delivery of public services. Supporting a wide diversity of uses and activities and promoting redevelopment are key strategies for Centers.

There are 5 types of Centers. Highland Park is a *Town*, intermediate in scale between small Hamlets and major Urban Centers. Some of the most valuable features of Towns include the comfortable, human scale of blocks, streets and open spaces, the easy walking access to civic and community activities, a variety of neighborhoods offering a diversity of housing choices and a mixed-use core offering locally oriented goods and services.

Highland Park is further designated as part of the *Smart Growth Area.* Smart Growth is the term used to describe well-planned, well-managed growth that adds new homes and creates new jobs, while preserving open space, farmland, and environmental resources. In New Jersey, Smart Growth supports development and redevelopment in recognized Centers, with existing infrastructure that serves the economy, the community and the environment.

While the Environmentally Sensitive Planning Area is used to protect and manage large areas of natural and environmental resources, there are significant cultural and environmental resources found throughout the other Planning Areas, as well. The Plan refers to these sites as *Historic and Cultural Sites* and *Critical Environmental Sites* (see **Figure 10**). The Plan treats

[37] The State Plan was formerly under the NJ Department of Community Affairs Office of Smart Growth (OSG).

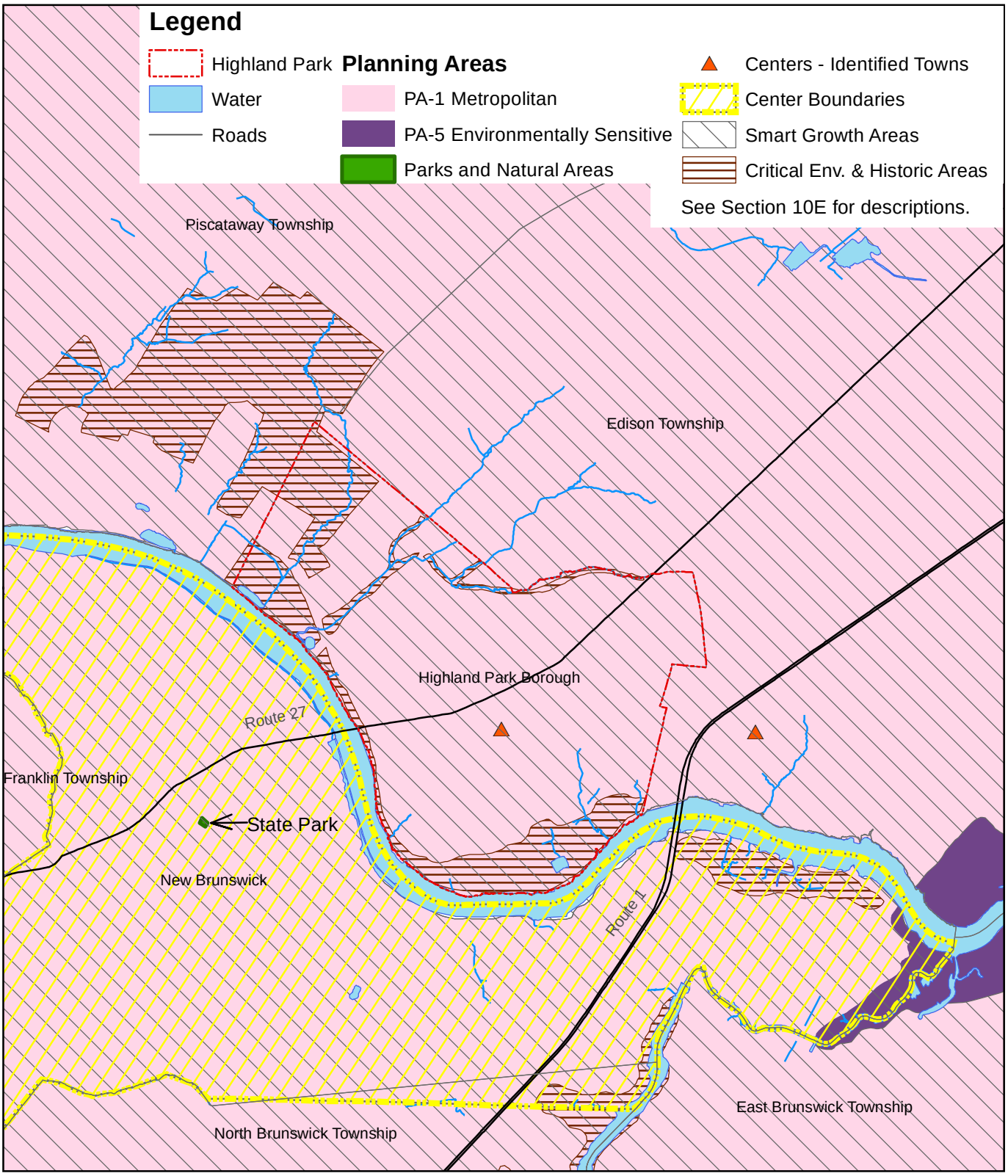

Figure 10: State Development and Redevelopment Plan

Current as of 12/7/2011

N
W E
S

0 0.25 0.5 1 Miles
0 1,050 2,100 4,200 Feet

Borough of Highland Park ERI 2012
Prepared by Kratzer Environmental Services

Data Sources: See Appendix B.
Note: Map accuracy is limited to the accuracy and scale of the original data sets; see Appendix B.
Disclaimer: This map was developed using NJDEP GIS digital data, but this secondary product has not been verified by NJDEP and is not NJDEP authorized.

these designated areas with the relevant provisions of historic, cultural and scenic and environmental Statewide Policies and the Environmentally Sensitive Planning Area. Within Highland Park, the Rutgers Ecological Preserve and the floodplain receive this designation (NJ State Planning Commission, 2001).

Another aspect of the state planning process is the denotation of *brownfields*, defined as any former or current commercial or industrial site, currently vacant or underutilized, on which there has been, or there is suspected to have been, a discharge of a contaminant. Brownfields are discussed in **Section 2C**, and the database is corrected and updated in **Table 2.5** and shown on **Figure 2f**.

F. Middlesex County Planning Board

The Middlesex County Department of Planning serves as the staff of the County Planning Board. The County Planning Board develops and administers a comprehensive strategy for managing development and growth as it affects all County facilities. Examples include preparation and administration of land development regulations, review of development projects, stormwater management, and wastewater management planning.

Within the Department of Planning there are five Divisions: Data Management and Technical Services, Comprehensive Planning and the Environment, Land Development Review, Transportation and Solid Waste Management. Advisory committees and cooperation with local municipalities assist in the decision making process (Middlesex County Planning Board, December 2011).

Specific programs and functions of each division can be found on the Middlesex County Planning Board website (see **Internet Resources**).

References: Regional Relationships

Raritan Basin Watershed Alliance

New Jersey Water Supply Authority. 2009. Raritan Basin Watershed Alliance. http://www.raritanbasin.org/alliance.html

Shallcross, Amy L. and Tom J. Stanuikynas. August 2002. Raritan Basin: Portrait of a Watershed. New Jersey Water Supply Authority. 47 pages. http://www.raritanbasin.org/Alliance/RBWMP_CD/Reports/Summary_Report.pdf

Sustainable Raritan

Ferrer, Jessica, Beth Ravit and Judy Shaw. Sustainable Raritan River Collaborative Action Report 2009-2010. 59 pages. http://www.blueraritan.org/resources/SRRIreport2010.pdf

Water Supply Planning

NJDEP Division of Watershed Management. 2011. Water Supply Planning. http://www.state.nj.us/dep/watershedmgt/water_supply_planning.htm

Water Quality Management Planning

NJDEP. July 7, 2008 (latest amendment). N.J.A.C. 7:15: Water Quality Management Planning. 97 pages. http://www.nj.gov/dep/rules/rules/njac7_15.pdf

NJDEP Division of Watershed Management. 2011. http://www.state.nj.us/dep/watershedmgt/index.htm

NJDEP Office of Environmental Planning. January 1997. Draft Statewide Watershed Management Framework Document for the State of New Jersey. http://www.nj.gov/dep/watershedmgt/DOCS/pdfs/FRAME97fixed.pdf

State Plan
NJ Department of State. December 2011. State Plan Website. http://www.nj.gov/state/planning/plan.html

NJ Department of State. September 28, 2011. The 2001 State Plan Policy Map and Other Maps. GIS data. http://www.nj.gov/state/planning/resources-gis.html
Brownfields SiteMart, 12/16/08 bfsitemart.zip (also shown on **Figure 2f**)
Center boundaries of the NJ State Development and Redevelopment Plan, 12/07/2011 cenlne2.zip
Cores (12/07/2011), Endorsed Plans (12/07/2011), Historic and Cultural Sites (10/11/2001), Nodes (04/06/2010), Urban Complex (03/01/2001) - none in or near Highland Park.
Critical Environmental and Historic Sites of the NJ State ... Plan, 12/07/2011 cehs2.zip
Identified Centers of the State ... Plan, 12/07/2011 cenpt2.zip
Planning Areas of the NJ State ... Plan, 12/07/2011 splan2.zip
Smart Growth Areas, 12/07/2011 sgareas.zip

NJ State Planning Commission. March 1, 2001. New Jersey State Development and Redevelopment Plan Executive Summary. 58 pages. http://www.state.nj.us/state/planning/docs/execsumm030101.pdf

Middlesex County Planning Board
Middlesex County Planning Board. December 2011. Website.
http://www.co.middlesex.nj.us/planningboard/index.asp

Internet Resources: Regional Relationships

Middlesex County Planning Board
Home Page: http://www.co.middlesex.nj.us/planningboard/index.asp
Environmental Resource Directory: http://www.co.middlesex.nj.us/planningboard/resource-directory.asp

NJDEP Division of Watershed Management Home Page: http://www.state.nj.us/dep/watershedmgt/index.htm

Raritan Basin Watershed Management Project: http://www.raritanbasin.org/alliance.html

State Development and Redevelopment Plan: http://www.nj.gov/state/planning/
Middlesex County map (pdf): http://nj.gov/state/planning/docs/middlesexcountymap.pdf

Sustainable Raritan River: http://www.blueraritan.org

11: COMPOSITE MAP OF ENVIRONMENTALLY CRITICAL AREAS

Throughout this document, many environmental and natural features of the Borough of Highland Park have been documented, described and mapped. One of the greatest values of mapping with GIS is to easily combine features in new ways. To accomplish this, **Figure 11** combines some of the mapped layers from previous sections, displaying features that make an area environmentally critical together on one map.

A useful definition of an "environmentally critical area" is provided in the Stormwater Management regulations (N.J.A.C. 7:8):

> " 'Environmentally critical area' means an area or feature which is of significant environmental value, including, but not limited to: stream corridors; natural heritage priority sites; habitats 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 (NJDEP, 2010)."

Figure 11 combines the following:

- Steep slopes greater than 30% (the only steep slopes data currently available for Highland Park)
- Floodplains
- Wetlands (from 2007 Land Use data; an LOI is necessary to determine actual boundary of wetlands)
- 50 foot wetlands buffers (from 2007 Land Use data; an LOI is necessary to determine actual buffer for wetlands – not all wetlands are given a 50 foot buffer)
- 50 foot riparian buffer (can be up to 300' if there are steep slopes or floodplains) (Borough of Highland Park, May 3, 2011)
- Forested areas (from 2007 Land Use data)
- Natural Heritage Grid Map (for generalized locations of rare plants; the grid for the extant population of *Sagittaria calycina var. spongiosa* is shown)
- Open space
- State Development and Redevelopment Plan Critical Environmental and Historic Areas

References: Environmentally Critical Areas

Borough of Highland Park, NJ. May 3, 2011. Chapter 230 Land Development Article XXII Riparian buffer Conservation Zone. http://www.ecode360.com/15557017

Borough of Highland Park, NJ. Chapter 230 Land Development Article XXIII Specific Standards §230-122 Steep Slope Ordinance. http://www.ecode360.com/14478770

NJDEP. April 2010. N.J.A.C. 7:8 Stormwater Management Rule. Date last amended: April 19, 2010. 39 pages. http://www.nj.gov/dep/rules/rules/njac7_8.pdf

Steep slopes: See Section 3B; Figure 3d

Floodplains: See Section 6B; Figure 6f
Riparian buffer: See Section 6B; Figure 6g
Wetlands & wetlands buffers: See Section 6C; Figure 6h
Forested areas: See Section 7A; Figure 7b
Natural Heritage Grid Map: See Section 7F; Figure 7g
Open Space: See Section 8D; Figure 8a
State Development and Redevelopment Plan Critical Areas: See Section 10E; Figure 10

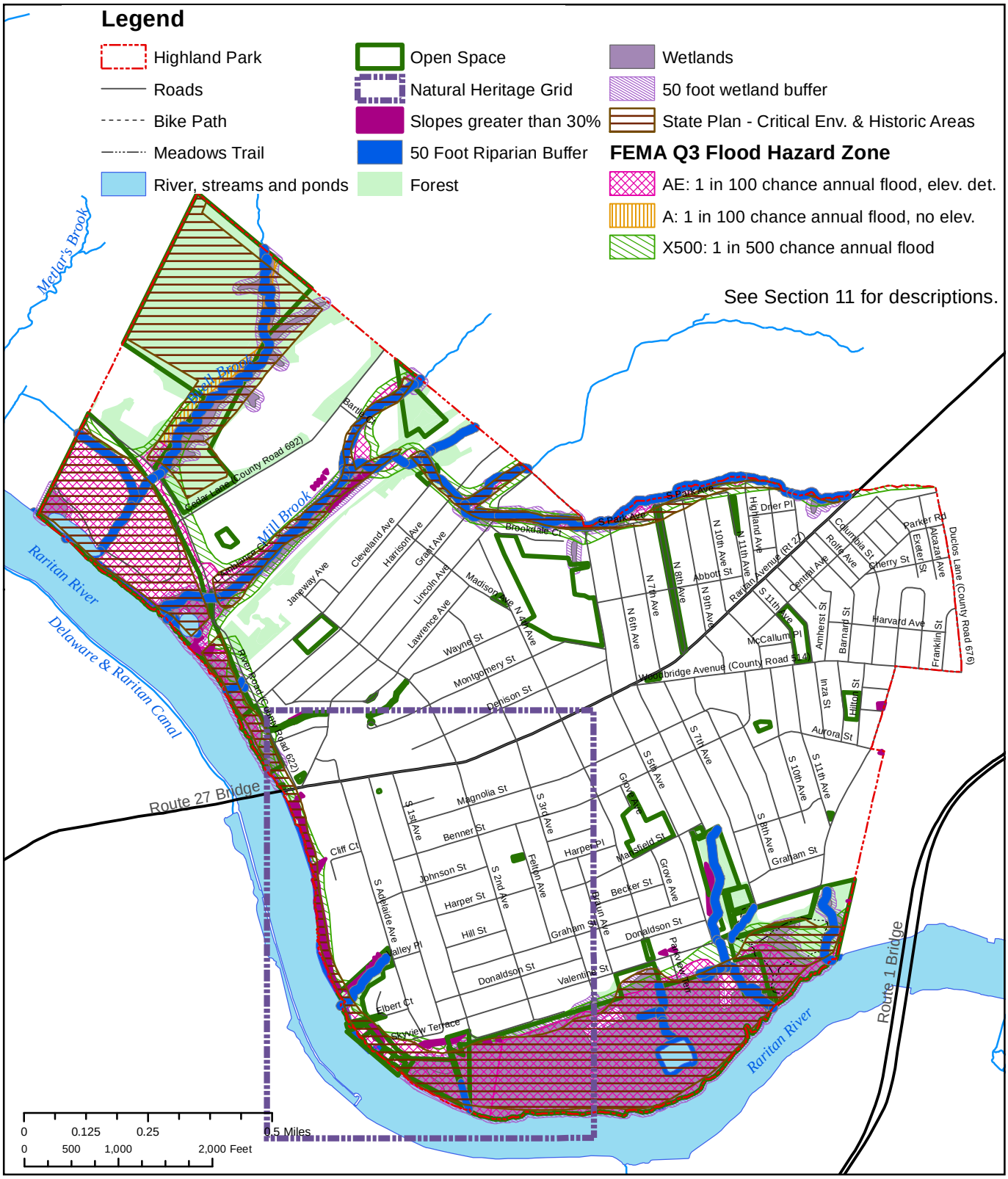

Figure 11: Environmentally Critical Areas

Borough of Highland Park ERI 2012
Prepared by Kratzer Environmental Services

Data Sources: See Appendix B.
Note: Map accuracy is limited to the accuracy and scale of the original data sets; see Appendix B.
Disclaimer: This map was developed using NJDEP GIS digital data, but this secondary product has not been verified by NJDEP and is not NJDEP authorized.

