ENVIRONMENTAL RESOURCE INVENTORY

ERI

MARCH 2012

For the Borough of:

SWEDESBORO

Gloucester County, New Jersey

by:

DELAWARE VALLEY dvrpc REGIONAL PLANNING COMMISSION

with:

The Swedesboro Environmental Commission

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The Delaware Valley Regional Planning Commission is dedicated to uniting the region's elected officials, planning professionals, and the public with a common vision of making a great region even greater. Shaping the way we live, work, and play, DVRPC builds consensus on improving transportation, promoting smart growth, protecting the environment, and enhancing the economy. We serve a diverse region of nine counties: Bucks, Chester, Delaware, Montgomery, and Philadelphia in Pennsylvania; and Burlington, Camden, Gloucester, and Mercer in New Jersey. DVRPC is the federally designated Metropolitan Planning Organization for the Greater Philadelphia Region — leading the way to a better future.

The symbol in our logo is adapted from the official DVRPC seal and is designed as a stylized image of the Delaware Valley. The outer ring symbolizes the region as a whole while the diagonal bar signifies the Delaware River. The two adjoining crescents represent the Commonwealth of Pennsylvania and the State of New Jersey.

DVRPC is funded by a variety of funding sources including federal grants from the U.S. Department of Transportation's Federal Highway Administration (FHWA) and Federal Transit Administration (FTA), the Pennsylvania and New Jersey departments of transportation, as well as by DVRPC's state and local member governments. The authors, however, are solely responsible for the findings and conclusions herein, which may not represent the official views or policies of the funding agencies.

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and

The Borough of Swedesboro

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The impetus for the creation of this document, and its guidance and review, came from the Swedesboro Environmental Commission.

The Swedesboro Environmental Commission:

- Larry Phillips, Chairperson
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- Denise Kues
- Deborah Phillips

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Executive Summary

Swedesboro is a municipality of less than one square mile (495 acres) with a population of almost 2,400 people. Named after the Swedish colonists who settled the area in the 1600s, Swedesboro became the civic and commercial hub for the surrounding agricultural region. Many historic buildings and structures from its early development are still present, including Trinity Church, the Vanleer Cabin, and many notable homes.

Swedesboro lies in the Inner Coastal Plain, which is characterized by highly productive, prime farmland. These agricultural soils, however, are also highly suitable for development. Buildable land and a temperate climate, in addition to Swedesboro's highway accessibility, have attracted much development in recent years.

Lake Narraticon

There are nearly two miles of streams running through Swedesboro, a majority of which are headwater streams. There are also over 10 acres of lakes and ponds, including Lake Narraticon and Mill Pond. Swedesboro lies entirely within the Raccoon Creek watershed, which is divided into two subwatersheds within the borough. In 2008, both of these subwatersheds were impaired for one or more designated uses.

All public water supply wells in Swedesboro tap the Potomac-Raritan-Magothy (PRM) aquifer system. Although vast, this confined aquifer has pumping restrictions due to overuse. Water conservation methods are crucial for maintaining the quantity and quality of Swedesboro's groundwater resources.

While a majority of Swedesboro's land is considered urban, it still supports a diversity of natural vegetation types, located mainly along its waterways. Upland forests cover eight percent of the borough, while wetlands and agriculture each make up five percent of the borough. Also located in Swedesboro is a freshwater tidal marsh complex, a rare ecological community. In addition, the bald eagle, an endangered species, and other species of concern have been identified in Swedesboro.

Swedesboro, along with the surrounding area, has experienced tremendous population growth in recent years. Accommodating development sustainably requires an understanding of the critical natural and community resources within the borough. This Environmental Resource Inventory (ERI) is an important step towards that goal.

CHAPTER 1

Introduction

The purpose of an Environmental Resource Inventory (ERI) is to identify and describe the natural resources of a community. A community's natural resources – its soil, water, air, forests, fields, and waterways – are fundamental to its character. The protection and wise use of those resources is essential to the public health, safety, and welfare of current and future residents.

The Environmental Resource Inventory provides the basis for the development of methods and steps to preserve, conserve, and utilize those resources, although it does not include specific recommendations to those ends. It is, instead, a compendium of all the existing information that can be found about a municipality's natural resources, presented in a form that is useful to a broad audience. The Inventory reflects a particular moment in time, and should be updated as new data becomes available.

The settlement and growth of Swedesboro is inherently tied to its natural resources. Early Swedish settlers found the land surrounding the banks of Raccoon Creek ideal for agricultural and industrial uses. Fertile soils allowed for productive farming and animal rearing, abundant woodlands supplied raw materials for mills and furnaces, and navigable streams connected Swedesboro to regional markets. Swedesboro continued to grow in the nineteenth and twentieth centuries following the construction of major railroads and highway corridors. Access to major employment centers along with a charming historic character and rural setting have long drawn residents to the borough.

As development pressures increase in and around Swedesboro, documentation of its natural resources becomes a necessity. Special measures to protect the integrity of wetland and forest habitats for a variety of plant and animal species are crucial. The protection of Raccoon Creek and Lake Narraticon is also important in order to maintain and improve high water quality, diverse habitats, and recreation opportunities for residents. These resources are critically important in protecting the health and vitality of the borough. An understanding of these resources will aid Swedesboro in balancing the pressures of growth with conservation, and will enable the borough to maintain and shape its unique identity while preserving its rich historic fabric and environmental resources.

Sources

Several documents and reports were utilized in preparing the *Environmental Resource Inventory (ERI) for the Borough of Swedesboro*. These reports and references are listed at the end of this document.

The maps and data relating to natural resources are mainly derived from the New Jersey Department of Environmental Protection's (NJDEP's) Geographic Information System mapping, the Landscape Project produced by the Endangered and Nongame Species Program of the NJDEP Division of Fish and Wildlife, reports by the United States Geologic Service (USGS) and New Jersey Geologic Service, and data and maps compiled by the Delaware Valley Regional Planning Commission (DVRPC). Information from these sources specific to Swedesboro has been included whenever it was available. Information from other reports about specific sites has also been incorporated, along with data provided by the borough and county. The ERI has been reviewed and revised by members of the Swedesboro Environmental Commission, the Swedesboro-Woolwich Historical Society, and other borough officials and residents.

Descriptive introductions to some topics have been included in the ERI to give readers background on various complex topics. The hope is that this information will also assist the Environmental Commission and other borough officials in obtaining additional data from state sources in the future and in determining the types of investigations that still need to be conducted.

CHAPTER 2

Brief History

Long before European settlement, various peoples occupied the lands near the Delaware River. By the time of European settlement, these Native Americans called themselves the Lenni Lenape. Later, they were called the Delaware Indians by Europeans. The Lenni Lenape inhabited much of southern New Jersey and their settlements were usually located along stream banks. The subtribe in the Raccoon Creek area called themselves the Narraticon, a word meaning raccoon. They farmed, maintained orchards, fished, and hunted. Deposits of unique blue clay found along the Delaware River also provided painting and pottery material for the Lenni Lenape.

Although these original inhabitants lived in southern New Jersey for thousands of years while leaving a minimal mark on the land, they succumbed to the diseases and encroachment of the newly arrived European settlers. By 1758, the remaining Native Americans south of the Raritan River were encouraged to live in the 3,258-acre reservation called Brotherton in present-day Shamong Township, New Jersey. This has been recognized as the first Indian Reservation in the country, although it did not survive beyond 1802. As with other Eastern tribes, those remaining ultimately moved westward. Tribal members from Brotherton relocated to join the Mahicans (or Mohicans) in New York State, and later moved to Ohio and then Wisconsin.

The first European settlers in the Delaware Valley were the Dutch, who, in 1624, founded a colony near what is today Gloucester City, Camden County. In 1644, King Charles II of England took control of much of America’s eastern seaboard, and deeded most of present-day New Jersey to his brother, the Duke of York, who split it into East and West.

In 1686, Gloucester County was formed as a part of Western New Jersey, and at the time included the present-day Atlantic and Camden Counties. During the colonial era, Gloucester County's main economic activity was agriculture, but eventually it expanded to include industrial and residential functions.

While most of Gloucester County was settled by English Quakers, the banks of Raccoon Creek, a tributary to the Delaware River, were first settled by Swedish and Finnish colonists as a part of New Sweden. They arrived as early as 1638, calling the settlement Raccoon due to its close proximity to Raccoon Creek. The Raccoon Creek was navigable up to the settlement. Settlers found the location along the riverbanks ideal for their agricultural lifestyle with fertile soils suitable for crops, freshwater streams, and abundant woodlands of oak, birch, maple, and pine.

The Swedes had well-established homesteads in the area by 1687 and had purchased much of their land from the Narraticon tribe. It was the Swedes who gave shelter to the

passengers of the first English ship to arrive in 1677, which docked on Raccoon Creek. As with all Swedish colonies, the 1702 founding of Trinity Church in present-day Swedesboro helped to preserve their culture in the New World.

Peter Kalm, a Finnish botanist and one of the most famous recorders of botany in the colonies, traveled in the region between 1748 and 1751. He established his headquarters in Raccoon and in his important account, *Travels in North America*, reported the different types of fruit growing on local farms. Early settlers grew grains, fruits, and vegetables and tended livestock. Farming continues to be a principal industry in the region, and some of New Jersey's richest farmland is located around present-day Swedesboro in Woolwich Township.

During the 1700s and 1800s, more people of European descent began moving into the region. Most were English and German settlers arriving from other parts of New Jersey, but there were also people from Ireland and, later, Italy. In addition, African Americans established communities in the area. As the population diversified, Raccoon was renamed Swedesboro in 1765 as a tribute to the original settlers and their heritage.

In 1794, Charles C. Stratton was born in the Stratton Mansion located just outside of Swedesboro. Stratton served in Congress and later as the Governor of New Jersey from 1845 to 1848. Stratton was the only Governor from Gloucester County, as well as the first popularly elected governor under the new State Constitution. Tradition claims Dolly Madison was a frequent visitor to the Stratton Mansion.

Swedesboro has long been an attractive location due to its close proximity to an interconnected network of waterways, roads, and railroads. Boats relied on the wide tidal Raccoon Creek to carry farm produce to local markets in Philadelphia while early gristmills and sawmills depended on the tributaries to these streams to provide their power. By the late-1600s, Swedesboro had become a rapidly growing town with the completion of King’s Highway, the first road to cross Camden and Gloucester counties. Established in 1854, the Swedesboro Railroad, one of the earliest lines in the southern part of Gloucester County, opened new markets for shipping products, especially farm produce, from the Swedesboro area to nearby regions.

By the mid-1800s, farms and mills were becoming the economic engine for Swedesboro and Woolwich Township. The fertile land provided rich soils for agriculture and the natural woodlands supplied raw material for mills which were powered by the streams. As these industries grew, new businesses arose that catered to their needs. Entrepreneurs supplied farmers with equipment, seeds, and feed while bakeries followed the development of flour-grinding mills. Delivery companies were established to transport these goods to larger markets.

Swedesboro served as the town center for the more rural Woolwich Township. Grocery stores and hardware stores arose to fulfill everyday needs of area residents. Stores selling dry goods and clothing as well as pharmacies opened along King’s Highway. In 1848, the first hotel, later named Clark’s Hotel, was built on Auburn Avenue. Swedesboro National Bank was founded in 1883 and it, along with its rival bank, Swedesboro Trust Company,

survived the Great Depression. Some of the first automobile dealerships also opened in town during the 1910s.

The glass production industry was present in Swedesboro during the late 1800s. Workers learned their trade from other local glass companies, and the industry lasted until the 1920s.

In 1902, Swedesboro was incorporated as a separate municipality from Woolwich Township. However, the borough has remained the center for Woolwich Township's commercial, economic, housing, and social activities.

Two canning factories built in the early 1900s contributed to decades of prosperity for Swedesboro. Workers would process food direct from the fields of Woolwich Township. Tomatoes were an important crop and products such as spaghetti sauce, ketchup, and tomato soup were canned in these factories.

One of these processing plants, founded by Edgar Hurff, was at one time the largest privately owned processing plant in the world. Hurff also developed the largest seed business in the world and was the first to process canned asparagus in the eastern United States. The Hurff plant became the California Packing Corporation plant that packaged Del Monte vegetables for many years. The facility serves today as a Del Monte distribution center and is located next to the railroad tracks on the western boundary of Swedesboro.

By the 1930s and 1940s, Swedesboro's population grew as the demand for farm labor increased. Many people of Italian descent arrived from Philadelphia to work as day laborers before purchasing their own family farms. Area farmers established the Swedesboro Auction as a way to connect farms within Woolwich Township to prospective buyers.

The 1950s to the present brought major changes in the character of Swedesboro. A period of population decline in Swedesboro lasted until the 1980s as farms became increasingly mechanized and fewer laborers were needed. Since that time, the area has seen significant growth. During the first decade of the 2000's, the population of Woolwich Township tripled in size, increasing from approximately 3,000 individuals in 2000 to over 9,000 in 2009. Woolwich Township was the fastest growing municipality on the entire East Coast until the recent economic downturn slowed the pace of development. The rapid growth of Woolwich Township has impacted Swedesboro in complex ways. The joint Swedesboro-Woolwich School District has been the fastest growing in the state, which has led to significant tax increases to support the schools. Despite the rapid growth of the surrounding area, Swedesboro retains its historic charm while continuing to serve the residential, commercial, and civic needs of a diverse community.

CHAPTER 3

Location, Size, and Land Use

Figure 1: Location of Swedesboro

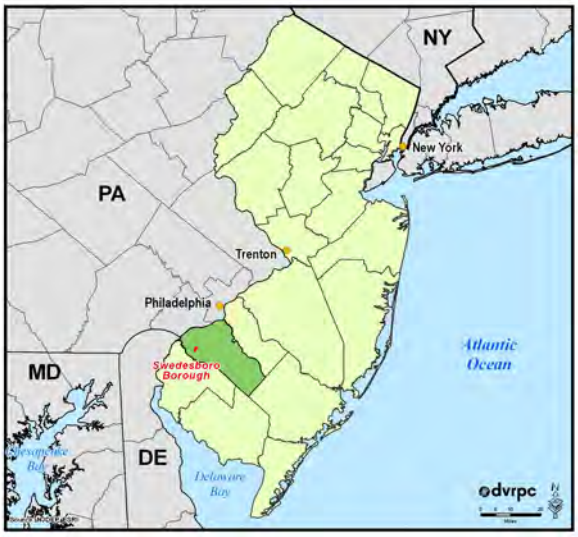
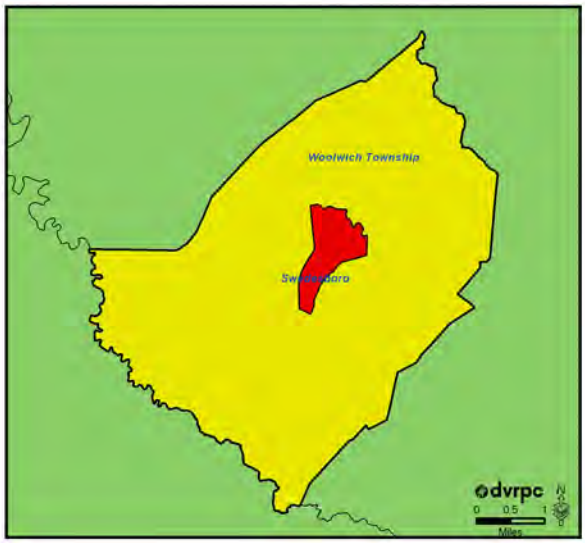


Figure 2: Location of Swedesboro within Woolwich



Swedesboro is an incorporated borough located in western Gloucester County, New Jersey. The borough is surrounded on all sides by Woolwich Township. See **Map 1: Borough of Swedesboro** and **Map 2: Aerial Photo (2007)**. Swedesboro is located 25 miles from Philadelphia and 50 miles from Trenton. Its location within Woolwich, Gloucester County, and New Jersey is shown in **Figures 1** and **2**.

Swedesboro occupies a total area of 0.8 square miles (495 acres), and is located on the Inner Coastal Plain of New Jersey. The U.S. Census Bureau estimates that Swedesboro had a population of 2,372 in 2009, a 15 percent increase from its 2000 population of 2,055.

Swedesboro is located two miles west of Exit 2 of the New Jersey Turnpike, and two to three miles east of Exits 10 and 11 of Interstate 295. These highways run relatively parallel to each other on either side of the borough. Route 322 is located approximately one mile north of the borough and connects these limited access highways. County Route 671, or Locke Avenue, borders the borough on the west. Auburn Road and Kings Highway intersect in the center of the municipality. Kings Highway continues northward through the municipality and is the main commercial street in Swedesboro. A number of other county routes connect Swedesboro to the larger region, including High Hill Road (CR 662), Center Square Road (CR 620), Lake Avenue (CR 694), Glen Echo Road (CR 538), and Swedesboro-Woodstown Road (CR 605). See the **Transportation** section for more detailed information.

The majority of the borough is developed. Commercial development is concentrated along the historic Kings Highway in the center of town, as well as in the southwestern corner of the borough. There is light industrial development along the rail line in the western section of the borough. Natural wetlands and forested areas surround Lake Narraticon and Raccoon Creek. The remainder of Swedesboro is residential in use.

According to 2007 New Jersey Department of Environmental Protection (NJDEP) data derived from aerial photography, the majority of land in Swedesboro is classified as urban, or developed, land (71 percent, or 351 acres). The next two most common types are forest (eight percent, or 40 acres), and water (six percent, or 29 acres). Agriculture and wetlands each consist of five percent (or 27 acres) of the land cover. Barren land is the least common type of land cover in Swedesboro and makes up just four percent (20 acres).

Table 1: General Land Cover (2007) shows Swedesboro's land cover grouped into general categories. **Table 2: Detailed Land Cover (2007)** breaks down the 2007 general land cover categories into detailed land cover categories. See also **Map 3: NJDEP Land Cover (2007)**. All maps are located at the end of the ERI in **Appendix G**.