APPENDIX A: DATA USE AGREEMENTS

Contents

A-1. Terms of Agreement for use of NJDEP GIS data

(Required by NJDEP Office of Information Management, Bureau of Geographic Information and Analysis.)

1. Digital data received from the NJDEP are to be used solely for internal purposes in the conduct of daily affairs.

2. The data are provided, as is, without warranty of any kind and the user is responsible for understanding the accuracy limitations of all digital data layers provided herein, as documented in the accompanying Data Dictionary and Readme files. Any reproduction or manipulation of the above data must ensure that the coordinate reference system remains intact.

3. Digital data received from the NJDEP may not be reproduced or redistributed for use by anyone without first obtaining written permission from the NJDEP. This clause is not intended to restrict distribution of printed mapped information produced from the digital data.

4. Any maps, publications, reports, or other documents produced as a result of this project that utilize NJDEP digital data will credit the NJDEP Geographic Information System (GIS) as the source of the data with the following credit/disclaimer:

> This (map/publication/report) was developed using New Jersey Department of Environmental Protection Geographic Information System digital data, but this secondary product has not been verified by NJDEP and is not state-authorized.

5. Users shall require any independent contractor, hired to undertake work that will utilize digital data obtained from the NJDEP, to agree not to use, reproduce, or redistribute NJDEP GIS data for any purpose other than the specified contractual work. All copies of NJDEP GIS data utilized by an independent contractor will be required to be returned to the original user at the close of such contractual work. Users hereby agree to abide by the use and reproduction conditions specified above and agree to hold any independent contractor to the same terms. By using data provided herein, the user acknowledges that terms and conditions have been read and that the user is bound by these criteria.

A-2. Cautions and Restrictions on Use of Natural Heritage Data

(Required by NJDEP Division of Parks and Forestry, Natural Lands Management.)

CAUTIONS AND RESTRICTIONS ON NATURAL HERITAGE DATA

The quantity and quality of data collected by the Natural Heritage Program is dependent on the research and observations of many individuals and organizations. Not all of this information is the result of comprehensive or site-specific field surveys. Some natural areas in New Jersey have never been thoroughly surveyed. As a result, new locations for plant and animal species are continuously added to the database. Since data acquisition is a dynamic, ongoing process, the Natural Heritage Program cannot provide a definitive statement on the presence, absence, or condition of biological elements in any part of New Jersey. Information supplied by the Natural Heritage Program summarizes existing data known to the program at the time of the request regarding the biological elements or locations in question. They should never be regarded as final statements on the elements or areas being considered, nor should they be substituted for on-site surveys required for environmental assessments. The attached data is provided as one source of information to assist others in the preservation of natural diversity.

This office cannot provide a letter of interpretation or a statement addressing the classification of wetlands as defined by the Freshwater Wetlands Act. Requests for such determination should be sent to the DEP Land Use Regulation Program, P.O. Box 401, Trenton, NJ 08625-0401.

The Landscape Project was developed by the Division of Fish & Wildlife, Endangered and Nongame Species Program to map critical habitat for rare animal species. Some of the rare species data in the Landscape Project is in the Natural Heritage Database, while other records were obtained from other sources. Natural Heritage Database response letters will list all species (if any) found during a search of the Landscape Project. However, any reports that are included with the response letter will only reference specific records if they are in the Natural Heritage Database. This office cannot answer any inquiries about the Landscape Project. All questions should be directed to the DEP Division of Fish and Wildlife, Endangered and Nongame Species Program, P.O. Box 400, Trenton, NJ 08625-0400.

This cautions and restrictions notice must be included whenever information provided by the Natural Heritage Database is published.

NJ Department of Environmental Protection
Division of Parks and Forestry
Natural Lands Management

APPENDIX B: METADATA FOR GIS DATA LAYERS USED FOR THE ENVIRONMENTAL RESOURCE INVENTORY FOR THE BOROUGH OF HIGHLAND PARK

Descriptions of Data Layers:

Data Disclaimers in Appendix A apply to the use of these data layers and the maps created from them. The user is responsible for understanding the accuracy limitations of the digital data layers, as documented in the accompanying report and metadata summaries, and the metadata files which accompany the data.

Contents

B-1. GIS Metadata – Summary of GIS Layers Used

Used for Figures	Source of Data*	Data Title	Date
most	Highland Park	Highland Park GPS Points - Bike Path	6/1/2011
most	Highland Park	Highland Park GPS Points - Donaldson Stream	6/1/2011
most	Highland Park	Highland Park GPS Points - Meadows Trail	12/9/2011
most	Highland Park	Highland Park GPS Points - Stream 7 (in The Meadows)	12/26/2011
most	Highland Park	Highland Park GPS Points - Stream on River Road in Johnson Park	6/1/2011
most	NJDEP, OIRM, BGIS	NJDEP 2002 Waters of New Jersey (Lakes and Ponds), Version 20080501	5/1/2008
most	NJDEP, OIRM, BGIS	NJDEP 2002 Waters of New Jersey (Rivers, Bays and Oceans), Version 20080501	5/1/2008
most	NJDEP, OIRM, BGIS	NJDEP Stream Network (Lower Hudson Basin)	5/1/2008
most	NJDOT	NJ Roadway 2010	6/6/2010
1a + others	NJDEP, OIRM, BGIS	NJDEP State Boundary of New Jersey	1/11/1998
1a + others	NJOIT, OGIS	Counties of New Jersey, New Jersey State Plane NAD83	5/20/2008
1b	NJStateAtlas	1930 Aerial Photograph	12/31/1930
1c	HistoricAerials	1963 Aerial Photography	12/31/1963
1d	NJOIT, OGIS	New Jersey 2002 High Resolution Orthophotography	7/31/2003
1e, 1f	NJOIT, OGIS	New Jersey 2007 - 2008 High Resolution Orthophotography, MrSID 5K Tiles	10/1/2008
1f	Google	2010 Aerial Photograph	
1g + others	Middlesex County	Middlesex County Railroads	6/28/2011
1g,1h,2g,6k,7a,7b,7c	NJDEP, OIRM, BGIS	NJDEP 2007 Land use/Land Cover Update, Lower Raritan, South River and Lawrence, WMA09	7/12/2010
1h	NJDEP, OIRM, BGIS	NJDEP 1986 Land Use/Land Cover for Middlesex County, New Jersey	1/1/1986
1h	NJDEP, OIRM, BGIS	NJDEP 1995/97 Land use/Land cover Update, Lower Raritan, South River and Lawrence WMA-9	12/1/2000
1h	NJDEP, OIRM, BGIS	NJDEP 2002 Land use/Land cover Update, Lower Raritan, South River and Lawrence WMA-9	1/1/2007
2a	NJDEP, DER, BAM	NJDEP Ambient Air Quality Monitors	3/1/2006
2a	NJDEP, NJGS	DGS00-1: NJDEP Drought Regions of New Jersey	7/1/2000
2e	NJDEP, DWM,BWR	New Jersey Statewide Sewer Service Area (Version 201110)	10/1/2011
2e, 2g	Middlesex County	Middlesex County Outfall Points	4/14/2011
2f	Middlesex County	Middlesex County Sewer Infrastructure	4/14/2011
2f	Middlesex County	Middlesex County Sewer trunk interceptor lines	4/14/2011
2f, 10	NJDS, OPA	Brownfields Site Mart Locations	12/1/2008
2g	Highland Park	Highland Park GPS Points - Cell Phone Towers	6/1/2011
2g	Highland Park	Highland Park GPS Points - Stormwater Outfalls	6/7/2011
2g	Highland Park	Highland Park GPS Points - Stormwater Outfalls (DPW)	6/6/2011
3a	NJDEP, NJGS	DGS02-7: Physiographic Provinces of New Jersey	6/30/2002
3b	NJDEP, NJGS	DGS00-3: Topographic Elevation Contours for New Jersey (1:100,000 Scale)	12/29/1999
3b	Highland Park	Highland Park GPS Points - Elevation Contour Corrections	2/20/2012
3c	NJDEP, NJGS	DGS99-4: Digital Elevation Grids for New Jersey (1:100,000 scale)	12/17/1999

3d, 6g, 7d, 11	NJDEP, NJFFS	2002 NJFFS Wildfire Fuel Hazard for Middlesex County, New Jersey	4/17/2009
3e	NJDEP, NJGS	DGS04-6: Bedrock Geology for New Jersey 1:100,000 Scale	5/10/2007
3e, 3f	NJDEP, NJGS	DGS04-6: Bedrock Geology for New Jersey - Faults	6/30/1999
3f	NJDEP, NJGS	DGS04-1: Earthquakes Epicentered In New Jersey	1/3/2011
3g	NJDEP, NJGS	DGS97-2: Surficial Geology of Middlesex County, New Jersey	3/15/1996
3g, 6h	Highland Park	Highland Park GPS Points - Historic Fill on River Road	6/1/2011
3g, 6h	NJDEP, NJGS	DGS04-7: Historic Fill for New Jersey as of February 2009 - New Brunswick Quad	2/17/2009
3g, 6h	NJDEP, NJGS	DGS04-7: Historic Fill for New Jersey as of February 2009 - Plainfield Quad	2/17/2009
4a - 4i	USDA, NRCS	Soil Survey Geographic 2005 (SSURGO) Database for Middlesex County	8/18/2008
5b, 5c	NJDEP, NJGS	DGS96-3: Ambient Ground-Water Quality of the New Jersey Part of the Newark Basin	11/5/1995
5b, 5c	NJDEP, NJGS	DGS98-5: Aquifers of New Jersey	5/21/1998
5c	NJDEP, NJGS	DGS08-1: Canals and Water Raceways in New Jersey	7/9/2009
5c	NJDEP, NJGS	DGS97-1: NJDEP Public-Community Water-Supply Wells for New Jersey	2/18/2010
5d	NJDEP, NJGS	DGS02-3: Ground-Water Recharge for Watershed Management Area 9	10/21/2004
5e	NJDEP, NJGS	DGS07-1: Aquifer Recharge Potential for NJ Watershed Management Area 9	10/8/2004
5f	Highland Park	Highland Park GPS Points - Known Contaminated Sites Update	6/16/2011
5f	NJDEP, SRP,DRS,ISE	NJDEP Known Contaminated Site List for New Jersey (Non-Homeowner), Fall 2009	8/1/2009
5f	NJDEP,SRP,DRS, ISE	NJDEP Classification Exception Areas/Well Restriction Areas Polygon Maps for New Jersey, Version 201011	11/1/2010
5f	NJDEP,SRP,DRS, ISE	NJDEP Deed Notice Extent Polygons in New Jersey, Version 201011	11/1/2010
5f, 6a, 6i, 6j, 6l	NJDEP, NJGS	14 Digit Hydrologic Unit Code Delineations for New Jersey (Version 20110225)	2/25/2011
6d	Highland Park	Highland Park GPS Points - Culverted and Channelized Streams	1/3/2012
6e	ESRI	Aerial photo imagery	1/1/2010
6e	Highland Park	Highland Park GPS Points - Low Tide	6/1/2011
6e	NJDEP	NJDEP Head of Tide Points for Watercourses of New Jersey	1/1/1986
6f, 11	FEMA	Digital Flood Insurance Rate Map Database, Middlesex County, New Jersey	7/6/2010
6g, 11	Highland Park	50' Riparian Zone Buffers	1/5/2012
6h, 7c, 11	NJDEP, OIRM, BGIS	NJDEP 2007 Land use/Land Cover Update, Lower Raritan, South River and Lawrence, WMA09 - wetlands only	7/12/2010
6i	NJDEP, BFBM	NJDEP Surface Water Quality Standards of New Jersey (SWQS) (Version 201012)	12/1/2010
6j	NJDEP, DWQ, BSWP	NJPDES Surface Water Discharges in New Jersey, (1:12,000) Version 201111	11/16/2011
6l	NJDEP, BFBM	Ambient Stream Quality Monitoring Sites (1998 - 2010)	11/20/2008
6l	NJDEP, BFBM	NJDEP Ambient Biomonitoring Network (AMNET) Version 201011	11/1/2010
6l	NJDEP, BFBM	NJDEP Existing Water Quality Stations in New Jersey	10/19/2007
6l	NJDEP, BFBM	NJDEP Fish Index of Biotic Integrity Monitoring Network (2000-2009)	12/15/2010
6l	NJDEP, BFBM	NJDEP Supplemental Ambient Surfacewater Monitoring Network (SASMN), Version 20101221	12/21/2010
6l	NJDEP, BFBM	STORET Water Quality Monitoring Stations	8/1/2005
6l	USGS, WRD	USGS continuous-streamflow gaging locations in New Jersey	4/17/2002
6l	USGS, WRD	USGS stream crest gaging locations in New Jersey	4/17/2002
6l	USGS, WRD	USGS stream lowflow gaging locations in New Jersey	4/17/2002