Table 1: General Land Cover (2007)

General Land Classes	Area (Acres)	Percentage
Agriculture	26.64	5.39%
Barren Land	20.79	4.20%
Forest	40.22	8.13%
Urban	351.07	70.97%
Water	29.32	5.93%
Wetlands	26.61	5.38%
Total	494.64	**100.00%**

Source: NJDEP, 2007

Table 2: Detailed Land Cover (2007)

Type	Area (Acres)	Percentage
Artificial Lakes	10.98	2.22%
Athletic Fields (Schools)	2.10	0.43%
Bridge Over Water	0.24	0.05%
Cemetery	7.84	1.58%
Commercial/Services	67.63	13.67%
Cropland and Pastureland	24.90	5.03%
Deciduous Brush/Shrubland	4.82	0.98%
Deciduous Forest (>50% Crown Closure)	26.90	5.44%
Deciduous Forest (10-50% Crown Closure)	6.59	1.33%
Deciduous Scrub/Shrub Wetlands	1.05	0.21%
Deciduous Wooded Wetlands	18.65	3.77%
Freshwater Tidal Marshes	4.24	0.86%
Herbaceous Wetlands	1.54	0.31%

Type	Area (Acres)	Percentage
Industrial	32.72	6.62%
Mixed Deciduous/Coniferous Brush/Shrubland	0.27	0.06%
Old Field (<25% Brush Covered)	1.63	0.33%
Other Agriculture	1.74	0.35%
Other Urban or Built-Up Land	22.78	4.61%
Phragmites Dominant Interior Wetlands	1.13	0.23%
Railroads	7.80	1.58%
Recreational Land	0.13	0.03%
Residential, High Density or Multiple Dwelling	5.13	1.04%
Residential, Rural, Single Unit	3.60	0.73%
Residential, Single Unit, Low Density	18.01	3.64%
Residential, Single Unit, Medium Density	177.74	35.93%
Stormwater Basin	2.63	0.53%
Tidal Rivers, Inland Bays, and Other Tidal Waters	18.10	3.66%
Transitional Areas	20.79	4.20%
Transportation/Communication/Utilities	2.96	0.60%
Total	**494.64**	100.00%

Source: NJDEP, 2007

Church Run

Complementing this NJDEP land cover data is land use data provided by DVRPC and based on 2005 digital imagery. Unlike the NJDEP data, different types of urban development are identified in more detail. As listed in **Table 3: DVRPC Land Uses (2005)** single family detached housing is the most common land use in the borough (40 percent), followed by commercial (20 percent). Wooded land, which includes wetlands areas, occupies another 15 percent. Agriculture land covers eight percent of the borough, and water and vacant land both make up approximately five percent. These land uses are depicted on **Map 4: DVRPC Land Uses (2005)**.

Table 3: DVRPC Land Uses (2005)

Land Use Description	Type	Area (Acres)	Percentage
Agriculture	Agriculture	39.52	7.99%
Commercial	Urban	97.40	19.69%
Community Services	Urban	18.70	3.78%
Parking: Commercial	Urban	13.96	2.82%
Parking: Community Services	Urban	4.04	0.82%
Parking: Multi-Family	Urban	0.64	0.13%
Recreation	Urban	2.16	0.44%
Residential: Multi-Family	Urban	1.20	0.24%
Residential: Single-Family Detached	Urban	191.90	38.80%
Utility	Urban	1.32	0.27%
Vacant	Barren	26.35	5.33%
Water	Water	24.30	4.91%
Wooded	Forest	73.17	14.79%
Total		**494.64**	**100.00%**

Source: DVRPC, 2010

CHAPTER 4

Natural Resources

Physiography

Source: NJDEP

Figure 3: The Physiographic Regions of New Jersey

Physiography is the study of a location in relation to its underlying geology. New Jersey is characterized by five physiographic provinces, shown in **Figure 3: The Physiographic Regions of New Jersey**. The rocky terrain of the Appalachian Province is at one extreme and the sands of the Atlantic coast are at the other.

The Atlantic Coastal Plain landscape extends from Massachusetts to Texas and is divided into Inner and Outer sections. The Coastal Plain generally consists of unconsolidated sands, silts, and clays. As these sediments are prone to erosion, the Coastal Plain is generally characterized by regions of low topographic relief. In New Jersey, the Inner Coastal Plain is made up of interbedded sand and clay. Deposits originating in the breakdown of Appalachian and Catskill sedimentary, metamorphic, and igneous rocks are interbedded with layers formed by oceanic (marine) deposition, which occurred as the ocean shoreline advanced and receded over geologic time. The Inner Plain layers date from the Cretaceous Period, 135 to 65 million years ago. Generally, soils of the Inner Coastal Plain are quite fertile.

The Outer Coastal Plain was formed more recently than the Inner Coastal Plain. It was laid down by the ocean and developed during the mid-to-late part of the Cenozoic Era, 65 million years ago to the present. Outer Coastal Plain soils are sandier and less fertile than those of the Inner Plain and do not hold water as well. In the general vicinity of the dividing line between the two parts of the Coastal Plain is a belt of low hills, which runs northeast and southwest through the southern half of New Jersey. These hills are the youngest of the Cretaceous formations and are largely made up of sand and marl formations. The Inner Coastal Plain lies to the west of the band of hills and the Outer Coastal Plain lies to the east.

Swedesboro lies entirely within the Inner Coastal Plain and its development has occurred on former agricultural land. Today, just 17 percent of Swedesboro is considered to contain prime farmland.

Topography and Surface Landscapes

Topography relates to the surface terrain and features of an area. At 93.17 feet above sea level, the highest point in Swedesboro is located in the southwest corner of the borough

near the intersection of King's Highway and Ogden Road. Elevation remains fairly consistent when heading north from that point until reaching East Avenue when the terrain gradually slopes down into the tidal marshes of Raccoon Creek. The lowest elevation in Swedesboro, approximately at sea level, is located in the northeast portion of the borough. The entire topography of Swedesboro is shown in **Map 5: Elevation**.

The vast majority of Swedesboro is rolling uplands as the borough has relatively low elevations and lies along the divide of two subwatersheds of Raccoon Creek. A more specific boundary can be seen in **Map 6: Watersheds**.

Despite some low elevations near Raccoon Creek, few areas in Swedesboro are located within FEMA's 100-year floodplain as shown on **Map 7: Floodplains (2010)**. Floodplains occur predominantly along bodies of water in Swedesboro as seen on the southern banks of Raccoon Creek and along Church Run, the tributary between Raccoon Creek and Lake Narraticon. In general, development has occurred on upland areas with wetlands and forests occurring in the lower elevations.

The few remaining natural areas in Swedesboro are typically wetlands around streams that are bordered by upland forests. As in most of southern New Jersey, Swedesboro's streams are relatively flat with mostly muddy and/or sandy bottoms, although the bottoms of some stream segments are lined with small rounded rocks and pebbles. The wetlands consist of mainly wooded deciduous or scrub plants, while the upland forests are characterized by rich soils that support deciduous trees.

Steep Slopes

Slope is measured as the percent of vertical rise to horizontal distance. The majority of Swedesboro has slopes of less than 10 percent, but there are some areas in the borough with steep slopes, up to 20 percent or greater. Most of these steep slopes are located along major water bodies, such as the southern banks of Raccoon Creek, Church Run, and the west and south banks of Lake Narraticon. Most of the steep slopes in the borough are well vegetated with forest cover or shrubs. However, the slopes on the western side of Lake Narraticon, as well as portions along the southern bank of Raccoon Creek, lack appropriate vegetative coverage. Swedesboro's steep slopes are depicted on **Map 8: Steep Slopes**.

Steep Slopes near Lake Narraticon

In general, development of areas with steep slopes is inadvisable as it is likely to result in soil instability, erosion, sedimentation of streams, increased stormwater runoff, and increased flooding. These effects are responsible for habitat destruction, water pollution, and potential damage

to property. Erosion on steep slopes is especially prevalent where excessive tree removal has taken place. See **Soil Erosion** in the **Environmental Issues** chapter for more details.

On steep slopes bordering creeks and streams, it is not unusual to see trees that have fallen into the gulleys or into the streams themselves. In some places, the rate of tree loss is accelerated beyond natural rates by erosion from flash flooding, which in turn is often caused by increases in impervious surface upstream. However, trees on steep slopes fall for other reasons as well, including age, severe storms (especially if their roots have been exposed from erosion), and heat and water loss, which dries the soil. Where steep slopes remain forested, some very old trees can be found. Some regions of steep slopes have been negatively affected by fertilizers from adjoining farm fields, by runoff from development, or by recent flooding, but there may still be sites with intact, diversified forest cover.

Soils

Knowledge of local soils is fundamental to understanding a place's environment, as it is the foundation for all land uses. A region's soil defines what vegetation can survive, influencing agricultural uses. Soil properties also affect the location and feasibility of wells, septic facilities and basements, often determining development potential in certain areas. Soil is also a nonrenewable natural resource that cannot be replenished on the human time scale.

Swedesboro's soils consist of eight series types and 15 variations within those series (excluding water) as identified by the U.S. Department of Agriculture's Natural Resources Conservation Service (NRCS). All soil types in the borough are listed in **Table 4: Soils** and shown on **Map 9: Soils**. The vast majority of Swedesboro contains soils in the Freehold series, which are well-drained upland soils that support a variety of plant life.

A large portion of native soils within Swedesboro have been converted into urban land complexes due to the presence of residential development in the area. Although land in the southern portion of the borough is identified as prime farmland, much of this land has since been converted to residential use.

About nine percent of all soils in Swedesboro are considered hydric. Hydric soils, as defined by the NRCS, are soils that formed under conditions of saturation, flooding, or ponding long enough during the growing season to develop anaerobic (oxygen-free) conditions in their subsurface. These soils have unique soil properties and are an important element of wetland areas. If a soil is classified as "hydric," land use may be restricted due to the relationship of hydric soils to the definition of wetlands and to laws regarding wetland preservation. Soils that have limitations, such as a high water table or flooding, can qualify as prime and of statewide importance when the limitations are overcome by measures such as drainage or flood control.

Table 4: Soils

Soil Type	Description	Area (Acres)	Percentage	Ag. Quality*	Hydric?
BEXAS	Berryland and Mullica soils, 0 to 2 percent slopes, occasionally flooded	11.81	2.39%	L-1	Yes
CosB	Colts Neck sandy loam, 2 to 5 percent slopes	32.52	6.57%	P-1	No
CosC	Colts Neck sandy loam, 5 to 10 percent slopes	4.64	0.94%	S-1	No
FmhAt	Fluvaquents, loamy, 0 to 3 percent slopes, frequently flooded	6.45	1.30%	NA	Yes
FrfB	Freehold loamy sand, 0 to 5 percent slopes	22.62	4.57%	P-1	Yes
FrfC	Freehold loamy sand, 5 to 10 percent slopes	4.45	0.91%	S-1	No
FrkA	Freehold sandy loam, 0 to 2 percent slopes	26.59	5.38%	P-1	No
FrkC	Freehold sandy loam, 5 to 10 percent slopes	0.00	0.00%	S-1	No
FrkE	Freehold sandy loam, 15 to 25 percent slopes	26.97	5.45%	NA	No
FrkF	Freehold sandy loam, 25 to 40 percent slopes	2.09	0.42%	NA	No
FrrB	Freehold-Urban land complex, 0 to 5 percent slopes	318.96	64.48%	NA	No
MaoB	Marlton sandy loam, 2 to 5 percent slopes	3.25	0.66%	P-1	Yes
UdauB	Udorthents-Urban land complex, 0 to 8 percent slopes	0.04	0.01%	NA	No
UR	Urban land	0.05	0.01%	NA	No
WATER	Water	33.81	6.84%	NA	No
WokA	Woodstown-Glassboro complex, 0 to 2 percent slopes	0.35	0.07%	P-1	Yes
Total		**494.64**	**100.00%**		

Source: USDA NRCS, 2004

*Explanation of Designations	
P–1	Prime Farmland
S–1	Statewide Importance
L–1	Local Importance
N/A	Soil not rated for agricultural use by NRCS, but may be suitable or currently used for such use.

Soil Quality Classification

Prime Farmland Soils

Approximately 17 percent (85 acres) of all soils in Swedesboro are classified as Prime Farmland (P-1). Prime Farmlands are lands that have the best combination of physical and chemical characteristics for producing food, feed, forage, fiber, and oilseed crops. They can sustain high yields of crops when managed with correct farming methods. Prime Farmlands are not excessively erodible or saturated with water for long periods of time and do not flood frequently. The majority of Prime Farmland in Swedesboro is located in the southern portion of the borough, with a smaller area between Route 671 and the railroad tracks.

The Natural Resources Conservation Service (NRCS) outlines specific criteria for Prime Farmland classification. For example, according to Prime and Unique Farmlands federal regulations, soil horizons (layers) within a depth of 40 inches must have a pH between 4.5 and 8.4 (mildly acidic to mildly basic). In addition, the soils must have an average temperature above 32°F at a depth of 20 inches. The USDA outlines additional Prime Farmland requirements for mean summer soil temperature, erodibility factor, water table depth, permeability rate, and more. Land classified as Prime Farmland does not have to be farmed but does have to be potentially available for such use. Thus, water and urban land does not qualify as Prime Farmland. However, some areas that are designated as Prime Farmland have since been developed.

Soils of Statewide Importance

About two percent (nine acres) of soils in Swedesboro are classified as soils of Statewide Importance (S-1). These soils are close in quality to Prime Farmland and can sustain high yields of crops when correctly managed under favorable conditions. Criteria for establishing Soils of Statewide Importance are determined by state agencies. These soils are located in two places: the very southern tip of the borough and south of Raccoon Creek east of Route 538.

Soils of Unique Importance

About two percent (12 acres) of soils in Swedesboro are soils considered to be of unique importance (U-1). The USDA outlines specific Unique Farmland criteria that support particular food or fiber crops, including temperature, humidity, air drainage, elevation, aspect, or proximity to market. In order for lands to be classified as Unique Farmland, the land must also be used for a specific high-value food or fiber, and have an adequate moisture supply for that crop. Soils of Unique Importance are located to the north of Lake Narraticon and are mostly associated with wetlands areas and riparian corridors. Again, they qualify for this agricultural designation only when drained.

Soils Not Rated

Approximately 79 percent (388 acres) of Swedesboro's soils have not been rated for agricultural use by the NRCS and are therefore labeled "N/A." These soils are not appropriate for agricultural use and may be best suited for other uses, or they may not yet have been assessed for quality by NRCS. NRCS created all of the Soil Quality Classifications in 1990, although several new subtypes of soils were created in 2005 which are not yet rated for agricultural use. Soils that are not rated are not necessarily limited to agricultural use.

See **Table 5: Agricultural Values for Soils** for the acreage of each of these classes of farmland. See also **Map 10: Agricultural Quality of Soils (2006)** for a visual depiction.

Table 5: Agricultural Values for Soils

Designation	Type/Farm Classification	Area (Acres)	Percentage
P-1	All areas are prime farmland	85.33	17.25
S-1	Farmland of statewide importance	9.13	1.85
U-1	Farmland of unique importance	11.81	2.39
N/A	Not prime farmland	388.37	78.52
Total		**494.64**	**100.00%**

Source: USDA NRCS, 2004

Soil Series

Several soil series appear more frequently in Swedesboro than others and are briefly described as follows according to the Gloucester County Soil Survey and NRCS soil database.

Freehold Series (including complex with Urban Land)

The most abundant soil series in Swedesboro is the Freehold Series, comprising over 80 percent (402 acres) of the borough. These soils can be found on uplands in the coastal plains, have slopes ranging from zero to 40 percent and are well-drained, moderately fertile soils formed by marine sediments containing glauconite. Found in many coastal plain soils, glauconite is a marine mineral that enhances soil fertility. Except for steep areas, Freehold soils support the growth of fruits, vegetables, grain, hay, pasture, nursery plants, and cultivated sod. They are designated as Prime Farmland or farmlands of Statewide Importance, with the exception of those located on steep slopes and Freehold-Urban Land Complex. In Swedesboro, Freehold-Urban Land Complex soils are found throughout the borough, concentrated in the central and northern sections of Swedesboro. Other Freehold Series soils are located on the southeast side of the borough. Freehold soils can often be found near soils from the Collington, Holmdel, Adelphia, and Tinton families.

Colts Neck Series

Approximately eight percent (37 acres) of Swedesboro consists of the Colts Neck series. These soils are typically found on upland summits and side slopes of the coastal plains. These soils are formed by loamy marine sediments that contain glauconite. On steep slopes, iron-cemented sandstone outcrops in some places. The Colts Neck series typically have slopes between zero and 40 percent and are well-drained. Depth to the seasonal high water table is greater than 60 inches from January through April. In their natural condition, Colts Neck soils are suitable for crops such as corn, small grains, and hay; tree fruits; truck crops; and ornamental nurseries. All of the Colts Neck soils in Swedesboro are designated as Prime Farmland or Farmland of Unique Importance and are located in the southernmost portion of the borough. Native vegetation is dominantly oak trees but in some places contains some yellow-poplar, beech, and scattered individual pitch or Virginia pines. Soils that are geographically associated with the presence of the Colts Neck Series include the Collington, Freehold, Holmdel, and Marlton series.

Berryland and Mullica Series

At approximately two percent (12 acres) of Swedesboro's soils, Berryland and Mullica soils make up the third most common soil series. These soils are found exclusively in the borough around the wetland area between Raccoon Creek and Lake Narraticon. The composition of this series includes 50 percent Berryland soils, 40 percent Mullica soils, and 10 percent minor components.

The Berryland series is most often classified as a loamy sand or sand and is found at elevations with slopes between 0 and 2 percent. It is typically found near broad, level areas adjacent to swamps and in the bottoms of closed depressions at levels just above the tidal mark. The soils are considered to be very poorly drained, with the depth to the seasonal high water table between 6-10 inches from October to June (and 12-24 inches in summer months). The associated land cover of Berryland soils is often best suited for woodlands, although some land is cleared for high-bush blueberry and cranberry cultivation. When drained, Berryland soils can support the growing of vegetables, corn, soybeans, and small grain. Woodland vegetation characteristic of Berryland soils includes pitch pine, Atlantic white cedar, red maple, and black gum. Dense understory can feature high-bush blueberry, sweet pepperbush, bay magnolia, leather leaf, gallberry, and greenbriar.

The Mullica Series soils consist of sandy fluviomarine deposits, loamy fluviomarine deposits, or a combination of both. Typically found at elevations with slopes between 0 and 2 percent, the soils appear in broad, flat land along streams in low headwater areas or areas with depressions or swales. They drain very poorly, and the depth to the seasonal high water table is 6-12 inches from December to May with wide seasonal fluctuation. Mullica soils have natural land coverage of woodlands, which include vegetation such as pin oak, white oak, willow oak, red maple, bay magnolia, sweet gum, black gum, and black birch. When drained, these soils can be used for pasture, and growing blueberries and a variety of vegetables.

Fluvaquents Series

Within Swedesboro, one percent (seven acres) of the soils are in the Fluvaquents series. These soils are found alongside streams and rivers in floodplain areas, and are formed from geologically recent (Holocene-era) alluvial deposits. They are normally deep and very poorly drained, with nearly level slopes from zero to 3 percent. Their permeability is slow and runoff is slow to nonexistent, with many Fluvaquents exhibiting ponding. Because they are recently formed and frequently flooded, they have not developed a differentiated soil profile and, in addition, are unsuitable for both agriculture and development. Fluvaquents support deciduous and coniferous forest, in addition to other wetlands vegetation. These soils are located adjacent to waterways in Swedesboro.

Soil Suitability

Certain soil characteristics can severely restrict the use of sites for construction and development.