6l	USGS, WRD	USGS surface-water quality gaging stations in New Jersey	4/17/2002
7e	Highland Park	Highland Park GPS Points - Street Tree Inventory	12/29/2011
7f	NJDEP, ENSP	NJDEP Landscape Project Emergent Wetland Version 2.1	7/1/2008
7f	NJDEP, ENSP	NJDEP Landscape Project Forest Version 2.1	7/1/2008
7f	NJDEP, ENSP	NJDEP Landscape Project Forested Wetland Version 2.1	7/1/2008
7g, 11	NJDEP, ONLM	NJDEP Natural Heritage Grid Map, Version 200911	11/1/2009
8a, 11	Highland Park	Highland Park GPS Points - Open Space	12/23/2011
8a, 11	Middlesex County	Middlesex County - Municipality Owned Open Space	9/28/2010
8a, 11	NJDEP, GA	NJDEP County Open Space and Recreation Areas in New Jersey	7/1/2011
8b	Highland Park	Highland Park GPS Points - Gardens	6/1/2011
9e	Highland Park	Highland Park GPS Points - Sites of High Archeological Potential	11/15/2011
9e	NJDEP, NHR,HPO	NJDEP Archaeological Site Grid of New Jersey (Edition 2011)	5/31/2011
9f	Highland Park	Highland Park GPS Points - Architecturally Interesting/Historic	10/1/2011
9f	Highland Park	Highland Park GPS Points - Livingston Manor Historic District	9/22/2011
10	NJDS, OPA	Center boundaries of the NJ State Development and Redevelopment Plan	12/7/2011
10	NJDS, OPA	Identified Centers of the State Development and Redevelopment Plan	12/7/2011
10	NJDS, OPA	Planning Areas of the NJ State Development and Redevelopment Plan	12/7/2011
10	NJDS, OPA	Smart Growth Areas	12/7/2011
10, 11	NJDA, OPA	Critical Environmental and Historic Sites (polygons) of the NJ State Development and Redevelopment Plan	12/7/2011

***Data Source Abbreviations:**	
ESRI	Environmental Systems Research Institute, Inc. (Esri.com)
FEMA	Federal Emergency Management Agency
Google	Google Earth (earth.google.com)
Highland Park	Highland Park Environmental Commission
HistoricAerials.com	Historic Aerials (historicaerials.com)
Middlesex County	Middlesex County Planning Board
NJDCA, OSG	NJ Department of Community Affairs, Office of Smart Growth (formerly the Office of State Planning)
NJDEP, BFBM	NJDEP Division of Landuse Management (DLM), Bureau of Freshwater & Biological Monitoring (BFBM)
NJDEP, DER, BAM	NJDEP Department of Environmental Regulation (DER), Bureau of Air Monitoring (BAM)
NJDEP, DWM, BWR	NJDEP Division of Watershed Management (DWM), Bureau of Watershed Regulation (BWR)
NJDEP, DWQ, BSWP	NJDEP Division of Water Quality (DWQ), Bureau of Surface Water Permitting
NJDEP, ENSP	NJDEP Division of Fish and Wildlife, Endangered and Nongame Species Program
NJDEP, NJGS	NJDEP Geological Survey
NJDEP, OEA, CTD	NJDEP Office of Environmental Analysis (OEA), Coast survey Limited (CTD)
NJDEP, OIRM, BGIS	NJDEP Office of Information Resources Management (OIRM), Bureau of Geographic Information Systems (BGIS)
NJDEP, SRP,DRS,ISE	NJDEP Site Remediation Program (SRP), Division of Remediation Support (DRS), Information Support Element (ISE)
NJDEP, WAT	NJDEP Bureau of Standards and Assessment, Water Assessment Team
NJDS, OPA	NJ Department of State, Office for Planning Advocacy
NJOIT, OGIS	New Jersey Office of Information Technology, Office of Geographic Information Systems
NJStateAtlas	New Jersey State Atlas (njstateatlas.com)
USDA, NRCS	United States Department of Agriculture, Natural Resources Conservation Service
USGS, WRD	United States Geological Survey, Water Resource Division

B-2. GIS Metadata – Details of GIS Data Layers Used

Environmental Systems Research Institute, Inc. (Esri.com)

Aerial photo imagery

Publication Date: 1/1/2010 Scale: Format: remote-sensing image
Used for Figure(s): 6e Online Link:
Short Description: Aerial photo - ESRI world imagery base layer 2010.

Federal Emergency Management Agency

Digital Flood Insurance Rate Map Database, Middlesex County, New Jersey

Publication Date: 7/6/2010 Scale: 1:12,000 Format: vector digital data
Used for Figure(s): 6f, 11 Online Link: http://www.fema.gov click on "Disasters and Maps" then click on "Map Service Center"
Short Description: The Digital Flood Insurance Rate Map (DFIRM) Database depicts flood risk information and supporting data used to develop the risk data. The FIRM is the basis for floodplain management, mitigation, and insurance activities for the National Flood Insurance Program (NFIP). The DFIRM Database presents the flood risk information depicted on the FIRM in a digital format suitable for use in electronic mapping applications.

Highland Park Environmental Commission

50' Riparian Zone Buffers

Publication Date: 1/5/2012 Scale: Format: vector digital data
Used for Figure(s): 6g, 11 Online Link: not available
Short Description: ArcMap was used by Kratzer Environmental Services to create 50' buffers around the ponds in Johnson and Donaldson Parks and the intermittent streams delineated by the Highland Park Environmental Commission.

Highland Park GPS Points - Architecturally Interesting/Historic

Publication Date: 10/1/2011 Scale: Format: Excel spreadsheet
Used for Figure(s): 9f Online Link: Not Available
Short Description: GPS points were collected by the Highland Park Environmental Commission to define the locations of architecturally interesting and historic structures within the Borough of Highland Park. Locations included those mentioned in the 1997 Highland Park Environmental Resource Inventory. These were converted to a shape file by Kratzer Environmental Services.

Highland Park GPS Points - Bike Path

Publication Date: 6/1/2011 Scale: Format: Excel spreadsheet
Used for Figure(s): most Online Link: Not Available
Short Description: GPS points were collected by the Highland Park Environmental Commission to define the location of the bike path in The Meadows in Highland Park. These were converted to a shape file by Kratzer Environmental Services.

Highland Park GPS Points - Cell Phone Towers

Publication Date: 6/1/2011 Scale: Format: Excel spreadsheet
Used for Figure(s): 2g Online Link: Not Available
Short Description: GPS points were collected by the Highland Park Environmental Commission to define the locations of cell towers within the Borough of Highland Park. These were converted to a shape file by Kratzer Environmental Services.

Highland Park GPS Points - Culverted and Channelized Streams

Publication Date: 1/3/2012 Scale: Format: Excel spreadsheet
Used for Figure(s): 6d Online Link: Not Available
Short Description: GPS points were collected by the Highland Park Environmental Commission to define locations where steams are channelized or culverted. Spreadsheet data of points were converted to polylines by Kratzer Environmental Services.

Highland Park GPS Points - Donaldson Stream

Publication Date: 6/1/2011 Scale: Format: Excel spreadsheet
Used for Figure(s): most Online Link: Not Available
Short Description: GPS points were collected by the Highland Park Environmental Commission to define the location of a small stream within Donaldson Park in Highland Park. These were converted to a shape file by Kratzer Environmental Services.

Highland Park GPS Points - Elevation Contour Corrections

Publication Date: 2/20/2012 Scale: Format: Excel spreadsheet
Used for Figure(s): 3b Online Link: Not Available
Short Description: Available elevation data had gaps in some of the elevation contours. Elevation points were collected by the

Highland Park Environmental Commission to correct these gaps.

Highland Park GPS Points - Gardens

Publication Date: 6/1/2011 Scale: Format: Excel spreadsheet
Used for Figure(s): 8b Online Link: Not Available
Short Description: GPS points were collected by the Highland Park Environmental Commission to define the corners and centers of gardens within the Borough of Highland Park. These were converted to a shape file by Kratzer Environmental Services.

Highland Park GPS Points - Historic Fill on River Road

Publication Date: 6/1/2011 Scale: Format: Excel spreadsheet
Used for Figure(s): 3g, 6h Online Link: Not Available
Short Description: GPS points were collected by the Highland Park Environmental Commission to define the corners of an area of historic fill on River Road in Highland Park, which is not included in the NJGS GIS layer of historic fill. These were converted to a shape file by Kratzer Environmental Services.

Highland Park GPS Points - Known Contaminated Sites Update

Publication Date: 6/16/2011 Scale: Format: Excel spreadsheet
Used for Figure(s): 5f Online Link: Not Available
Short Description: GPS points were collected by the Highland Park Environmental Commission to map the locations of 2 additional Known Contaminated Sites (KCS) (from updated Data Miner search), to correct the locations of 4 KCS and to delete 2 sites no longer on the list in Highland Park.

Highland Park GPS Points - Livingston Manor Historic District

Publication Date: 9/22/2011 Scale: Format: Excel spreadsheet
Used for Figure(s): 9f Online Link: Not Available
Short Description: GPS points were collected by the Highland Park Environmental Commission to define the outline of the Livingston Manor Historic District. Spreadsheet data of points were converted to polylines by Kratzer Environmental Services.

Highland Park GPS Points - Low Tide

Publication Date: 6/1/2011 Scale: Format: Excel spreadsheet
Used for Figure(s): 6e Online Link: Not Available
Short Description: GPS points were collected by the Highland Park Environmental Commission to define the location of low tide mud flats in the Raritan River in the Borough of Highland Park. These were converted to a shape file by Kratzer Environmental Services.

Highland Park GPS Points - Meadows Trail

Publication Date: 12/9/2011 Scale: Format: Excel spreadsheet
Used for Figure(s): most Online Link: Not Available
Short Description: GPS points were collected by the Highland Park Environmental Commission to define the location of the Meadows Trail in Highland Park. This represents the current trail after flooding in 2011 necessitated re-routing. These were converted to a shape file by Kratzer Environmental Services.

Highland Park GPS Points - Open Space

Publication Date: 12/23/2011 Scale: Format: Excel spreadsheet
Used for Figure(s): 8a, 11 Online Link: Not Available
Short Description: GPS points were collected by the Highland Park Environmental Commission to define additional open space locations. Spreadsheet data of points marking corners were converted to polylines by Kratzer Environmental Services.

Highland Park GPS Points - Sites of High Archeological Potential

Publication Date: 11/15/2011 Scale: Format: Excel spreadsheet
Used for Figure(s): 9e Online Link: Not Available
Short Description: GPS points were collected by the Highland Park Environmental Commission to define the locations of sites of high archeological potential within the Borough of Highland Park. These were converted to a shape file by Kratzer Environmental Services.

Highland Park GPS Points - Stormwater Outfalls

Publication Date: 6/7/2011 Scale: Format: Excel spreadsheet
Used for Figure(s): 2g Online Link: Not Available
Short Description: One GPS point was collected by the Highland Park Environmental Commission to define an additional stormwater outfall that was not included on the Middlesex County data or the Highland Park DPW data. This point was converted to a shape file by Kratzer Environmental Services.

Highland Park GPS Points - Stormwater Outfalls (DPW)

Publication Date: 6/6/2011 Scale: Format: Excel spreadsheet
Used for Figure(s): 2g Online Link: Not Available
Short Description: GPS points were collected by the Highland Park Department of Public Works define additional stormwater outfalls that were not included on the Middlesex County data. This point was converted to a shape file by Kratzer Environmental Services.

Highland Park GPS Points - Stream 7 (in The Meadows)

Publication Date: 12/26/2011 Scale: Format: Excel spreadsheet
Used for Figure(s): most Online Link: Not Available
Short Description: GPS points were collected by the Highland Park Environmental Commission to define the location of a small unnamed stream in The Meadows (designated as "Stream 7" in this report. Spreadsheet data of points were converted to polylines by Kratzer Environmental Services.

Highland Park GPS Points - Stream on River Road in Johnson Park
Publication Date: 6/1/2011 Scale: Format: Excel spreadsheet
Used for Figure(s): most Online Link: Not Available
Short Description: GPS points were collected by the Highland Park Environmental Commission to define the location of a small stream in Johnson Park within the Borough of Highland Park. These were converted to a shape file by Kratzer Environmental Services.

Highland Park GPS Points - Street Tree Inventory
Publication Date: 12/29/2011 Scale: Format: Excel spreadsheet
Used for Figure(s): 7e Online Link: Not Available
Short Description: GPS points were collected by the Highland Park Environmental Commission to define locations of significant street trees. Spreadsheet data of points were converted to polylines by Kratzer Environmental Services.

Historic Aerials (historicaerials.com)

1963 Aerial Photography
Publication Date: 12/31/1963 Scale: Format: remote-sensing image
Used for Figure(s): 1c Online Link: historicaerials.com (fee)
Short Description: HistoricAerials.com website accessed 7/7/2011. 1963 Aerial photo image of Highland Park.

Middlesex County Planning Board

Middlesex County - Municipality Owned Open Space
Publication Date: 9/28/2010 Scale: Format: vector digital data
Used for Figure(s): 8a, 11 Online Link: Not Available
Short Description: County database of open Space owned by the Borough of Highland Park.

Middlesex County Outfall Points
Publication Date: 4/14/2011 Scale: Format: vector digital data
Used for Figure(s): 2e, 2g Online Link: Not Available
Short Description: Comprehensive data of all storm pipe outfalls in Middlesex County as collected by the county public works department.

Middlesex County Railroads
Publication Date: 6/28/2011 Scale: Format: vector digital data
Used for Figure(s): 1g and Online Link: Not Available
Short Description: Railroads in Middlesex County from Middlesex County Planning Board.

Middlesex County Sewer Infrastructure
Publication Date: 4/14/2011 Scale: Format: vector digital data
Used for Figure(s): 2f Online Link: Not Available
Short Description: Sewer lines of Middlesex County derived from paper maps and GIS data that was provided by each municipality.

Middlesex County Sewer trunk interceptor lines
Publication Date: 4/14/2011 Scale: Format: vector digital data
Used for Figure(s): 2f Online Link: Not Available
Short Description: Sewer trunk interceptor lines from Middlesex County Planning Board.

NJDEP Division of Landuse Management (DLM), Bureau of Freshwater & Biological Monitoring (BFBM)

Ambient Stream Quality Monitoring Sites (1998 - 2010)
Publication Date: 11/20/2008 Scale: 1:2,400 Format: vector digital data
Used for Figure(s): 6l Online Link: http://www.state.nj.us/dep/gis/digidownload/zips/statewide/swpts.zip
Short Description: This dataset is a GIS layer of points representing ambient stream sites monitored cooperatively by the New Jersey Department of Environmental Protection (NJDEP) and the US Geological Survey (USGS) for water quality parameters. It includes fields identifying the type of station for each monitoring year as well as the presence and type of water level gauge, the associated land use, the method of locating the points and the availability of flow data.

NJDEP Ambient Biomonitoring Network (AMNET) Version 201011
Publication Date: 11/1/2010 Scale: 1:24,000 Format: vector digital data
Used for Figure(s): 6l Online Link: http://www.state.nj.us/dep/gis/digidownload/zips/statewide/biopts.zip
Short Description: This data represents point sites sampled by NJDEP as part of its Ambient Biomonitoring Network

(AMNET).

NJDEP Existing Water Quality Stations in New Jersey

Publication Date: 10/19/2007 Scale: Format: vector digital data
Used for Figure(s): 6l Online Link: http://www.state.nj.us/dep/gis/digidownload/zips/statewide/ewqpoi.zip
Short Description: This data represents sampling points for the EWQ (Existing Water Quality) project at NJDEP. The EWQ Network was designed to provide supplemental data for water quality for the entire state.