Table 6: Soil Limitations for Development records the soils and their possible limitations for building foundations and septic systems. As indicated in the table, the borough has some soils that are severely limited for on-site septic systems. Septic systems require soils that have a low water table (five feet or more from the surface) and high permeability to allow for proper drainage of wastewater. Soils with high water tables (five feet or less from the surface) create a potential for erosion, wet basements, and low permeability, often allowing wastewater to collect near the surface. Because the suitability of a soil for a septic disposal field is very site-specific and relies on many factors, including but not limited to the soil type, there is not an accurate source of soil information regarding this subject. The best way to determine soil suitability for a septic system is to request a site survey by a professional.

Table 6: Soil Limitations for Development

Soil Series	Soil Types	Area (Acres)	Land Use Implications*		
			Building without Basement	Building with Basement	Septic Systems
Freehold	FrfB, FrfC, FrkA, FrkC, FrkE, FrkF, FrrB	401.72	A*/C	A*/C	A*/C
Colts Neck	CosB, CosC	37.16	A	A	A
WATER	Water	33.81	NR	NR	NR
Berryland and Mullica	BEXAS	11.81	C	C	C
Fluvaquents	FmhAt	6.45	C	C	C
Marlton	MaoB	3.25	B	B	B
Woodstown-Glassboro complex	WokA	0.35	C	C	C

Soil Series	Soil Types	Area (Acres)	Land Use Implications*		
			Building without Basement	Building with Basement	Septic Systems
Urban Land	UR	0.05	NR	NR	NR
Udorthents-Urban Land complex	UdauB	0.04	A*	A*	A*
Total		**494.64**			

Source: USDA NRCS, 2004

*Key to Land Use Implications	
A = Not Limited	Little or no limitation(s) or easily corrected by use of normal equipment and design techniques.
B = Somewhat Limited	Presence of some limitations which normally can be overcome by careful design and management at a somewhat greater cost.
C = Very Limited	Limitations that normally cannot be overcome without exceptional, complex, or costly measures.
NA = Not Rated	Soil series/type not rated for designated use.
* = Urban Complex	This soil complex contains urban land, which has already been developed and is NR for all listed uses.

Climate

Geographically situated approximately halfway between the Equator and the North Pole, New Jersey's climate is extremely variable. The state's temperate, continental climate is influenced by hot, cold, dry, and humid airstreams that create highly variable local weather conditions. From May through September, New Jersey is dominated by moist, tropical air originating in the Gulf of Mexico and carried by prevailing winds from the southwest. In winter, winds generally prevail from the northwest, bringing cold, polar air masses from subarctic Canada. The Appalachian Mountains to the west and the Atlantic Ocean to the east have a moderating effect on climate in the area, and temperatures below zero or above l00 degrees are a rarity. Precipitation is fairly evenly distributed throughout the year with maximum amounts during the late summer months. Much of the summer rainfall is from local thunderstorms.

Although New Jersey is one of the smallest states in the country, it has five distinct climate regions. The state's climate varies across these five regions: North, Central, Southwest, Pine Barrens, and Coastal. Distinct variations between these climate regions is due to a combination of factors, including geology, distance from the Atlantic Ocean, and prevailing atmospheric flow patterns. Swedesboro is entirely located within the Southwest climate zone.

The Southwest climate zone has the highest average daily temperatures in the state and, without sandy soils, tends to have higher nighttime minimum temperatures than in the neighboring Pine Barrens. This region receives less precipitation than the Northern and Central regions of the state since it is farther away from the Great Lakes-St. Lawrence storm track. It is also far enough inland to avoid the heavier rains from some coastal storms, and so the Southwest Region receives less precipitation than the Coastal Region.

In the Southwest Zone, prevailing winds are from the southwest, except in winter when west to northwest winds dominate. High humidity and moderate temperatures prevail when winds flow from the south or east. The moderating effect of the Delaware River also allows for a longer growing season in this region. Autumn frosts usually occur about four weeks later here than in the North and the last spring frosts are about four weeks earlier, giving this region the longest growing season in New Jersey.

The U.S Department of Commerce houses the National Oceanic and Atmospheric Administration (NOAA) and National Climate Data Center (NCDC), which run the largest active archive of weather data in the world. They operate over 4,000 weather stations in the United States and gather data from the National Weather Service, Coast Guard, Federal Aviation Administration, various military services, and voluntary observers. The NCDC climate data is recorded over a 30-year period and updated at the end of each decade.

The closest NCDC station to Swedesboro is located in Glassboro, New Jersey, approximately twelve miles to the east, and provides climate, weather, and water forecasts and warnings for parts of southern New Jersey. Based on data collected by the NCDC from 1971 to 2000, the mean annual temperature in Swedesboro is 54.2°F. January is the coldest month with a mean temperature of 31.8,°F he hottest month with a mean temperature of 76.1°F.

The Southwest climate zone receives less precipitation than the North, Central, and Coastal regions, but more than the Pine Barrens region. The normal average annual precipitation for the area between 1971 and 2000 was 45.54 inches, less than the statewide normal annual precipitation of 47.87 inches. The region's lack of orographic features (elevated terrain) and its greater distance from the Great Lakes-St. Lawrence storm track may explain the lower precipitation. August is the rainiest month with a mean precipitation of 4.42 inches, and February is the driest month with an average of just 2.83 inches.

Snowfall typically occurs in New Jersey when moist air from the south converges with cold air from the north. In Swedesboro, snowfall may occur from November to mid-April, but is most likely to occur from December to March. From NCDC data gathered between 1971 and 2000, the average monthly snowfall is greatest in January, which has an average mean of 3.7 inches.

Severe storm events, including thunderstorms, tropical storms, blizzards, ice storms, hail storms, and tornadoes occur in Gloucester County with varying frequency. Most areas in the state experience about 25 to 30 thunderstorms a year which strike inland areas like Swedesboro more often than coastal areas and cause periods of heavy rain. From NCDC data gathered between 1971 and 2000, Swedesboro's heaviest month of recorded rain occurred in August 1971 with 12.75 inches. Hurricanes are less likely to cause significant

damage to inland areas, and tornadoes are infrequent with only about five generally weak tornadoes occurring in New Jersey each year.

Growing Seasons

According to the U.S. Department of Agriculture (USDA), Swedesboro is located within the northern limits of Plant Hardiness Zone 7a, where annual minimum temperatures are typically within 0°F and 5°F. Hardiness zones are based on average annual minimum temperatures and are helpful in indicating which plant species are able to survive the winter in each area. In New Jersey, all of Salem County, adjacent portions of Cumberland County and Gloucester County, and areas along the Atlantic Coast are designated as Zone 7a, which is the warmest USDA Plant Hardiness Zone in New Jersey.

The USDA continues to use the 1990 plant hardiness zones, although several other groups, including the Arbor Day Foundation, have reclassified areas based on recent 10-year weather trends, which indicate a general rise in temperature. The 2006 Arbor Day Foundation Plant Hardiness Zone Map increased the zone designation for most of New Jersey and classifies Swedesboro as within Zone 7, which has a minimum temperature between 0°F and 10°F.

The NCDC station in Glassboro, New Jersey also records the area's frost information with data expressing the possibility of a light freeze at 32°F occurring after spring dates and before autumn dates at 50 percent. Swedesboro's growing season, generally defined as the period between the last spring frost and the first autumn frost, is approximately six and a half months, or 200 days, from mid-April through end of-October. The frost-free growing season in Swedesboro is about 80 days longer than in northern New Jersey, where frosts generally end in May and begin in October.

Surface Water Resources

All of the land and water in Swedesboro drains into the Raccoon Creek, which itself drains to the Delaware River and ultimately to the Atlantic Ocean. The tidal Raccoon Creek forms the northern boundary of Swedesboro. In addition, there is one tributary of Raccoon Creek, Church Run, which runs through Swedesboro.

Watersheds

A watershed is all the land that drains to a particular waterway, such as a river, stream, lake, or wetland. The high points in the terrain, such as hills and ridges, define the boundaries of a watershed. Large watersheds are made up of a succession of smaller ones, and smaller ones are made up of the smallest area – down to the catchment area of a local site. So, for example, the Delaware River watershed is made up of many smaller watersheds, such as the Raccoon Creek watershed, which itself consists of smaller subwatersheds. These subwatersheds can be further subdivided into smaller ones, each surrounding smaller

tributaries that flow to the larger channel, and so on down to the catchment level. Watersheds are natural ecological units, where soil, water, air, plants, and animals interact in a complex relationship.

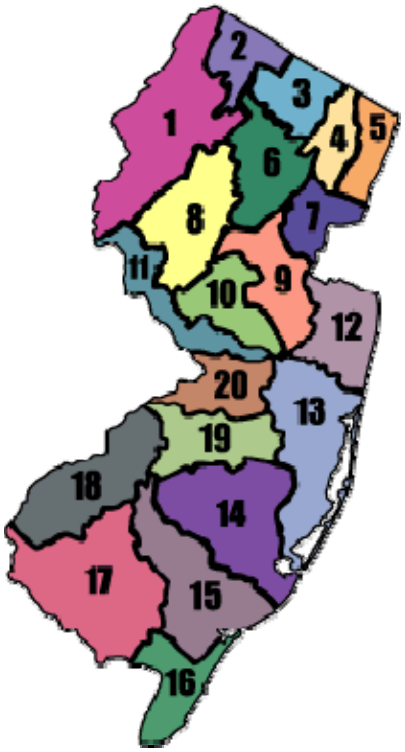
Each watershed corresponds to a hydrological unit code (HUC), as delineated by the United States Geological Survey (USGS). A HUC 11 watershed (identified by an 11-digit code) contains a number of HUC 14 subwatersheds (identified by a 14-digit code). New Jersey has 152 HUC 11 watersheds and over 900 HUC 14 subwatersheds. The land in Swedesboro lies entirely within one HUC 11 watershed division: Raccoon Creek. Within the Raccoon Creek watershed, Swedesboro lies within two subwatersheds. The area within the watershed and its subwatersheds is listed in **Table 7: Watersheds and Subwatersheds**. See also **Map 6: Watersheds** and **Map 11: Surface Water, Wetlands, and Vernal Pools**.

Lower Delaware Tributaries: New Jersey Watershed Management Area 18

The NJ Department of Environmental Protection manages natural resources on a watershed basis. The state has been divided into 20 Watershed Management Areas (WMAs), as shown in **Figure 4: Watershed Management Areas in New Jersey.** Swedesboro is located within WMA 18: Lower Delaware Tributaries.

Figure 4: Watershed Management Areas in New Jersey

1: Upper Delaware
2: Wallkill
3: Pompton, Pequannock, Wanaque, Ramapo
4: Lower Passaic, Saddle River
5: Hackensack, Hudson, Pascack
6: Upper and Mid Passaic, Whippany, Rockaway
7: Arthur Kill
8: North and South Branch Raritan
9: Lower Raritan, South River, Lawrence
10: Millstone
11: Central Delaware
12: Monmouth
13: Barnegat Bay
14: Mullica
15: Great Egg Harbor
16: Cape May
17: Maurice, Salem, Cohansey
18: Lower Delaware
19: Rancocas
20: Assiscunk, Crosswicks, Doctors



Source: NJDEP

WMA 18 includes the Cooper River, Big Timber, Mantua, Newton, Oldmans, Pennsauken, Pompeston, Raccoon, Repaupo, and Woodbury Creeks, as well as Baldwin Run, Swede Run, and Maple Swamp. This WMA includes all or part of 68 municipalities in Burlington, Camden, and Gloucester Counties, encompassing 391 square miles. In general, industrial and urban development is concentrated downstream closer to the Delaware River and the upstream headwaters have more forested and agricultural land uses. The upstream areas are more influenced by suburban and agricultural runoff problems, whereas the downstream portions are influenced by both past and present industrial and urban uses.

Raccoon Creek Watershed

The Raccoon Creek watershed is approximately 40 square miles and 19 miles long. Raccoon Creek drains the central portion of Gloucester County before emptying into the Delaware River across from Marcus Hook, Pennsylvania. Raccoon Creek has two main tributaries that begin in Elk and South Harrison Townships. Once joined, the main branch flows northwestward through Harrison, Woolwich, including Swedesboro, and Logan Townships. Raccoon Creek is navigable from Kings Highway westward and was a major mode of transportation to and from Swedesboro in the 18th and 19th centuries.

Table 7: Watersheds and Subwatersheds

Watershed Name (HUC 11 #)	Subwatershed Name	HUC 14 #	Total Area (Acres) - Subwatershed	Percentage of Swedesboro
Raccoon Creek/ Birch Creek (02040202150)	Raccoon Creek (Swedesboro Road - Russell Mill Road)	02040202150050	354.97	71.76%
	Raccoon Creek (Below Swedesboro Road / Birch Creek)	02040202150060	139.67	28.24%
Total			**494.64**	**100.00%**

Source: NJDEP, 2000

Streams

There are 1.9 stream miles within Swedesboro. Raccoon Creek runs along the northern border of the borough. A tributary of Raccoon Creek, Church Run, flows into Raccoon Creek just south of Kings Highway along the borough's boundary. Church Run is dammed at Lake Avenue, which forms Lake Narraticon. South of the Lake, Church Run forms the southeastern border of Swedesboro. Narraticon Run flows from the southeast through Woolwich Township and enters Lake Narraticon at the southern point of the lake outside Swedesboro's boundaries.

Waterways are classified by their stream order, which is a hierarchy used to differentiate smaller streams from larger ones. This is illustrated in **Figure 5**. First through third-order streams are considered headwater streams and constitute the vast majority of streams worldwide. Fourth through sixth-order streams are considered medium streams, while larger order streams are considered rivers.

Figure 5: Stream Order Classification

Source: T.A. Endreny, 2003

About 0.9 miles in Swedesboro are first-order streams (or headwaters), meaning they are the initial sections of stream channels with no contributing tributaries. The headwaters are where a stream is "born" and actually begins to flow. Church Run is a first-order stream within Swedesboro.

Headwaters are of particular importance because they tend to contain a diversity of aquatic species and their condition affects downstream water quality. Because of their small size, they are highly susceptible to impairment by human activities on the land. First- and second-order streams are narrow and often shallow, and are characterized by relatively small base flows. This makes them subject to greater temperature fluctuations, especially when forested buffers on their banks are removed. They are also easily over-silted by sediment-laden runoff and their water quality can be rapidly degraded. In addition, first-order streams are greatly affected by changes in the local water table because they are fed by groundwater sources. Headwaters are important sites for the aquatic life that is at the base of the food chain and often serve as spawning or nursery areas for fish.

Within Swedesboro, Raccoon Creek is a fourth-order stream, which indicates that more than one third-order stream flows into it.

Table 8: Stream Classification

Stream Order	Length (miles)
1	0.83
2	0.54
4	0.49
Total	**1.89**

Source: NJDEP, 2002

Raccoon Creek is tidal for its entire length through Swedesboro, as is the portion of Church Run to the north of Lake Narraticon. Tidal flows bring water into the streams twice a day and both help and hinder maintenance of good water quality in tidal streams. The flood (incoming) tide carries leaves and nutrients that are beneficial to aquatic organisms, but it also limits the regular flushing out of silt and pollutant-laden waters coming from upstream. Silt deposition within a stream tends to increase during flood tides, although deposition is also a function of stream shape, the presence of specific flow barriers, and the quantity of silt (the load) being carried by the stream. See **Map 11: Surface Water, Wetlands, and Vernal Pools.**

Lakes and Ponds

Most lakes and ponds in Southern New Jersey were created by damming streams. These dams were primarily constructed as the power source for the numerous mills built throughout the area, especially during the 19th century. Although the mills are gone in most cases, the lakes and dams remain. Today, many of these lakes are used for recreation or may be sites for homes.

Lake Narraticon

Lake Narraticon is 8.7 acres in size and was created by damming Church Run. Like many smaller water bodies in the state, Lake Narraticon is classified as an artificial lake by NJDEP. The portion of Lake Narraticon within Swedesboro is completely surrounded by residential development. In addition to Lake Narraticon, there is a smaller 1.7-acre lake adjacent to it, which is known locally as Mill Pond.

Wetlands

Wetlands support unique communities that serve as natural water filters and as incubators for many beneficial species. The term “wetland” is applied to areas where water meets the soil surface and supports a particular biological community. The source of water for a wetland can be an estuary, river, stream, lake edge, or groundwater that rises close to the land surface. Under normal circumstances, wetlands are those areas that support a prevalence of defined wetland plants on a wetland soil. The U.S. Fish & Wildlife Service designates all large vascular plants as wetland (hydric), non-wetland (non-hydric), or in-between (facultative). Wetland soils, also known as hydric soils, are areas where the land is saturated for at least seven consecutive days during the growing season. Wetlands are classified as either tidal (coastal) or nontidal (interior). Tidal wetlands can be either saline or freshwater. There are also special wetlands categories to denote saturated areas that have been altered by human activities.

New Jersey protects freshwater wetlands under the New Jersey Freshwater Wetlands Protection Act Rules: N.J.A.C. A 7:7A. The law also protects transition areas, or “buffers,”

around freshwater wetlands. The New Jersey freshwater wetlands maps provide guidance on where wetlands are found in New Jersey, but they are not the final word. Only an official determination from DEP, called a "letter of interpretation (LOI)," can legally determine for sure if there are freshwater wetlands on a property. An LOI verifies the presence, absence, and boundaries of freshwater wetlands and transition areas on a site. Activities permitted to occur within wetlands are very limited and usually require a permit. Additional information on wetlands rules and permits is available through NJDEP.

All Swedesboro's wetlands are freshwater. Natural wetlands cover 27 acres within the borough (five percent of total land area), of which 19 acres are deciduous wooded wetlands, four are freshwater tidal marshes, one acre is low-growing emergent, scrub/shrub wetlands, two acres are herbaceous (low, non-woody plants) wetlands, and one acre is *Phragmites* dominate interior wetlands. See **Table 2: Detailed Land Cover (2007)** and **Map 11: Surface Water, Wetlands, and Vernal Pools**. A more detailed description of Swedesboro's natural wetland areas is found in the **Biological Resources** section, under "Wetlands."

Vernal Pools

Vernal pools are bodies of water that appear following snowmelt and during spring rains, but disappear or are dry during the rest of the year. They are highly important sites for certain rare species of amphibians. Particular types of frogs and salamanders will only breed in vernal ponds (obligate breeders), which provide their offspring with a measure of protection because the pond's impermanence prevents the residence of predators of the eggs and young, especially fish. Other species, called facultative breeders, may use vernal pools but are not limited to them for breeding.