NJDEP Fish Index of Biotic Integrity Monitoring Network (2000-2009)

Publication Date: 12/15/2010 Scale: Format: vector digital data
Used for Figure(s): 6l Online Link: http://www.nj.gov/dep/gis/digidownload/zips/statewide/fibi.zip
Short Description: This data represents the NJDEP Fish Index of Biotic Integrity Monitoring Network active sample point locations for the years 2000 to 2009. A FIBI is an index that measures the health of a stream based on multiple attributes of the resident fish assemblage. Each site sampled is scored based on its deviation from reference conditions (i.e., what would be found in an unimpacted stream) and classified as "poor", "fair", "good" or "excellent".

NJDEP Supplemental Ambient Surfacewater Monitoring Network (SASMN), Version 20101221

Publication Date: 12/21/2010 Scale: 1:24,000 Format: vector digital data
Used for Figure(s): 6l Online Link: http://www.state.nj.us/dep/gis/digidownload/zips/statewide/sasmn.zip
Short Description: This data represents sampling points for the Supplemental Ambient Surfacewater Monitoring Network (formerly EWQ) project at NJDEP. The SASMN Network was designed to provide supplemental data for water quality for the entire state.

NJDEP Surface Water Quality Standards of New Jersey (SWQS) (Version 201012)

Publication Date: 12/1/2010 Scale: 1:24,000 Format: vector digital data
Used for Figure(s): 6i Online Link: http://www.state.nj.us/dep/gis/digidownload/zips/statewide/swqs.zip
Short Description: This data is a digital representation of New Jersey's Surface Water Quality Standards in accordance with "Surface Water Quality Standards for New Jersey Waters" as designated in N.J.A.C. 7:9 B. The Surface Water Quality Standards (SWQS) establish the designated uses to be achieved and specify the water quality (criteria) necessary to protect the State's waters. The GIS layer reflects the stream classifications and anti-degradation designations adopted as of December 21, 2009 is supplemental only and is not legally binding.

STORET Water Quality Monitoring Stations

Publication Date: 8/1/2005 Scale: unknown Format: vector digital data
Used for Figure(s): 6l Online Link: http://www.state.nj.us/dep/gis/digidownload/zips/statewide/storet.zip
Short Description: The STORET data maintains the locations of water quality monitoring stations from NJDEP's NJ STORET (Modernized) database. A station is a location at which a data collection event takes place, such a collection of a field sample, measurement of field parameters or evaluation of environmental habitats. NJ STORET maintains NJDEP's water quality monitoring data from January 1, 1999 to the present. Note: water quality monitoring data sampled prior to this date is stored in EPA's Legacy STORET database.

NJDEP Department of Environmental Regulation (DER), Bureau of Air Monitoring (BAM)

NJDEP Ambient Air Quality Monitors

Publication Date: 3/1/2006 Scale: 1:1,600 Format: vector digital data
Used for Figure(s): 2a Online Link: http://www.state.nj.us/dep/gis/digidownload/zips/statewide/airqm.zip
Short Description: Ambient Air Quality Monitors are strategically located stations throughout the state of New Jersey and collect and analyze certain air pollutant data.

NJDEP Division of Water Quality (DWQ), Bureau of Surface Water Permitting

NJPDES Surface Water Discharges in New Jersey, (1:12,000) Version 201111

Publication Date: 11/16/2011 Scale: 1:12,000 Format: vector digital data
Used for Figure(s): 6j Online Link: http://www.state.nj.us/dep/gis/digidownload/zips/statewide/njpdesswd.zip
Short Description: New Jersey Pollutant Discharge Elimination System (NJPDES) surface water discharge pipe GIS point coverage compiled from GPSed locations, NJPDES databases, and permit applications. This coverage contains the surface water discharge points and the receiving waters coordinates for the active as well as terminated pipes.

NJDEP Division of Fish and Wildlife, Endangered and Nongame Species Program

NJDEP Landscape Project Emergent Wetland Version 2.1

Publication Date: 7/1/2008 Scale: 1:12,000 Format: vector digital data
Used for Figure(s): 7f Online Link: http://www.state.nj.us/dep/gis/digidownload/zips/landscape/emergent.zip
Short Description: The Emergent data set depicts critical area maps for emergent dependent species which are generated

by selecting specific land-use classes from the NJDEP's LULC data set. This data set is a product of the Landscape Project, a pro-active, ecosystem-level approach to the long-term protection of imperiled and priority species and their important habitats in New Jersey. This version (version 2.1) was created by intersecting imperiled and priority species data with NJDEP 2002 Land use/Land cover Update. The resulting data layer identifies, delineates and ranks (based on the conservation status of species present) habitat statewide. Each patch is coded for the number of sightings of priority, state threatened, state endangered and federally listed species present. The data is designed to be used for state and local planning, open space acquisition and land-use regulation.

NJDEP Landscape Project Forest Version 2.1

Publication Date: 7/1/2008 Scale: 1:1200 Format: vector digital data
Used for Figure(s): 7f Online Link: http://www.state.nj.us/dep/gis/digidownload/zips/landscape/forest.zip
Short Description: The Forest data set depicts critical area maps for forest dependent species which are generated by selecting specific land-use classes from the NJDEP's LULC data set. See description of NJDEP Landscape Project Emergent Wetland Version 2.1 for more details.

NJDEP Landscape Project Forested Wetland Version 2.1

Publication Date: 7/1/2008 Scale: 1:1200 Format: vector digital data
Used for Figure(s): 7f Online Link: http://www.state.nj.us/dep/gis/digidownload/zips/landscape/forestedwetlands
Short Description: The Forested Wetland data set depicts critical area maps for forested wetland dependent species which are generated by selecting specific land-use classes from the NJDEP's LULC data set. See description of NJDEP Landscape Project Emergent Wetland Version 2.1 for more details.

NJDEP Geological Survey

14 Digit Hydrologic Unit Code Delineations for New Jersey (Version 20110225)

Publication Date: 2/25/2011 Scale: Format: vector digital data
Used for Figure(s): 5f, 6a, 6i, Online Link: http://www.state.nj.us/dep/gis/digidownload/zips/statewide/dephuc14.zip
Short Description: Watershed boundaries were based on elevations and water courses from 1:24,000-scale (7.5-minute) USGS quadrangles. These were revised (NJDEP, 2006) by clipping the unit boundaries to the official NJ state boundary and addition of some additional identification information. Once high-resolution LiDAR data (at 1:2,400 or better) become available for New Jersey the 14-digit hydrologic units will be redrawn and this interim coverage will be replaced.

DGS00-1: NJDEP Drought Regions of New Jersey

Publication Date: 7/1/2000 Scale: 1:24,000 Format: vector digital data
Used for Figure(s): 2a Online Link: http://www.state.nj.us/dep/njgs/geodata/dgs00-1.zip
Short Description: This coverage is a ArcView 3.x Geographic Information System shapefile that delineates New Jersey drought regions, counties, and municipalities. Drought regions provide a regulatory basis for coordinating local responses to regional water-supply shortages. The six drought regions are based on watershed and water-supply considerations.

DGS00-3: Topographic Elevation Contours for New Jersey (1:100,000 Scale)

Publication Date: 12/29/1999 Scale: 1:100,000 Format: vector digital data
Used for Figure(s): 3b Online Link: http://www.state.nj.us/dep/njgs/geodata/dgs00-3.htm
Short Description: Topographic elevation contour lines for New Jersey have been assembled for use in Geographic Information Systems (GIS). These data are georegistered to the NAD83 N.J. State Plane Coordinate System and are based on: 1) the 1:100,000 scale, U.S. Geological Survey Digital Line Graphs (DLG-3) of topographical-relief contours (hypsography), and 2) a line coverage of the N.J. coastline and shoreline from the N.J. Department of Environmental Protection (NJDEP) data archives. Line values for topographic-elevation contours are given in integer meters and decimal feet. The contour interval for the coverage ranges from 5-meters in the south part of the State to 20-meters in the north part.

DGS02-3: Ground-Water Recharge for Watershed Management Area 9

Publication Date: 10/21/2004 Scale: 1:24,000 Format: vector digital data
Used for Figure(s): 5d Online Link: http://www.njgeology.org/geodata/dgs02-3/dgs02-3.htm
Short Description: An estimation of ground-water recharge for Watershed Management Area 9 (Lower Raritan River, South River and Lawrence Brook). Ground-water recharge is estimated using the NJGS methodology from NJ Geological Survey Report GSR-32 "A Method for Evaluation of Ground-Water-Recharge Areas in New Jersey. Land-use/land-cover, soil and municipality-based climatic data were combined and used to produce an estimate of ground-water recharge in inches/year. Recharge was then ranked by volume (billions of gallons/year) using natural breaks in the percentage of total volume. The ground-water recharge model is limited to parcels of 1 acre or greater.

DGS02-7: Physiographic Provinces of New Jersey

Publication Date: 6/30/2002 Scale: 1:100,000 Format: vector digital data
Used for Figure(s): 3a Online Link: http://www.state.nj.us/dep/njgs/geodata/dgs02-7.htm
Short Description: New Jersey is divided into the Valley and Ridge, Highlands, Piedmont, and Coastal Plain Physiographic Provinces. Each province defines a region in which relief, landforms, and geology are significantly different from that of the adjoining and nearby regions. The boundary between each

province is determined by a major change in topography and geology, and this data set delineates the boundary lines between them.

DGS04-1: Earthquakes Epicentered In New Jersey

Publication Date: 1/3/2011 Scale: Format: vector digital data
Used for Figure(s): 3f Online Link: http://www.state.nj.us/dep/njgs/geodata/dgs04-1.htm
Short Description: The New Jersey Geological Survey Digital Geodata Series DGS04-1 dataset shows earthquakes that had epicenters in New Jersey. This data has 168 earthquakes with epicenters in New Jersey. Most are minor with magnitudes ranging from 0.4 to 5.3 and depths up to 25 km below sea level. Earthquakes with magnitude of 0 (zero) implies that the magnitude is unknown.

DGS04-6: Bedrock Geology for New Jersey - Faults

Publication Date: 6/30/1999 Scale: 1:100,000 Format: vector digital data
Used for Figure(s): 3e, 3f Online Link: http://www.state.nj.us/dep/njgs/geodata/dgs04-6.htm
Short Description: The Bedrock Geology of New Jersey consists of statewide and countywide data layers (contacts, faults, folds, dikes). The data are provided in: ESRI's ARC/INFO Geographic Information Systems (GIS). The GIS data were scanned and digitized from United States Geological Survey Miscellaneous Investigations and Open-File Series 1:100,000 scale geologic maps compiled from 1984 to 1993.

DGS04-6: Bedrock Geology for New Jersey 1:100,000 Scale

Publication Date: 5/10/2007 Scale: 1:100,000 Format: vector digital data
Used for Figure(s): 3e Online Link: http://www.state.nj.us/dep/njgs/geodata/dgs04-6.htm
Short Description: The Bedrock Geology of New Jersey consists of statewide and countywide data layers (contacts, faults, folds, dikes). The data are provided in: ESRI's ARC/INFO Geographic Information Systems (GIS). The GIS data were scanned and digitized from United States Geological Survey Miscellaneous Investigations and Open-File Series 1:100,000 scale geologic maps compiled from 1984 to 1993.

DGS04-7: Historic Fill for New Jersey as of February 2009 - New Brunswick Quad

Publication Date: 2/17/2009 Scale: 1:100,000 Format: vector digital data
Used for Figure(s): 3g, 6h Online Link: http://www.state.nj.us/dep/njgs/geodata/dgs04-7.htm
Short Description: The "Brownfield and Contaminated Site Remediation Act" (N.J.S.A. 58:10B-1 et seq.) requires the Department of Environmental Protection to map regions of the state where large areas of historic fill exist and make this information available to the public. This map shows areas of historic fill covering more than approximately 5 acres. For the purposes of this map, historic fill is non-indigenous material placed on a site in order to raise the topographic elevation of the site. No representation is made as to the composition of the fill or presence of contamination in the fill. Fill was mapped from stereo aerial photography taken in March 1979, supplemented in places by planimetric aerial photography taken in the spring of 1991 and 1992. Additional areas of fill were mapped by comparing areas of swamp, marsh, and floodplain shown on archival topographic and geologic maps on file at the N. J. Geological Survey, dated between 1840 and 1910, to their modern extent.

DGS04-7: Historic Fill for New Jersey as of February 2009 - Plainfield Quad

Publication Date: 2/17/2009 Scale: 1:100,000 Format: vector digital data
Used for Figure(s): 3g, 6h Online Link: http://www.state.nj.us/dep/njgs/geodata/dgs04-7.htm
Short Description: The "Brownfield and Contaminated Site Remediation Act" (N.J.S.A. 58:10B-1 et seq.) requires the Department of Environmental Protection to map regions of the state where large areas of historic fill exist and make this information available to the public. This map shows areas of historic fill covering more than approximately 5 acres. For the purposes of this map, historic fill is non-indigenous material placed on a site in order to raise the topographic elevation of the site. No representation is made as to the composition of the fill or presence of contamination in the fill. Fill was mapped from stereo aerial photography taken in March 1979, supplemented in places by planimetric aerial photography taken in the spring of 1991 and 1992. Additional areas of fill were mapped by comparing areas of swamp, marsh, and floodplain shown on archival topographic and geologic maps on file at the N. J. Geological Survey, dated between 1840 and 1910, to their modern extent.

DGS07-1: Aquifer Recharge Potential for NJ Watershed Management Area 9

Publication Date: 10/8/2004 Scale: 1:24,000 Format: vector digital data
Used for Figure(s): 5e Online Link: http://www.njgeology.org/geodata/dgs07-1.htm
Short Description: A qualitative representation of the potential for aquifer recharge for New Jersey Watershed Management Area 9 (Lower Raritan and South Rivers, and Lawrence Brook), built upon the combination of ground-water recharge value rankings and well-yield-based aquifer rankings. The ground-water recharge model is limited to parcels of 1 acre or greater.

DGS08-1: Canals and Water Raceways in New Jersey

Publication Date: 7/9/2009 Scale: Format: vector digital data
Used for Figure(s): 5c Online Link: http://www.njgeology.org/geodata/dgs08-1.htm
Short Description: This shapefile shows locations of current and historic canals and raceways. Where possible, these have been mapped based on site visits or current aerial photographs.

DGS96-3: Ambient Ground-Water Quality of the New Jersey Part of the Newark Basin

Publication Date: 11/5/1995 Scale: 1:24,000 Format: vector digital data
Used for Figure(s): 5b, 5c Online Link: http://www.state.nj.us/dep/njgs/geodata/dgsdown/dgs96-3.zip
Short Description: This map shows the location of wells used to characterize natural ground-water quality in the New Jersey part of the Mesozoic Newark basin. Wells include those from the Ambient Ground Water Quality Network and a study focusing on radionuclides in ground water. The data include attribute tables for the well locations and chemical parameters sampled for each well.