Once a vernal pond is certified, regulations require that a 75-foot buffer be maintained around the pond. NJDEP's Division of Land Use Regulation oversees this designation and restricts development around vernal ponds by denying construction permits. Local municipalities can provide additional protection by negotiating conservation easements on the land surrounding the pond or by instituting restrictive zoning, such as passing a stream corridor protection overlay ordinance that specifically includes the vernal pools

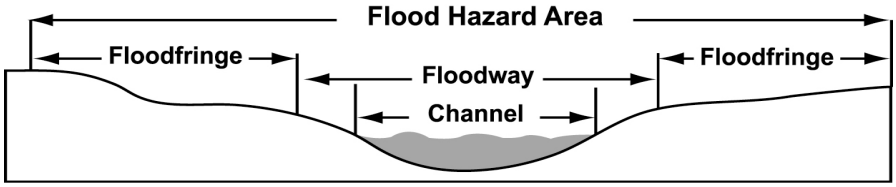
According to the Center for Remote Sensing and Spatial Analysis (CRSSA) at Rutgers University, there are no potential vernal pools within Swedesboro, although there are a number in Woolwich Township, one of which is located directly on the border, south of Ogden Road. These are shown on **Map 11: Surface Water, Wetlands, and Vernal Pools**. Surveying of the site is needed to determine if the vernal pool is still in existence as a natural habitat, and if it is, what species are present. Once surveyed, the New Jersey Division of Fish and Wildlife will review the data and those pools that meet the criteria will be certified.

Floodplains

Areas naturally subject to flooding are called floodplains, or flood hazard areas. Floodplains encompass a floodway, which is the portion of a floodplain subject to high velocities of moving

water, and the adjacent flood fringe, which helps to hold and carry excess water during overflow of the normal stream channel. These areas are shown in **Figure 6** below. The 100-year floodplain is defined as the land area that will be inundated by the overflow of water resulting from a 100-year flood (a flood that has a one percent chance of occurring in any given year).

Figure 6: Parts of a Flood Hazard Area



Source: NJDEP

Although the terms “flood hazard area” and “100-year floodplain” refer to similar concepts, NJDEP defines them in slightly different ways. New Jersey’s regulations define the flood hazard area as the area inundated by a flood resulting from the 100-year discharge increased by 25 percent. This type of flood, called the “flood hazard area design flood,” is regulated by NJDEP.

Floodplains require protection in order to prevent property loss to residents, especially within the boundaries of the floodway. Equally important is the preservation of the environmentally sensitive aquatic communities that exist in floodplains. These communities are often the first link in the food chain of the aquatic ecosystem. In addition, floodplains serve the function of removing and mitigating various pollutants through the uptake by their vegetation of excess chemical loads in the water and generally by the filtering of sediments. All efforts to keep development out of floodplains will help to preserve the flood-carrying capacity of streams and their water quality.

A Tributary to Lake Narraticon

In New Jersey and throughout the country, building in areas subject to flooding is regulated to protect lives, property, and the environment. New Jersey regulates construction in the flood hazard area under the Flood Hazard Area Control Act, N.J.S.A. 58:16A-50 et seq., and its implementing rules at N.J.A.C. 7:13. Activities that are proposed to occur in a flood hazard area will require issuance of a flood hazard area permit or a letter of non-applicability from NJDEP. Additional information on floodplain activities is available from NJDEP and from its website under “Land Use.”

New Jersey’s flood hazard area maps are not available in digital form. Consequently, it is only possible to approximate the spatial extent of the flood hazard area in Swedesboro by using the Federal Emergency Management Agency’s (FEMA’s) 100-year floodplain maps. As of

2010, FEMA's maps show that 51 acres, or 10 percent, of Swedesboro's land is within the 100-year floodplain, and an additional 0.8 acres are within the 500-year floodplain. All of Swedesboro's floodplain areas are located along the main stem of the Raccoon Creek and its tributaries. See **Map 7: Floodplains (2010)** and **Table 9: Floodplains**.

Table 9: Floodplains

Flood Plain	Area (Acres)	Percentage of Swedesboro
100 Year Flood Plain	51.25	10.36%
500 Year Flood Plain	0.79	0.16%
Total Floodplain Area	**52.04**	**10.52%**
Total Swedesboro Area	**494.64**	

Source: FEMA, 2010

Surface Water Quality

Water quality standards are established by federal and state governments to ensure that water is suitable for its intended use. The ultimate objective of the federal Clean Water Act (P.L. 95-217) is to restore and maintain the chemical, physical, and biological integrity of the nation's waters. Standards are intended to restore the quality of the nation's waters to provide for the protection and propagation of fish, shellfish, and wildlife and to provide for recreation in and out of the water, wherever attainable.

All water bodies in New Jersey are classified by NJDEP as either freshwater (FW), pinelands water (PL), saline estuarine water (SE), or saline coastal water (SC). Freshwater is further broken down into freshwater that originates and is wholly within federal or state parks, forests, or fish and wildlife lands (FW1) and all other freshwater (FW2). The water quality for each of these groups must be able to support designated uses that are assigned to each water body classification (see Surface Water Quality Standards N.J.A.C. 7:9B-1.12). In addition to being classified as FW1 and FW2, fresh water bodies are classified as trout producing (TP), trout maintaining (TM), or nontrout waters (NT).

Lake Narraticon

Saline waters are also classified as saline estuarine (SE) and saline coastal (SC). SE waters are further classified into SE1, SE2, and SE3 based on their designated uses. SE1 designated uses are shellfish harvesting in accordance with N.J.A.C. 7:12, maintenance, migration, and propagation of the natural and established biota; primary contact recreation (swimming), and any other reasonable uses. SE2 uses are maintenance, migration, and propagation of the natural and established biota; migration of

diadromous fish, maintenance of wildlife; secondary contact recreation (fishing, boating); and any other reasonable uses. SE3 designated uses include secondary contact recreation; maintenance and migration of fish populations; migration of diadromous fish; maintenance of wildlife; and any other reasonable uses. In addition, each of these classifications may also be subject to different water quality standards.

In Swedesboro, Raccoon Creek is classified as a freshwater water body with nontrout waters. From Kings Highway to the Delaware River, Raccoon Creek is also listed as saline estuarine. See below, **Table 10: Water Quality Classifications of Streams**.

Table 10: Water Quality Classifications of Streams

Stream	Classification
Raccoon Creek – Source to Kings Highway	FW2-NT
Raccoon Creek – Kings Highway to Delaware River	FW2-NT/SE2

Source: NJDEP, Surface Water Quality Standards, N.J.A.C. 7:9B

According to NJDEP rules, FW2-NT waters must provide for (1) the maintenance, migration, and propagation of the natural and established biota; (2) primary and secondary contact recreation; (3) industrial and agricultural water supply; (4) public potable water supply after conventional filtration and disinfection; and (5) any other reasonable uses.

The determination of whether or not water quality is sufficient to meet a body of water's designated use(s) is based on an analysis of certain surface water quality parameters, including fecal coliform, dissolved oxygen, pH, phosphorous, and toxic substances. NJDEP also evaluates water quality by examining the health of aquatic macroinvertebrate life in a stream.

New Jersey's Integrated Water Quality Monitoring and Assessment Report

A Tributary to Lake Narraticon

The Federal Clean Water Act mandates that states submit biennial reports to the U.S. Environmental Protection Agency (EPA) that describe the quality of their waters. States must submit two reports: the first is the Water Quality Inventory Report, or 305(b) Report, which documents the status of principal waters in terms of overall water quality and support of designated uses; the second is the 303(d) List, which lists the water bodies that are not attaining water-quality standards. States must also prioritize the impaired water bodies on the 303(d) List for Total Maximum Daily Load (TMDL) analyses and identify those high-priority water bodies for which they anticipate establishing TMDLs in the next two years. See **Total Maximum Daily Loads** in the following section for a greater description.

Beginning in 2002, the NJDEP combined the 305(b) Report and the 303(d) List into a single report, according to the EPA's guidance. The biennial *Integrated Water Quality Monitoring and Assessment Report* places the state's waters on one of five "sublists." Sublists 1 and 2 contain waters that are attaining standards. Sublist 3 contains waters that have insufficient data to determine their status. Sublist 4 contains waters that do not attain water-quality standards, but which meet one of the following three conditions: (1) a TMDL has been completed for the pollutant causing nonattainment; (2) other enforceable pollution control requirements are reasonably expected to result in conformance with the applicable water-quality standards; or (3) nonattainment is caused by something other than a pollutant. Sublist 5, equivalent to the 303(d) List, contains waters that do not attain their designated use and for which a TMDL is required.

In 2006, NJDEP began reporting water-quality data on a HUC 14 subwatershed basis, and so the assessment of portions of rivers and streams are reported by the subwatershed they fall within. Subwatersheds (assessment units) are assessed on their attainment of eight different designated uses, although not all uses are applicable to all subwatersheds. The designated uses are as follows:

- Aquatic life (general)
- Aquatic life (trout)
- Recreation
- Drinking water supply
- Industrial water supply
- Agricultural water supply
- Shellfish harvesting
- Fish consumption

From the 2008 NJDEP Integrated Water Quality Monitoring and Assessment Report, one of the two subwatersheds in which Swedesboro is located has mainly insufficient data for assessment (Sublist 3), while the other subwatershed has mostly a mix of attained designated uses (Sublist 1 or 2) or has insufficient data. For aquatic life, which is the most general and encompassing parameter of water quality, both subwatersheds are impaired (Sublist 5). As none of the waters in Swedesboro support trout or shellfish, those designated uses are not applicable. See **Map 12: Water Quality (2008)** and **Table 11: Integrated Water Quality Monitoring and Assessment Report, 2008**.