DGS97-1: NJDEP Public-Community Water-Supply Wells for New Jersey

Publication Date: 2/18/2010 Scale: 1:24,000 Format: vector digital data
Used for Figure(s): 5c Online Link: http://www.state.nj.us/dep/njgs/geodata/dgs97-1.zip
Short Description: The Public-Community Water-Supply (PCWS) Wells contains information for the wells in New Jersey that supply potable water to public communities. The NJDEP has cataloged and field located using the Global Positioning System (GPS) the PCWS wells as part of the Source Water Area delineation process. The data contained within is from the NJGS Wells Database.

DGS97-2: Surficial Geology of Middlesex County, New Jersey

Publication Date: 3/15/1996 Scale: 1:24,000 Format: vector digital data
Used for Figure(s): 3g Online Link: http://www.state.nj.us/dep/njgs/geodata/dgsdown/dgs97-2.zip
Short Description: This coverage shows the surficial geologic materials of Middlesex County. Surficial materials are the unconsolidated sediments that overlie bedrock or Coastal Plain formations, and that are the parent material for agronomic soils.

DGS98-5: Aquifers of New Jersey

Publication Date: 5/21/1998 Scale: 1:250,000 Format: vector digital data
Used for Figure(s): 5b, 5c Online Link: http://www.nj.gov/dep/gis/geowebsplash.htm
Short Description: The bedrock-aquifer coverage includes fractured-rock aquifers of the Valley and Ridge, Highlands, and Piedmont physiographic provinces, and aquifers and confining units of the Coastal Plain physiographic province.

DGS99-4: Digital Elevation Grids for New Jersey (1:100,000 scale)

Publication Date: 12/17/1999 Scale: 1:100,000 Format: vector digital data
Used for Figure(s): 3c Online Link: http://www.state.nj.us/dep/njgs/geodata/dgs99-4.htm
Short Description: A set of ARC/INFO GRID digital elevation themes with 100-foot cells has been compiled for New Jersey. These data are modified from the U.S. Geological Survey (USGS) 30-meter Digital Elevation Model data. DGS99-4 includes a set of nine elevation grids, an associated set of nine shaded-relief (hillshade) grids, and ArcView shade legends for project use.

NJDEP Office of Information Resources Management (OIRM), Bureau of Geographic Information Systems (BGIS)

NJDEP 1986 Land Use/Land Cover for Middlesex County, New Jersey

Publication Date: 1/1/1986 Scale: 1:24,000 Format: vector digital data
Used for Figure(s): 1h Online Link: http://www.state.nj.us/dep/gis/digidownload/zips/lulc/midlulc.zip
Short Description: This data was created by combining two separate data sets, the land use/land cover layer from the Integrated Terrain Unit Maps (ITUM) for this county and the freshwater wetlands (FWW) layer generated under the New Jersey Freshwater Wetlands Mapping Program. The Arc/INFO LULC coverage has been converted to an ArcView shapefile for distribution. The ITUM land use/land cover was photo interpreted from 1986 color infrared (CIR) 1:58000 aerial photos, and delineated using a modified Anderson et al. 1976, classification system to 1:24000 rectified photo-basemaps. Minimum mapping unit = 2.5 acres.

NJDEP 1995/97 Land use/Land cover Update, Lower Raritan, South River and Lawrence WMA-9

Publication Date: 12/1/2000 Scale: 1:12,000 Format: vector digital data
Used for Figure(s): 1h Online Link: http://www.state.nj.us/dep/gis/digidownload/zips/lulc95/w09lu95.zip
Short Description: This data was created by comparing the 1986 land use/land cover (LU/LC) layer from NJ DEP's geographical information systems (GIS) database to 1995/97 color infrared (CIR) imagery and delineating areas of change. Minimum mapping unit (MMU) is 1 acre.

NJDEP 2002 Land use/Land cover Update, Lower Raritan, South River and Lawrence WMA-9

Publication Date: 1/1/2007 Scale: Format: vector digital data
Used for Figure(s): 1h Online Link: http://www.state.nj.us/dep/gis/digidownload/zips/lulc02/w09lu02.zip
Short Description: The 2002 LU/LC was created by comparing the 1995/97 LU/LC layer from NJ DEP's geographical information systems (GIS) database to 2002 color infrared (CIR) imagery and delineating areas of change. Minimum mapping unit (MMU) is 1 acre.

NJDEP 2002 Waters of New Jersey (Lakes and Ponds), Version 20080501

Publication Date: 5/1/2008 Scale: 1:2,400 Format: vector digital data
Used for Figure(s): most Online Link: http://www.state.nj.us/dep/gis/digidownload/zips/statewide/njwaterbody.zip
Short Description: Photo Interpretation of the 2002 color infrared (CIR) imagery and digitizing of the 2002 Land Use/Land Cover data was done by Aerial Information Systems, Inc., Redlands, CA, under direction of

the New Jersey Department of Environmental Protection (NJDEP), Bureau of Geographic Information System (BGIS). The data was created by extracting water polygons which represented lakes and ponds from the 2002 land use/land cover (LU/LC) layer from NJ DEP's geographical information

NJDEP 2002 Waters of New Jersey (Rivers, Bays and Oceans), Version 20080501

Publication Date: 5/1/2008 Scale: 1:2,400 Format: vector digital data
Used for Figure(s): most Online Link: http://www.state.nj.us/dep/gis/digidownload/zips/statewide/njarea.zip
Short Description: Photo Interpretation of the 2002 color infrared (CIR) imagery and digitizing of the 2002 Land Use/Land Cover data was done by Aerial Information Systems, Inc., Redlands, CA, under direction of the New Jersey Department of Environmental Protection (NJDEP), Bureau of Geographic Information System (BGIS). The data was created by extracting water polygons which represented Rivers, Bays and Oceans from the 2002 land use/land cover (LU/LC) layer from NJ DEP's geographical information systems (GIS) database.

NJDEP 2007 Land use/Land Cover Update, Lower Raritan, South River and Lawrence, WMA09

Publication Date: 7/12/2010 Scale: 1:2400 Format: vector digital data
Used for Figure(s): 1g,1h,2g, Online Link: http://www.state.nj.us/dep/gis/digidownload/zips/lulc07/w09lu07.zip
Short Description: The 2007 LU/LC data set is the fourth in a series of land use mapping efforts that was begun in 1986. Revisions and additions to the initial baseline layer were done in subsequent years from imagery captured in 1995/97, 2002 and 2007. This present 2007 update was created by comparing the 2002 LU/LC layer from NJ DEP's Geographical Information Systems (GIS) database to 2007 color infrared (CIR) imagery and delineating and coding areas of change. Work for this data set was done by Aerial Information Systems, Inc., Redlands, CA, under direction of the New Jersey Department of Environmental Protection (NJDEP), Bureau of Geographic Information System (BGIS). Minimum mapping unit (MMU) is 1 acre.

NJDEP 2007 Land use/Land Cover Update, Lower Raritan, South River and Lawrence, WMA09 - wetlands only

Publication Date: 7/12/2010 Scale: 1:2,400 Format: vector digital data
Used for Figure(s): 6h, 7c, 11 Online Link: http://www.state.nj.us/dep/gis/digidownload/zips/lulc07/w09lu07.zip
Short Description: Wetlands were selected from 2007 land use/land cover data layer. Additional layers were created by calculating a 50 foot buffer and 150 foot buffer surrounding the wetlands. These are for illustration purposes, because an LOI from NJDEP is necessary to officially delineate wetlands and wetland buffers (transition areas).

NJDEP State Boundary of New Jersey

Publication Date: 1/11/1998 Scale: 1:24,000 Format: vector digital data
Used for Figure(s): 1a and Online Link: http://www.state.nj.us/dep/gis/digidownload/zips/statewide/state.zip
Short Description: This data represents the New Jersey State Boundary.

NJDEP Stream Network (Lower Hudson Basin)

Publication Date: 5/1/2008 Scale: 1:2,400 Format: vector digital data
Used for Figure(s): most Online Link: http://www.state.nj.us/dep/gis/digidownload/zips/hydro02/flowline020301.zip
Short Description: This metadata file contains generic information for the Streams delineated from 2002 color infrared (CIR) imagery.
Digitizing of this data was done by Aerial Information Systems, Inc., Redlands, CA, under direction of the New Jersey Department of Environmental Protection (NJDEP), Bureau of Geographic Information System (BGIS).

NJDEP Site Remediation Program (SRP), Division of Remediation Support (DRS), Information Support Element (ISE)

NJDEP Known Contaminated Site List for New Jersey (Non-Homeowner), Fall 2009

Publication Date: 8/1/2009 Scale: 1:1000 Format: vector digital data
Used for Figure(s): 5f Online Link: http://www.state.nj.us/dep/gis/digidownload/zips/statewide/kcsl.zip
Short Description: The Known Contaminated Sites List (KCSNJ) for New Jersey (Non-Homeowner) 2009 are those non-homeowner sites and properties within the state where contamination of soil or ground water has been confirmed at levels equal to or greater than applicable standards. This list of Known Contaminated Sites may include sites where remediation is either currently under way, required but not yet initiated or has been completed.

NJ Department of State, Office for Planning Advocacy

Brownfields Site Mart Locations

Publication Date: 12/1/2008 Scale: Format: vector digital data
Used for Figure(s): 2f, 10 Online Link: http://www.nj.gov/state/planning/docs/bfsitemart.zip
Short Description: The Brownfields SiteMart is a point feature class representing brownfield sites within the State of New Jersey that have been selected for inclusion on the NJ SiteMart, a website that indexes brownfield sites. Brownfields are defined as any former or current commercial or industrial site,

currently vacant or underutilized, on which there has been, or there is suspected to have been, a

Center boundaries of the NJ State Development and Redevelopment Plan

Publication Date: 12/7/2011 Scale: 1:24,000 Format: vector digital data
Used for Figure(s): 10 Online Link: http://www.nj.gov/state/planning/docs/cenlne2.zip
Short Description: This dataset contains the boundaries of Designated and Proposed Center of the NJ State Development and Redevelopment Plan (NJSDRP).

Critical Environmental and Historic Sites (polygons) of the NJ State Development and Redevelopment Plan

Publication Date: 12/7/2011 Scale: 1:24,000 Format: vector digital data
Used for Figure(s): 10, 11 Online Link: http://www.nj.gov/state/planning/docs/cehs2.zip
Short Description: This dataset contains the boundaries of Critical Environmental and Historic Sites (CEHS) of the NJ State Development and Redevelopment Plan (NJSDRP). CEHSs are areas, generally less than one square mile, which include one, or more, environmentally or historically sensitive features and are recognized by the State Planning Commission. CEHS locations were submitted by county and local entities. All sites submitted were accepted, with minimal requirement for documentation. Refer to the NJSDRP for further description of the geographic nature of CEHSs.

Identified Centers of the State Development and Redevelopment Plan

Publication Date: 12/7/2011 Scale: 1:24,000 Format: vector digital data
Used for Figure(s): 10 Online Link: http://www.nj.gov/state/planning/docs/cenpt2.zip
Short Description: This dataset contains the locations of Identified Centers of the NJ State Development and Redevelopment Plan (NJSDRP). Centers are the NJSDRP's preferred vehicle for accommodating

Planning Areas of the NJ State Development and Redevelopment Plan

Publication Date: 12/7/2011 Scale: 1:24000 Format: vector digital data
Used for Figure(s): 10 Online Link: http://www.nj.gov/state/planning/docs/splan2.zip
Short Description: This dataset contains the boundaries of the Planning Areas of the NJ State Development and Redevelopment Plan (NJSDRP). Planning Areas are areas of land, not less than one square mile, that share certain conditions, such as population density, infrastructure systems, level of development, or environmental sensitivity.

Smart Growth Areas

Publication Date: 12/7/2011 Scale: 1:24,000 Format: vector digital data
Used for Figure(s): 10 Online Link: http://www.nj.gov/state/planning/docs/sgareas.zip
Short Description: This dataset contains the boundaries of New Jersey's Smart Growth Areas. The Smart Growth Areas are a subset of the NJ State Development & Redevelopment Plan combined with growth areas of the NJ Pinelands Management Areas as well as some areas of the Meadowlands.

New Jersey Office Of Information Technology Office Of Geographic Information Systems

Counties of New Jersey, New Jersey State Plane NAD83

Publication Date: 5/20/2008 Scale: 1:2,400 Format: Vector digital data
Used for Figure(s): 1a and Online Link: https://njgin.state.nj.us/NJ_NJGINExplorer/index.jsp
Short Description: This data set is a spatial representation of counties in New Jersey.

Municipalities of New Jersey, New Jersey State Plane NAD83

Publication Date: 5/20/2008 Scale: 1:2,400 Format: vector digital data
Used for Figure(s): most Online Link: https://njgin.state.nj.us/NJ_NJGINExplorer/index.jsp
Short Description: This data set is a spatial representation of municipalities in New Jersey. These polygons do not represent legal boundaries. In some maps all municipalities are shown, while in others, only the boundary of Highland Park is used.

New Jersey 2002 High Resolution Orthophotography

Publication Date: 7/31/2003 Scale: 1:2,400 Format: remote-sensing image
Used for Figure(s): 1d Online Link: https://njgin.state.nj.us/NJ_NJGINExplorer/IW.jsp?DLayer=NJ 2002 Orthophotography
Short Description: Aerial photography of the entire State of New Jersey was captured during February-April, 2002. Digital color infrared (CIR) orthophotography of New Jersey in State Plane NAD83 Coordinates, U.S. Survey Feet. The digital orthophotography was produced at a scale of 1:2400 (1"=200') with a 1 foot pixel resolution. Digital orthophotography combines the image characteristics of a photograph with the geometric qualities of a map. Digital orthophotography is a process which converts aerial photography from an original photo negative to a digital product that has been positionally corrected for camera lens distortion, vertical displacement and variations in aircraft altitude and orientation.

New Jersey 2007 - 2008 High Resolution Orthophotography, MrSID 5K Tiles

Publication Date: 10/1/2008 Scale: 1:2,400 Format: remote-sensing image
Used for Figure(s): 1e, 1f Online Link: https://njgin.state.nj.us/NJ_NJGINExplorer/IW.jsp?DLayer=NJ 2007 Orthophotography
Short Description: Aerial photography of the entire State of New Jersey was captured during March-May, 2007. Digital

orthophotography of New Jersey in State Plane Coordinate System NAD83 Coordinates, U.S. Survey Feet. Multi-spectral digital orthophotography was produced at a scale of 1:2400 (1"=200') with a 1 foot pixel resolution for The State of New Jersey totaling approximately 8,162 square miles. Digital orthophotography combines the image characteristics of a photograph with the geometric qualities of a map. Digital orthophotography is a process which converts a digitized perspective aerial photograph or other remotely sensed image data to a digital product that has been rectified for camera lens distortion, vertical displacement caused by terrain relief and variations in aircraft altitude and

New Jersey State Atlas (njstateatlas.com)

1930 Aerial Photograph

Publication Date: 12/31/1930 Scale: Format: remote-sensing image
Used for Figure(s): 1b Online Link: http://njstateatlas.com/1930/
Short Description: NJ State Atlas website accessed 7/5/2011. 1930 Aerial Photo Image of Highland Park. Http://njstateatlas.com/1930/ . Not geo-referenced.

United States Department of Agriculture, Natural Resources Conservation Service

Soil Survey Geographic 2005 (SSURGO) Database for Middlesex County

Publication Date: 8/18/2008 Scale: 1:20,000 Format: vector digital data
Used for Figure(s): 4a - 4i Online Link: http://SoilDataMart.nrcs.usda.gov/
Short Description: SSURGO depicts information about the kinds and distribution of soils on the landscape. The soil map and data used in the SSURGO product were prepared by soil scientists as part of the National Cooperative Soil Survey. Middlesex County soils data sets were downloaded from the Natural Resource Conservation Service (NRCS) Soil Data Mart. The soil map units are linked to attributes and interpretations in the National Soil Information System relational database. Photographic or digital enlargement of these maps to scales greater than at which they were originally mapped can cause misinterpretation of the data. The depicted soil boundaries, interpretations, and analysis derived from them do not eliminate the need for onsite sampling, testing, and detailed study of specific sites for intensive uses. Thus, these data and their interpretations are intended for planning purposes only.

United States Geological Survey, Water Resource Division

USGS continuous-streamflow gaging locations in New Jersey

Publication Date: 4/17/2002 Scale: Format: vector digital data
Used for Figure(s): 6l Online Link: http://www.njgeology.org/geodata/dgs02-5/streamgage.zip
Short Description: This dataset is a GIS point coverage of continuous-streamflow gaging stations within the United States Geological Survey (USGS), Water Resource Division (WRD) streamflow-data-collection networks in the New Jersey District. Some of these sites are currently reporting streamflow data on the Interent. Other points in this coverage represent discontinued gages.

USGS stream crest gaging locations in New Jersey

Publication Date: 4/17/2002 Scale: Format: vector digital data
Used for Figure(s): 6l Online Link: http://www.njgeology.org/geodata/dgs02-5/creststage.zip
Short Description: This dataset is a GIS point coverage of stream crest gaging stations within the United States Geological Survey (USGS), Water Resource Division (WRD) streamflow-data-collection networks in the New Jersey District. Some of these sites are measured occasionally. Other points in this coverage represent discontinued gages.

USGS stream lowflow gaging locations in New Jersey

Publication Date: 4/17/2002 Scale: Format: vector digital data
Used for Figure(s): 6l Online Link: http://www.njgeology.org/geodata/dgs02-5/lowflow.zip
Short Description: This dataset is a GIS point coverage of stream lowflow gaging stations within the United States Geological Survey (USGS), Water Resource Division (WRD) streamflow-data-collection networks in the New Jersey District. Some of these sites are currently reporting streamflow data on the Interent. Other points in this coverage represent discontinued gages.

USGS surface-water quality gaging stations in New Jersey

Publication Date: 4/17/2002 Scale: Format: vector digital data
Used for Figure(s): 6l Online Link: http://www.njgeology.org/geodata/dgs02-5/wqgages.zip
Short Description: This dataset is a GIS point coverage of water-quality gaging stations within the United States Geological Survey (USGS), Water Resource Division (WRD) streamflow-data-collection networks in the New Jersey District. Some of these sites are currently reporting water quality data on the Internet. Other points in this coverage represent discontinued gage present discontinued gages.

APPENDIX C: PLANTS, ANIMALS & ENDANGERED SPECIES

Contents

C-1. Native Plants Growing in Highland Park Gardens

Wildflowers

Aconitum uncinatum	Blue monkshood
Agastache scrophulariaefolia	Purple giant hyssop
Anaphalis margaritacea	Pearly everlasting
Anemone canadensis	Canada anemone
Anemone quinquefolia	Wood anemone
Aquilegia canadensis	Wild columbine
Arisaema triphyllum	Jack-in-the-pulpit
Asarum canadense	Wild ginger
Asclepias tuberose	Butterfly weed
Asclepias syriaca	Milkweed
Aster divaricata	Wood aster
Aster ericoides	Heath aster
Aster novae-angliae	New England aster
Aster oblongifolius	Aster - 'October Skies' cultivar
Baptisia australis	Blue false indigo
Camassia leichtlinii, C.quamash	Camass
Cassia hebecarpa	Wild senna
Chelone lyonii	Turtlehead
Cimicifuga racemosa	Bugbane, Black cohosh
Convallaria majalis	Lily of the valley [some debate about native status]
Coreopsis lanceolata	tickseed
Coreopsis rosea	pink coreopsis
Coreopsis verticillata	Thread leaf tickseed
Dicentra exemia	Wild bleeding heart
Dodecatheon meadia	Shooting star
Echinacea purpurea	Purple coneflower
Eupatorium coelestinum	Perennial ageratum
Eupatorium perfoliatum	boneset
Eupatorium purpureum	Joe pye weed
Eupatorium rugosum	White snakeroot
Geranium maculatum	Wood geranium
Hedyotis caerulea	Bluets
Heliopsis helianthoides	Summer sundrops
Heuchera americana	Alumroot
Hibiscus palustris/moscheutos	Rose mallow
Iris cristata	Dwarf crested iris
Jeffersonia diphylla	Twinleaf
Liatris spicata	Blazing star
Lobelia cardinalis	Cardinal flower
Lobelia siphilitica	Great blue lobelia
Mertensia virginica	Virginia blue bells

Monarda didyma	Beebalm
Penstemon digitalis	Beardtongue - 'Husker Red' cultivar
Phlox divaricata	Woodland phlox
Phlox carolina	Miss Lingard garden phlox
Phlox paniculata	Garden phlox, summer phlox
Phlox stolonifera	Creeping phlox
Phlox subulata	Moss pink
Physostegia virginiana	Obedient plant
Polemonium reptans	Jacob's ladder
Polygonatum biflorum	Solomon's seal
Porteranthus = Gillenia stipulatus	Bowman's root, American ipecac
Rudbeckia fulgida	Eastern coneflower
Rudbeckia hirta	Black-eyed Susan
Rudbeckia laciniata	Cutleaf coneflower
Salvia lyrata	Cancer weed, lyre-leaf sage, wild sage
Silene caroliniana	Wild pink
Sisyrinchium angustifolium	Blue-eyed grass
Solidago canadensis	Goldenrod;[many more species exist]
Thalictrum dasycarpum	Meadow rue
Thalictrum dioicum	Early meadow rue
Tiarella cordifolia	Foamflower, 'Brandywine' cultivar
Tiarella wherryi	Wherry's foamflower
Tradescantia virginiana	Spiderwort
Viola sororia, V.cucullata, et al	Common, meadow, marsh violet [NJ state flower]
Uvularia grandiflora	Big merry bells
Zizia aurea	Golden alexander

Shrubs

Aronia arbutifolia	Red chokeberry
Aronia melanocarpa	Black chokeberry
Calycanthus floridus	Eastern sweetshrub
Callicarpa americana	American beautyberry
Ceanothus americanus	New Jersey tea
Clethra alnifolia	Sweet pepperbush
Cornus alternifolia	Pagoda dogwood, Pigeonberry
Cornus racemosa	Grey dogwood
Cornus sericea	Red osier dogwood, Yellow twig dogwood
Euonymus americanus	Strawberry bush
Fothergilla gardenii	Dwarf fothergilla
Hamamellis virginiana	American witch hazel
Hydrangea arborescens	Smooth hydrangea
Hydrangea quercifolia	Oakleaf hydrangea
Ilex glabra	Inkberry holly
Ilex verticillata	Winterberry holly
Itea virginica	Virginia sweetspire
Juniperus horizontalis	Creeping juniper

Leucothoe fontanesiana	Drooping leucothoe
Lindera benzoin	Spicebush
Sambucus canadensis	Common elderberry
Physocarpus opulifolius	Ninebark
Rhododendrun viscosum	Swamp azalea
Rhus aromatica	Fragrant sumac
Rhus typhina	Staghorn sumac
Vaccinium corymbosum	Blueberry
Viburnum acerifolium	Maple-leaved viburnum
Viburnum dentatum	Arrowwood viburnum
Vibernum prunifolium	Blackhaw
Viburnum trilobum	American cranberrybush

Vines

Ampelopsis quinquefolia	Virginia creeper
Campsis radicans	Trumpet vine, Trumpet creeper
Lonicera sempervirens	Trumpet honeysuckle
Parthenocissus quinquefolia	Virginia creeper
Wisteria frutescens	American wisteria

Trees

Acer rubrum	Red maple
Acer saccharum	Sugar maple
Aesculus pavia	Red buckeye
Amelanchier canadensis	Serviceberry, Shadbush
Betula nigra	River birch
Carya species	Hickory (probably Shagbark)
Celtis occidentalis	Hackberry
Cercis canadensis	Redbud
Chamaecyparis thyoides	Atlantic white cedar
Cladrastis kentukea	Yellowwood
Cornus florida	Flowering dogwood
Crataegus (species)	Hawthorn
Fraxinus (species)	Ash (white, green and/or red ash trees)
Ilex opaca	American holly
Juglans nigra	Black walnut
Juniperus virginiana	Eastern red cedar
Liquidamber styraciflua	Sweetgum
Liriodendron tulipifera	Tuliptree
Magnolia macrophylla	Bigleaf magnolia
Magnolia virginiana	Sweet bay magnolia
Nyssa sylvatica	Black tupelo
Oxydendrun arboreum	Sourwood
Pinus strobus	White pine
Platanus occidentalis	American sycamore
Prunus serotina	Wild black cherry

Quercus alba	White oak
Quercus muehlenbergii	Chinkapin oak
Quercus nigra or velutina (not sure)	Black oak
Quercus palustris	Pin oak
Quercus phellos	Willow oak
Quercus rubra	Northern red oak
Tilia americana	American linden, 'Redmond' cultivar

Ferns

Adiantum pedatum	Maidenhair fern
Athyrium asplenioides	Lady fern
Dennstaedtia punctilobula	Hayscented fern
Dryopteris marginalis	Marginal wood fern
Matteuccia struthiopteris	Ostrich fern
Polystichum acrostichoides	Christmas fern
Onoclea sensibilis	Sensitive fern
Osmunda cinnamomea	Cinnamon fern
Osmunda regalis	Royal fern

Grasses, Sedges

Carex nigra	Black sedge
Panicum virgatum	Switch grass

Total species: 145

Prepared and updated April, 2010 by:
Jeff Zajac (member, Highland Park Community Wildlife Habitat, NPSNJ)
Karen Swaine (member HPSTAC, HP Environmental.Commission, NPSNJ)
Mary Denver (member HPSTAC, NPSNJ, HP Community Wildlife Habitat)
Belinda Beetham (member HPSTAC, NPSNJ)
Updated June 2011 by: Highland Park Environmental Commission

C-2. Birds in Highland Park

Common Name	Breeding Status	Non-Breeding Status
American Black Duck		
American Coot		
American Crow		
American Goldfinch		
American Kestrel	Special Concern+	Special Concern+
American Oystercatcher	Special Concern	Special Concern
American Pipit		
American Redstart		
American Robin		
American Tree Sparrow		
American Wigeon		
American Woodcock		
Bald Eagle	Endangered	Threatened
Baltimore Oriole		
Bank Swallow		
Bar-headed Goose		
Barn Swallow		
Belted Kingfisher		
Black & white Warbler		
Black Skimmer	Endangered	Threatened
Black Vulture		
Black-billed Cuckoo	Special Concern	Regional Priority
Blackburnian Warbler	Special Concern	Regional Priority
Black-capped Chickadee		
Black-crowned Night Heron	Threatened	Special Concern
Blackpoll Warbler		
Black-throat. Blue Warbler	Special Concern	Stable
Black-throat. Green Warbler	Special Concern	Stable
Blue jay		
Blue-gray Gnatcatcher		
Blue-headed Vireo	Special Concern	Stable
Blue-winged Teal		
Blue-winged Warbler		
Bonaparte's Gull		
Brant		
Broad-winged Hawk	Special Concern	Regional Priority
Brown Creeper		
Brown Thrasher	Special Concern	Regional Priority
Brown-headed Cowbird		
Buff-breasted Sandpiper		
Bufflehead		
Cackling Goose		
Canada Goose		
Canada Warbler	Special Concern	Regional Priority
Canvasback		
Carolina Chickadee		
Carolina Wren		
Caspian Tern	Special Concern	Regional Priority
Cattle Egret	Special Concern+	Special Concern
Cedar Waxwing		
Chestnut-sided Warbler		
Chimney Swift		
Chipping Sparrow		
Cliff Swallow	Special Concern	Special Concern
Common Goldeneye		
Common Grackle		
Common Loon		
Common Merganser		
Common Nighthawk	Special Concern	Special Concern
Common Redpoll		
Common Tern	Special Concern	Regional Priority
Common Yellowthroat		
Cooper's hawk	?	Threatened

Common Name	Breeding Status	Non-Breeding Status
Dark-eyed Junco		
Dickcissel		
Double-crest. Cormorant		
Downy Woodpecker		
Eastern Bluebird		
Eastern Kingbird		
Eastern Meadowlark	Special Concern	Special Concern
Eastern Phoebe		
Eastern Towhee		
Eastern Wood-Pewee		
Egyptian Goose		
European Starling		
Field Sparrow		
Fish Crow		
Fox Sparrow		
Gadwall		
Glossy Ibis	Special Concern	Regional Priority
Golden-crowned Kinglet		
Gray Catbird		
Great Black-backed Gull		
Great Blue Heron	Special Concern	Stable
Great Cormorant		
Great Crested Flycatcher		
Great Egret		
Great Horned Owl		
Greater Scaup		
Greater Yellowlegs		
Green Heron		
Green-winged Teal		
Gyrfalcon		
Hairy Woodpecker		
Hermit Thrush		
Herring Gull		
Hooded Merganser	Special Concern	Regional Priority
Hooded Warbler	Special Concern	Regional Priority
Horned Grebe		
Horned lark	Special Concern+	Special Concern
House Finch		
House Sparrow		
House Wren		
Iceland Gull		
Indigo Bunting		
Killdeer		
Laughing Gull		
Least Flycatcher	Special Concern	Stable
Least Sandpiper		
Least Tern	?	Endangered
Lesser Black-backed Gull		
Lesser Scaup		
Lesser Yellowlegs		
Lincoln's Sparrow		
Little Blue Heron	Special Concern	Special Concern
Magnolia Warbler		
Mallard		
Merlin		
Mourning Dove		
Mute Swan		
Nashville Warbler	Special Concern	Stable
No. Rough-winged Swallow		
Northern Cardinal		
Northern Flicker		
Northern Goshawk	Endangered	Special Concern
Northern Harrier	Endangered	Special Concern
Nrthern Mockingbird		

Common Name	Breeding Status	Non-Breeding Status
Northern Parula	Special Concern	Stable
Northern Pintail		
Northern Shoveler		
Northern Waterthrush		
Orchard Oriole		
Osprey	Threatened	
Ovenbird		
Palm Warbler		
Peregrine Falcon	?	Endangered
Pied-billed Grebe	Endangered	Special Concern
Pileated Woodpecker		
Pine Siskin		
Pine Warbler		
Prairie Warbler		
Prothonotary Warbler		
Purple Finch		
Red-bellied Woodpecker		
Red-breasted Merganser		
Red-breasted Nuthatch		
Red-eyed Vireo		
Redhead		
Red-headed Woodpecker	?	Threatened
Red-shouldered Hawk	Endangered	Threatened
Red-tail Hawk		
Red-throated Loon		
Red-winged Blackbird		
Ring-billed Gull		
Ring-necked Duck		
Rock Pigeon		
Rose-breasted Grosbeak		
Rough-legged Hawk		
Ruby-crowned Kinglet		
Ruby-thr. Hummingbird		
Ruddy Duck		
Ruffed Grouse		
Rusty Blackbird		
Savannah Sparrow	Threatened	
Scarlet Tanager		

Common Name	Breeding Status	Non-Breeding Status
Semipalmated Plover	N/A	Special Concern
Semipalmated Sandpiper	Special Concern	Special Concern
Sharp-shinned hawk		
Short-billed Dowitcher		
Snow Goose		
Snowy Egret	Special Concern	Regional Priority
Solitary Sandpiper		
Song Sparrow		
Spotted Sandpiper	Special Concern	Regional Priority
Summer Tanager		
Surf Scoter		
Swainson's Thrush		
Swamp Sparrow		
Tree Swallow		
Tufted Titmouse		
Turkey Vulture		
Veery	Special Concern	Regional Priority
Warbling Vireo		
Western Sandpiper		
White-breasted Nuthatch		
White-crowned Sparrow		
White-eyed Vireo		
White-rumped Sandpiper		
White-throated Sparrow		
Wild Turkey		
Winter Wren	Special Concern	Stable
Wood Duck		
Wood Thrush	Special Concern	Regional Priority
Yellow Warbler		
Yellow-bellied Sapsucker		
Yellow-billed Cuckoo		
Yellow-breasted Chat	Special Concern	Regional Priority
Yellow-crowned Night Heron	Threatened	
Yellow-rumped Warbler		
Yellow-throated Vireo		

+ Proposed for change to Threatened status

Williams, Joanne. 2010. Bird Sightings 2010 (Highland Park Area, primarily Donaldson and Johnson Parks). 2001-2011 also available. http://www.leoraw.com/hpenv/biod/birds.php

NJDEP Division of Fish and Wildlife. October 29, 2008. Wildlife Species of Special Concern in New Jersey. http://www.njfishandwildlife.com/spclspp.htm

NJDEP Division of Fish and Wildlife. March 11, 2004. New Jersey's Endangered and Threatened Wildlife. http://www.njfishandwildlife.com/tandespp.htm

C-3. Middlesex County Rare Plant Species and Ecological Communities

7/30/2008

Rare Plant Species and Ecological Communities Presently Recorded in the NJ Natural Heritage Database

Scientific Name	Common Name	Federal Status	State Status	Regional Status	G Rank	S Rank
County: **Middlesex**						
Terrestrial Community - Other Classification						
Leersia oryzoides - polygonum (caespitosum, hydropiper) herbaceous vegetation	Rice Cutgrass - (Oriental Ladysthumb, Marshpepper Knotweed) Coastal Plain Intermittent Pond Herbaceous Vegetation				G4	S2S3
Vascular Plant						
Agalinis auriculata	Ear-leaf False Foxglove			HL	G3	SX
Agastache nepetoides	Yellow Giant-hyssop			HL	G5	S2
Artemisia campestris ssp. caudata	Beach Wormwood			HL	G5T5	S2
Asclepias rubra	Red Milkweed			LP, HL	G4G5	S2
Asclepias variegata	White Milkweed			HL	G5	S2
Asclepias verticillata	Whorled Milkweed			HL	G5	S2
Aster concolor	Eastern Silvery Aster			LP, HL	G4?	S2
Aster radula	Low Rough Aster		E	LP, HL	G5	S1
Bidens bidentoides	Estuary Burr-marigold			HL	G3	S2
Bidens eatonii	Eaton's Beggar-ticks		E	LP, HL	G2	S1.1
Calamovilfa brevipilis	Pine Barren Reedgrass			LP	G4	S4
Carex barrattii	Barratt's Sedge			LP	G4	S4
Carex louisianica	Louisiana Sedge		E	LP, HL	G5	S1
Carex polymorpha	Variable Sedge		E	LP, HL	G3	S1
Carex retrorsa	Retrorse Sedge			HL	G5	S2
Carex utriculata	Bottle-shaped Sedge			HL	G5	S2
Carex willdenowii var. willdenowii	Willdenow's Sedge			HL	G5T5	S2
Castilleja coccinea	Scarlet Indian-paintbrush			HL	G5	S2

County: **Middlesex**

Ceratophyllum echinatum	Spiny Coontail		E	LP, HL	G4?	S1
Clematis occidentalis var. occidentalis	Purple Clematis			HL	G5T5	S2
Crataegus calpodendron	Pear Hawthorn		E	LP, HL	G5	S1
Cuphea viscosissima	Blue Waxweed			HL	G5?	S3
Cyperus lancastriensis	Lancaster Flat Sedge		E	LP, HL	G5	S1
Desmodium humifusum	Trailing Tick-trefoil		E	LP, HL	G1G2Q	S1
Draba reptans	Carolina Whitlow-grass		E	LP, HL	G5	SH
Elatine americana	American Waterwort			HL	G4	S2
Epilobium angustifolium ssp. circumvagum	Narrow-leaf Fireweed			HL	G5T5	S1
Eupatorium altissimum	Tall Boneset			HL	G5	S2
Gentiana saponaria var. saponaria	Soapwort Gentian			HL	G5TNR	S3
Helonias bullata	Swamp-pink	LT	E	LP, HL	G3	S3
Hottonia inflata	Featherfoil		E	LP, HL	G4	S1
Hydrocotyle ranunculoides	Floating Marsh-pennywort		E	LP, HL	G5	S1
Isoetes riparia var. riparia	Shore Quillwort			HL	G5?T5?Q	S3
Lathyrus ochroleucus	Cream Vetchling		E	LP, HL	G4G5	SH
Liatris scariosa var. novae-angliae	Northern Blazing-star		E	LP, HL	G5?T3	SH
Listera australis	Southern Twayblade			LP, HL	G4	S2
Lygodium palmatum	Climbing Fern			LP, HL	G4	S2
Lysimachia hybrida	Lowland Loosestrife			HL	G5	S3
Malaxis unifolia	Green Adder's-mouth			HL	G5	S2
Melanthium virginicum	Virginia Bunchflower		E	LP, HL	G5	S1
Micranthemum micranthemoides	Nuttall's Mudwort		E	LP, HL	GH	SH
Mimulus alatus	Winged Monkey-flower			HL	G5	S3
Myriophyllum tenellum	Slender Water-milfoil		E	LP, HL	G5	S1
Myriophyllum verticillatum	Whorled Water-milfoil		E	LP, HL	G5	SH

County: **Middlesex**

Phoradendron leucarpum	American Mistletoe		LP, HL	G5	S2
Plantago maritima var. juncoides	Seaside Plantain		HL	G5T5	S2
Platanthera ciliaris	Yellow Fringed Orchid		LP, HL	G5	S2
Platanthera flava var. flava	Southern Rein Orchid	E	LP, HL	G4T4?Q	S1
Platanthera flava var. herbiola	Tubercled Rein Orchid		HL	G4T4Q	S2
Platanthera peramoena	Purple Fringeless Orchid	E	LP, HL	G5	S1
Polygala polygama	Racemed Milkwort		HL	G5	S2
Polygonum glaucum	Sea-beach Knotweed	E	LP, HL	G3	S1
Puccinellia fasciculata	Saltmarsh Alkali Grass		HL	G3G5	S2
Pycnanthemum torrei	Torrey's Mountain-mint	E	LP, HL	G2	S1
Ranunculus pusillus var. pusillus	Low Spearwort		HL	G5T4?	S2
Rhododendron canadense	Rhodora	E	LP, HL	G5	S1
Ribes cynosbati	Prickly Gooseberry		HL	G5	SH
Sabatia dodecandra var. dodecandra	Large Marsh-pink		HL	G5?T4T5	S2
Sagittaria australis	Southern Arrowhead	E	LP, HL	G5	S1
Sagittaria calycina var. spongiosa	Tidal Arrowhead		HL	G5T4	S3
Scirpus maritimus	Saltmarsh Bulrush	E	LP, HL	G5	SH
Scutellaria leonardii	Small Skullcap	E	LP, HL	G4T4	S1
Solidago elliottii	Elliott's Goldenrod		HL	G5	S3
Solidago rigida	Prairie Goldenrod	E	LP, HL	G5T5	S1
Stachys hyssopifolia	Hyssop Hedge-nettle		HL	G5	S2
Triglochin maritima	Seaside Arrow-grass	E	LP, HL	G5	S1
Utricularia gibba	Humped Bladderwort		LP, HL	G5	S3
Utricularia purpurea	Purple Bladderwort		LP, HL	G5	S3
Verbena simplex	Narrow-leaf Vervain	E	LP, HL	G5	S1

County: **Middlesex**

Viburnum opulus var. americanum	Highbush-cranberry		HL	G5T5	S3
Vicia americana var. americana	American Purple Vetch		HL	G5T5	S1
Viola brittoniana var. brittoniana	Britton's Coast Violet		HL	G4G5T4T5	S3
Zigadenus leimanthoides	Death-camus	E	LP, HL	G4Q	S1

C-4. Rare Plant Report Form

Natural Heritage Rare Plant Species Reporting Form

This form is used to report a personal field sighting of a rare plant species tracked by the Natural Heritage Database. It may also be used to summarize locational information from a published or unpublished report. Plant species tracked include those appearing on the State Endangered Plant Species List or the Plant Species of Concern List (http://www.nj.gov/dep/parksandforests/natural/heritage/spplant.html). The Office of Natural Lands Management can provide copies of the lists upon request. In order for this form to be processed, the sections preceded by an asterisk (*) must be completed.

Send completed form to: DEP, Division of Parks and Forestry, Office of Natural Lands Management, Natural Heritage Program, P.O. Box 404, Trenton, NJ 08625-0404.

Today's Date: (date this form is being completed) _____

Common Name: _____ **Scientific Name:** _____

***Location Map:** *A mapped location of the occurrence must accompany this form.* The ideal format is to locate the site on a photocopied section of a U.S. Geological Survey 7.5 minute topographical map, and to also sketch a second map showing finer details. Be sure to provide the name of the USGS map.

GPS Coordinates (If available please provide the following):

Datum Used:	☐ NAD 1983	☐ NAD 1927	☐ WGS84	☐ Other _____
Lat/Long (if applicable):	_____ N (Latitude)		_____ W (Longitude)	
UTM (if applicable)	18 N/S: _____ Northing		_____ Easting	
Accuracy Level:	+/-_____ ☐ feet or ☐ meters			

***Directions to Site:** Directions to the element occurrence using a readily locatable and relatively permanent landmark on or near the site (such as a road intersection, a prominent hill or cliff) as the starting point. Use clear, complete sentences so that someone who is unfamiliar with the area will be able to relocate the element occurrence using your written directions (e.g., "About 50 ft. N. of small stream draining Brindel Lake, 0.5 mi. SE of Brindeltown and 0.2 mi. WSW of jct. of Range Rd. and Rt. 539, Fort Dix").

***Date(s) of the Observation(s):** _____

Identification: How was the species identification made? Name the identification manuals used or the experts consulted. Were there identification problems?

***Number of Individuals Observed:**

☐ 1-10 ☐ 11-50 ☐ 101-1,000 ☐ 1,001-10,000 ☐ >10,000

If possible, provide the exact number of individuals and an estimated percentage of flowering/fruiting individuals. For rhizomatous plants such as grasses and sedges, what was counted as individual – separate culms or entire clumps or patches?

Life Stages Present: Check life stages observed or provide an estimate of the numbers of individuals for each life stage.

☐ vegetative ☐ in bud ☐ flower ☐ seed dispersing ☐ seedling ☐ dormant

Associated Species/Additional Biological Data: List any associated species and/or additional rare species observed at this site. What else was observed? Provide information on the general condition or vigor of the individuals and viability of the population(s).

Habitat Data: Describe the specific area where the occurrence is located. List natural community types, dominant vegetation and information on the physical environment such as substrate type, hydrology, moisture regime, slope and aspect. Also, describe the surrounding landscape.

Threats: Describe any current or potential threats to this occurrence. If invasive species are present, please list.

Ownership: If known, please provide landowner(s) name, address, phone #.

Information Source:

***Name, Address and Phone #** (of person filing report):

Name:	
Address:	
Phone Number:	

*Does this information come directly from ☐ a field visit or ☐ a published or unpublished report?

Citation: For information taken from a published or unpublished report, please provide a copy of the cover page and the pertinent portions of the report. If a copy can not be provided, list below the author, date, title, publisher, and page numbers.

Voucher: Was the observation vouchered with ☐ a photograph? ☐ a video/digital format? ☐ a specimen?
If possible, attach a copy of the photograph or tape. If specimen voucher, please provide the name of the repository:

Confirmation: Would you accompany a biologist to the site if needed? ☐ yes ☐ no

Additional Comments: (use extra sheets if needed)

C-5. Rare Wildlife Report Form

RARE WILDLIFE SIGHTING REPORT FORM

REPORT FORM MUST BE ACCOMPANIED BY AN AERIAL PHOTOGRAPH, SATELLITE IMAGE, OR TOPOGRAPHIC MAP WITH THE LOCATION PRECISELY MARKED. PLEASE PRINT LEGIBLY.
*The inclusion of a map is mandatory, please see other side for further information on obtaining a map.

General Information

Today's Date _____
Common Name _____ Scientific Name (If known) _____

Where did the sighting take place?

Municipality/ Township _____ County _____

Topographic quad (if known) _____ Coordinates in state plane feet (if known) _____ _____

Directions to location with landmarks, which will enable the future relocation of the site where the species was sighted:

_____

_____

_____

Land Owner (name, address and phone number, if known) _____
Describe habitat at the point of sighting and habitat in the general area of the sighting location.

_____

_____

Would you accompany a biologist to the site if needed? ☐ Yes ☐ No
Can you describe any immediate or future plans to develop or disturb the site? ☐ Yes ☐ No
If so, please describe. _____

_____

Locational Accuracy

1. Is your depiction of the sighting location on the topographic map or aerial photo within 6m (20ft) of the animals actual location on the ground? ☐ Yes ☐ No (if no, answer question 2 below)

2. Your mapping is accurate to within ___ meters ___ feet ___ miles of the actual location.

What was observed?

How was the species identification made? (ex. Sighting, Call, Road Kill, etc.) _____

Date and time of this sighting (ex. August 20, 2004, 10:30am) _____

How frequently has this species been sighted at this location and over how long a period of time? _____

_____

Number of individuals sighted: Adult ____ Immature ____ Larva ____ Unknown/Other ____

Describe sighting and activity observed (ex. Nesting, Perched, Flying, Sunning, etc.) _____

Describe physical features that identify the sighted animal as the species you are reporting. _____

_____

_____

Were photos taken? ☐ Yes ☐ No Was video recorded? ☐ Yes ☐ No Was audio recorded? ☐ Yes ☐ No
(PHOTOS/VIDEO/AUDIO ARE STRONGLY ENCOURAGED IN ORDER TO VERIFY THE ACCURACY OF A SIGHTING. Items should be identified with the date taken, location, and observer signature. Items will not be returned.)

List manuals used or experts consulted to verify identification. _____

Provide a brief background on wildlife knowledge and/or experience, or additional information that would add to the validity of the sighting. _____

_____

Can this be verified by someone else or can anyone vouch for your identification skills? ☐ Yes ☐ No _____

Describe any additional information that may be useful in regards to the condition of the animal or location.

_____

_____

Your Contact information

Name _____
Street _____
City _____ State _____ ZIP _____
Daytime Phone ( ) - E-mail _____

Preferred method of contact _____

Signature _____

Conserve Wildlife
NJ Division of Fish, Game & Wildlife
Endangered & Nongame Species Program

Return to:
Endangered and Nongame Species Program
NJ Division of Fish and Wildlife
PO Box 400
Trenton, NJ 08625-0400
(609) 292-9400

NEW JERSEY DIVISION OF
Fish and Wildlife

Instructions

1. Complete this form for first-hand field observations only.
2. DO NOT COMPLETE THIS FORM if the source of your information is a report, letter, conversation, or other document. Send us the documentation instead.
3. Attach a copy of a map.(*see below*)
4. Only report one species at each location per form and map.

***Mapping**
A map is necessary to help our biologists determine if suitable habitat is present at the location. Once the suitability of the area is determined the map provided aids in the delineation of land to be protected. Ideally the most accurate form of map is an aerial photo, which can be obtained from http://www.state.nj.us/dep/gis/newmapping.htm, if you are comfortable with your ability to identify the location of the sighting accurately on them. In addition, satellite-derived images are available at http://www.maps.google.com. These images can be printed and clearly marked with a pen. An alternative to an aerial photo or satellite image is a topographic map. You may also print copies of topographic maps from the internet at http://www.topozone.com. Please use 1:24,000 scale topographic maps only. Please provide either an image or a topographic map, but NOT both. Thank you.

Refer to the DFW website for further information: http://www.njfishandwildlife.com/ensp/rprtform.htm

APPENDIX D: LOCAL & REGIONAL CONSERVATION GROUPS

The following non-profit groups may be of interest to readers of this report. Listing does not constitute an endorsement by the Borough of Highland Park.

Association of NJ Environmental Commissions www.anjec.org ANJEC is a private, nonprofit educational organization for environmental commissioners, concerned individuals and organizations to protect natural resources and improve the quality of life in NJ.
Central Jersey Trout Unlimited www.cjtu.org Our mission is to conserve, protect and restore New Jersey's cold water fisheries and their environments.
Conserve Wildlife Foundation of New Jersey www.conservewildlifenj.org The Conserve Wildlife Foundation of NJ is a private, not-for-profit organization dedicated to conserving and protecting New Jersey's endangered and threatened wildlife.
Earth Share of New Jersey www.earthsharenj.org A coalition of leading environmental organizations working to promote human health and welfare through environmental management, conservation, advocacy, research, education, and grassroots organizing in New Jersey.
Middlesex County - Rutgers Cooperative Research and Extension www.co.middlesex.nj.us/extensionservices/index.asp The Cooperative Extension serves as the educational outreach arm of the US Dept. of Agriculture to provide research based information concerning agriculture, nutrition and food safety.
National Wildlife Federation www.nwf.org The National Wildlife Federation promotes wildlife conservation.
Native Plant Society of New Jersey www.npsnj.org The Native Plant Society of NJ is a statewide non-profit organization founded for the appreciation, protection, and study of the native flora of New Jersey.
NatureServe www.natureserve.org NatureServe is a network providing the scientific basis for effective conservation of rare and endangered species and threatened ecosystems. NJ Natural Heritage Program is the local program for NJ: www.state.nj.us/dep/parksandforests/natural/heritage/index.html
New Jersey Aquarium www.njaquarium.org The New Jersey Academy for Aquatic Sciences promotes the understanding, appreciation and protection of aquatic life and habitats through research, education and youth development programs.
New Jersey Audubon www.njaudubon.org The NJAS is a statewide non-profit organization which fosters environmental awareness and a conservation ethic among NJ's citizens; protects NJ's birds, other animals, and plants, especially endangered and threatened species; and promotes preservation of NJ's valuable natural habitats.
New Jersey Community Water Watch http://www.njpirgstudents.org/water-watch New Jersey Community Water Watch is a joint program between AmeriCorps and the NJPIRG Law

and Policy Center that works to empower students and community members to address water quality problems in NJ's urban areas through education, cleanups and stream monitoring.
New Jersey Conservation Foundation www.njconservation.org The NJCF mission is to preserve New Jersey land and natural resources for the benefit of all now and for future generations. As a leading innovator and catalyst for saving land, NJCF: creates and promotes strong land use policies; protects strategic lands.
New Jersey Future www.njfuture.org New Jersey Future's mission is to achieve smart growth statewide: growth that protects New Jersey's open lands and natural resources, improves communities, transportation and housing choices through research, policy analysis, public education and advocacy.
New Jersey Sierra Club www.newjersey.sierraclub.org Mission is to explore, enjoy, and protect the wild places of the earth; To practice and promote the responsible use of the earth's ecosystems and resources; To educate and enlist humanity to protect and restore the quality of the natural and human environments.
New Jersey Natural Lands Trust nj.gov/dep/njnlt/ Mission is to preserve land in its natural state for enjoyment by the public and to protect natural diversity through the acquisition of open space.
New Jersey Section - American Water Works Association www.njawwa.org The NJAWWA is dedicated to the promotion of public health and welfare in the provision of drinking water of unquestionable quality and sufficient quantity by advancing the technology, science, management and government policies relative to the stewardship of water.
New Jersey Water Supply Authority – Watershed Protection Unit www.njwsa.org/wpu/ Raritan Basin Watershed Management Project www.raritanbasin.org/alliance.html The NJWSA formed its Watershed Protection Programs Unit in Fiscal Year 1999 to improve the protection of water resources for the Raritan River Basin, the Manasquan River watershed and the Delaware & Raritan Canal and its tributary watersheds.
PlanSmart NJ www.plansmartnj.org/ PlanSmart NJ is a statewide civic action group committed to improving the quality of community life through the advancement of sound land use planning and regional cooperation.
South Branch Watershed Association www.sbwa.org The South Branch Watershed Association (SBWA) is a not-for-profit organization dedicated to protecting the environment in the watershed of the South Branch Raritan River.
Sustainable Raritan River www.blueraritan.org/ The members of the Raritan River Collaborative are working together to achieve the highest quality for the waters and riparian areas of the Raritan River basin.
The Nature Conservancy - NJ www.nature.org/wherewework/northamerica/states/newjersey/ The mission of the Nature Conservancy is to preserve the plants, animals and natural communities that represent the diversity of life on Earth by protecting the lands and waters they need to survive.
Upper Raritan Watershed Association www.urwa.org URWA's mission is to ensure the protection of the natural resources of the Upper Raritan Watershed through education, advocacy, land preservation and stewardship.
Wild New Jersey www.wildnj.com/ Created to foster an understanding of, and respect for, wildlife and wild places in the Garden State.

APPENDIX E: LIVINGSTON MANOR HISTORIC DISTRICT

Livingston Manor Historic District

Livingston Homestead Waldron House	
U.S. National Register of Historic Places	
New Jersey Register of Historic Places	
Location:	801 Harrison Avenue
Architect:	Whittlesey, Waldron et al
Architectural style:	Greek Revival
NRHP Reference#:	02000215[39]
NJRHP #:	3950 [40]
Significant dates	
Added to NRHP:	March 20, 2002
Designated NJRHP:	December 20, 2001

Livingston Manor Historic District	
U.S. National Register of Historic Places	
U.S. Historic District	
New Jersey Register of Historic Places	
Location:	Parts of Cleveland, Grant, Harrison, Lawrence, Lincoln, Madison, and North Second Avenues and River Road
NRHP Reference#:	04000672[39]
NJRHP #:	4289 [40]
Added to NRHP:	July 7, 2004

Livingston Manor was a subdivision built upon the lands surrounding the Livingston Homestead. This subdivision was the brainchild of Watson Whittlesey (1863–1914), a real estate developer born in Rochester, New York. Whittlesey was more than a typical land speculator; he was a community builder, which was noted by his residency in various Livingston Manor houses from 1906 to 1914, and by his active involvement in the municipal affairs of Highland Park. Instead of auctioning lots like his 19th century predecessors, Whittlesey sold subdivided lots with either a house completely built by his company or with the promise of providing a company-constructed house similar to those previously constructed.[41]

The suburban development grew between 1906 and 1925 when Whittlesey's company, the Livingston Manor Corporation and its successor, the Highland Park Building Company, constructed single-family houses from plans produced by a select group of architects. While a variety of building types and styles are present on each block, the buildings in the district are distinct by the use of specific building plans found nowhere else in Highland Park and by the embellishments that are typical of the Craftsman philosophy, which emphasized the value of the labor of skilled artisans who showed pride in their abilities.

In the first years of this development, the houses were constructed one entire block at a time beginning with the southeast side of Grant Avenue between Lawrence Avenue and North Second Avenue. The next block to be developed was the northwest side of Lincoln Avenue between Lawrence Avenue and North Second Avenue. Six stucco bungalows were then constructed on the southern side of Lawrence east of Lincoln Avenue. As the housing development grew in popularity, houses were constructed less systematically by block, and more often on lots that individual homeowners randomly selected from the remaining available properties. Whittlesey used plans from architects George Edward Krug and Francis George Hasselman, as well as plans generated by several local architects including John Arthur Blish and William Boylan [42] Several of Livingston Manor's Tudor Revival houses were designed by Highland Park's eminent architect, Alexander Merchant. Merchant created numerous buildings in New Brunswick and

Highland Park (see list below). Like other early-20th century architects, he was active during the period of early American modernism, but having trained at the firm of Carrère and Hastings. Merchant developed and maintained a classical design vocabulary.
Many workers in the building trades such as Harvey E. Dodge, Frederick Nietscke, a carpenter and Harold Richard Segoine, a contractor, have also been identified as Livingston Manor Corporation employees as well as Livingston Manor residents. Whittlesey, with his wife Anna, also lived in several Livingston Manor houses including the Spanish Colonial style house at 35 Harrison Avenue designed specifically for them.
On December 1, 1906, the first deeds were transferred to two individual homeowners. Many prominent New Brunswick and Highland Park residents bought houses in this new neighborhood. They included Rutgers College professors, school teachers, bank employees, factory owners, and store owners. Census data shows that most of the women were housewives and mothers. There were many extended families. Some families took in boarders and several households included live-in servants.[43] Sixty-two houses had been constructed in Livingston Manor by 1910.

In 1912, Watson Whittlesey hired a sales agent, John F. Green, and began selling bungalow lots. These properties were smaller and less expensive, and a set of plans for a bungalow was given to any purchaser. By 1913, 120 houses had been constructed in Livingston Manor.

Dubbed "Lord of the Manor", Whittlesey created a neighborhood spirit by giving receptions to the residents; by providing playgrounds for the children; and by encouraging the men to take a more active part in public affairs. After his death on April 8, 1914, Manor residents turned out in the hundreds to attend a memorial service at his house. [44]

The Highland Park Building Company was incorporated in 1914 by long-standing members of his company including builder Robert Lufburrow and engineer Harold Richard Segoine. In 1916, Mrs. Whittlesey, who was president of the Livingston Manor Corporation, turned over the privately owned streets, sidewalks, and curbs to the borough. Remarkably, there were no provisions for the borough to accept public ownership of the sewers. That required an act of legislation at the statehouse in Trenton, which was accomplished by Senator Florance, Assemblyman Edgar, and signed by Governor Walter Evans Edge he following year. Anna Wilcox Whittlesey, "Lady of the Manor", died on August 16, 1918. She was remembered as "a woman of rare refinement and culture, and the soul of hospitality."[45]

Highland Park's identity as a streetcar suburb was transformed to that of an automobile suburb during the 1920s. Two hundred and ten dwellings had been constructed in Livingston Manor by 1922. The Livingston Manor Corporation continued to have transactions into the 1960s, but the area's significant development had taken place by 1925.

It has always been locally recognized that Livingston Manor is an important neighborhood in Highland Park. The Livingston Manor Historic District was listed in the New Jersey Register of Historic Places on April 1, 2004 and in the National Register of Historic Places on July 7, 2004. This text was condensed from the National Register nomination written by Borough Historian Jeanne Kolva [42].

Buildings Designed by Alexander Merchant

- 55 South Adelaide Avenue (1909)
- Lafayette School on South Second Avenue and Benner Street (original school-1907 and Second Avenue wing-1915. The third wing on Second Avenue was designed by Merchant's son Alexander Merchant, Jr. in 1952). The Lafayette School is now condominiums and no longer a school.
- Reformed Church on South Second Avenue (original church-1897 and auditorium wing circa 1920)
- Irving School on Central Avenue (original building-1914)
- The Center School on North Third Avenue (formerly the Hamilton School in 1914)
- The Pomeranz Building on Raritan Avenue and South Third Avenue (1920)
- 82 Harrison Avenue (1913)
- Two houses on Cliff Court (1914)
- Several houses on South Adelaide Avenue near Cliff Court (1910–1914)
- The Highland Park High School (original building-1926)
- The Masonic Temple on Raritan Avenue at North Fourth Avenue (1923) It remains as a one-story commercial building after a fire in 1965 destroyed the upper levels of the auditorium and offices.
- The Brody House at corner of Raritan and North Adelaide Avenues (built 1911—demolished 1997)
- The former Police Station at 137 Raritan Avenue (now a deli).
- Anshe Emeth Memorial Temple on Livingston Avenue in neighboring New Brunswick (1929)

References

- [39] National Register of Historic Places. Retrieved 2011-07-05.
- [40]"New Jersey and National Registers of Historic Places - Middlesex County". NJ DEP - Historic Preservation Office. June 2, 2011. p. 11. Retrieved July 5, 2011.
- [41] "Livingston Manor Historic District". Highland Park Historical Society. Retrieved 2011-07-06.
- [42] Kolva, Jeanne and Joanne Pisciotta. *Highland Park; Borough of Homes*. (Charleston, SC: Arcadia Publishing, 2005).
- [43] US Census 1910, 1920, and New Jersey Census of 1915.
- [44] Daily Home News, April 10, 1914.
- [45] Daily Home News, August 17, 1918 Obituary. "New Jersey - Middlesex County"

Source: Wikipedia, Highland Park, New Jersey, http://en.wikipedia.org/wiki/Highland_Park,_New_Jersey#cite_ref-43 Accessed 10/20/11