Table 11: Integrated Water-Quality Monitoring and Assessment Report, 2008

Subwatershed Name	Subwatershed ID	Aquatic Life (General)	Recreation	Drinking Water Supply	Ag. Water Supply	Industrial Water Supply	Fish Consumption
Raccoon Creek (Swedesboro Road* - Russell Mill Road)	02040202150050	5	3	3	3	3	3
Raccoon Creek (Below Swedesboro Road* / Birch Creek)	02040202150060	5	3	2	2	2	3
*Locke Ave; NJDEP incorrectly identifies this as Swedesboro Road.							

Source: NJDEP, 2008

Sublist	Placement Conditions
Sublist 1	The designated use is assessed and attained AND all other designated uses in the assessment unit are assessed and attained. (Fish consumption use is not factored into this determination based on EPA guidance.)
Sublist 2	The designated use is assessed and attained BUT one or more designated uses in the assessment unit are not attained and/or there is insufficient data to make a determination.
Sublist 3	Insufficient data is available to determine if the designated use is attained.
Sublist 4	The designated use is not attained or is threatened; however, development of a TMDL is not required for one of the following reasons: 4A: A TMDL has been completed for the pollutant causing nonattainment; 4B: Other enforceable pollution control requirements are reasonably expected to result in the conformance with the applicable water-quality standard(s) in the near future and the designated use will be attained through these means; or 4C; Nonattainment is caused by something other than a pollutant.
Sublist 5	The designated use is not attained or is threatened by a pollutant or pollutants and a TMDL is required.

Both of the Raccoon Creek subwatersheds in Swedesboro do not attain the designated use of aquatic life. They are each impaired due to one or more parameters for that use, as shown in **Table 12: New Jersey's 303(d) List of Impaired Waters, 2008**. Phosphorus, total suspended solids (TSS), and an unknown cause were the reasons for impairment.

Table 12: New Jersey's 303(d) List of Impaired Waters, 2008

WMA	Subwatershed Name	Subwatershed ID (HUC 14#)	Parameter	Ranking
18	Raccoon Creek (Swedesboro Road* - Russell Mill Road)	02040202150050	Cause Unknown	Low
18	Raccoon Creek (Below Swedesboro Road* / Birch Creek)	02040202150060	Phosphorus	Medium
			Total Suspended Solids	Low
*Locke Ave; NJDEP incorrectly identifies this as Swedesboro Road.				

Source: NJDEP, 2008

Phosphorus exists naturally at low levels within the environment, although excess phosphorus can lead to harmful algae blooms. As the excess algae dies and its decomposition uses up the oxygen, "dead zones" can develop where no aquatic life can survive. Typical causes of phosphorus pollution include over-fertilization of lawns and agricultural areas; runoff from impervious surfaces like parking lots, lawns, rooftops, and roadways; discharge from waste-water treatment plants; and overflow from septic systems. Soil erosion is a major contributor of phosphorus to streams, and streambank erosion occurring during floods can transport high quantities of phosphorous into the water system.

Total suspended solids (TSS) refers to solid materials, both organic and inorganic, that are suspended in water. High concentrations of TSS make water warmer by absorbing sunlight, while also blocking sunlight from reaching aquatic plants, decreasing photosynthesis and reducing oxygen in the water, which then kills aquatic animal life. These materials enter water bodies through stormwater runoff, streambank erosion, industrial wastes, wastewater discharges, improperly managed construction sites, and other sources.

Total Maximum Daily Loads (TMDLs)

For impaired waterways with a high-priority ranking for remediation, the state is required by the EPA to establish a TMDL. A TMDL quantifies the amount of a pollutant that a water body can assimilate (its loading capacity) without violating water quality standards. The purpose of a TMDL is to initiate a management approach or restoration plan based on identifying the sources of a pollutant and determining the percentage reductions of the pollutant that must be achieved by each source. These sources can be point sources, such as sewage treatment plants, or nonpoint sources, such as stormwater runoff.

Although Swedesboro contains portions of two subwatersheds with impaired water quality, neither of these were ranked as having a high priority for remediation and are not listed on the TMDL schedule.

Water-Quality Monitoring Networks

New Jersey's Integrated Report is based on the water quality assessments of a number of different monitoring networks. The Ambient Surface Water Monitoring Network (ASWMN) and the Ambient Biological Monitoring Network (AMNET) are the two primary sources of surface water monitoring data. Beyond the information included in the Integrated Report, additional water-quality data gathered from these monitoring stations is available through the USGS and the NJDEP.

The ASWMN is a cooperative network between USGS and NJDEP that samples surface water quality at 112 stations in the state, none of which are located within Swedesboro. These stations monitor stream flow as well as temperature, dissolved oxygen (DO), pH, carbon dioxide, nitrogen, ammonia, phosphorus, arsenic, and many other parameters.

AMNET is another water-quality monitoring system that the Integrated Report is based upon. AMNET, administered solely by NJDEP, consists of over 800 stream sites in the state and provides long-term biological data. The program samples and evaluates the benthic macroinvertebrate population at each site as a biological indicator of water quality on a five year schedule. Benthic macroinvertebrates are bottom-dwelling aquatic insects, worms, mollusks, and crustaceans that are large enough to be seen by the naked eye. There is one AMNET monitoring site (AN0685) in Swedesboro located in Raccoon Creek at Kings Highway. Beyond the information included in the Integrated Report shown in **Tables 11** and **12**, additional water-quality data gathered from this monitoring station is available through NJDEP.

The 2000 AMNET report indicates that the biological conditions at the Raccoon Creek monitoring station in Swedesboro are severely impaired. This is an increase in severity from the 1995 score of moderately impaired, signifying that the water quality in the creek declined over time. The data shows the macroinvertebrate population is overwhelmingly dominated by one species, and there is a relative lack of clean water organisms in the water. In addition, this monitoring station indicates Raccoon Creek has significant organic pollution, or an excessive or high number of nutrients in the water. This pollution can originate from untreated sewage, urban and industrial run-off, farm waste or farm run-off and often leads to low levels of dissolved oxygen in the water, making it difficult for organisms to survive. Plus, visual observations reveal the stream water is turbid (cloudy) and streambank vegetation and stability is poor.

Fish Consumption Advisories

Certain fish may contain toxic chemicals, such as PCBs, dioxins, or mercury, which accumulate in bottom sediment and bottom-dwelling aquatic life, including fish tissue. Chemical contaminants, such as dioxin and PCBs, are classified by the U.S. EPA as probable cancer-causing substances in humans. Elevated levels of mercury can pose health risks to the human nervous system. Infants, children, pregnant women, nursing mothers, and women of childbearing age are considered to be at higher risk from contaminants in fish than other members of the general public. Since 1982, NJDEP has been catching fish at numerous

sampling stations throughout the state and testing for contaminant levels. The NJDEP then adopts advisories to guide residents on safe consumption practices.

The consumption advisories for fish caught in general freshwater in New Jersey are listed in **Table 13: Fish Consumption Advisories** below. There are no additional fish consumption advisories for water bodies located within Swedesboro. More details on preparation and consumption of fish are found at the NJDEP advisory website.

Table 13: Fish Consumption Advisories

Species	General Population	High-Risk Individuals
	Eat No More Than:	Eat No More Than:
General Freshwater Advisories		
Trout (Brown, Brook, Rainbow)	One Meal Per Week	One Meal Per Week
Largemouth Bass		One Meal Per Month
Smallmouth Bass		
Chain Pickerel		
Yellow Bullhead	No Restrictions	
Brown Bullhead		
Sunfish		One Meal Per Week

Source: NJDEP, 2010

Other Monitoring

Knowing the actual condition of streams and stream banks, and planning for their improvement, requires more frequent surveying and monitoring that the state can provide. NJDEP primarily monitors main channels in nontidal areas, and only does biological assessments through AMNET on a five-year cycle. A community may benefit from additional stream or lake surveys and regular monitoring by local organizations or a professional service. Although local residents have noticed a change in the water conditions of Lake Narraticon over the past several years, there has been no regular monitoring of the lake or of Raccoon Creek and its tributaries within Swedesboro.

The South Jersey Land & Water Trust (SJLWT) is an example of a local non-profit organization that conducts stream assessments throughout Southern New Jersey. They have conducted many visual stream assessments of specific sites on Raccoon Creek over the past several years. Four of SJLWT's assessments are particularly important because they were conducted slightly upstream from Swedesboro above and below Russell Mill Road in Woolwich Township. The assessments were taken on Raccoon Creek as well as the Basgalore Creek Branch. See **Table 14: Raccoon Creek Stream Assessments near Swedesboro** for the results of these stream assessments.

Stream assessments take into account many aspects of a stream. The assessment looks at physical properties such as the channel width, dominant material of the stream floor, and condition of the banks and surrounding vegetation. It also rates the clarity and nutrient content of the water as well as the quality of habitat for fish and invertebrate species. A visual stream assessment will also record streamside land uses within 100 feet of the banks and indicate any stormwater outfall pipes or ditches adjacent to the stream.

Each component of the assessment is rated on a scale of one (poor) to 10 (excellent). The overall score is based on the average of the rankings. An overall score of less than six indicates poor conditions, 6.1 to 7.4 is fair, 7.5 to 8.9 is good, and nine or above indicates excellent conditions.

At the time of the assessments in 2006, Raccoon Creek and the Basgalore Creek Branch at Russell Mill Road had overall scores between eight and nine, indicative of relatively good stream conditions. Updated stream assessments of these areas may help to demonstrate how the creek is changing over time. In addition, assessments within Swedesboro on Raccoon Creek and Church Run would be helpful to evaluate water quality in the direct vicinity of the borough.

Table 14: Raccoon Creek Stream Assessments near Swedesboro

Assessment Location	Channel Condition	Hydrologic Alteration	Invertebrate Habitat	Riparian Zone (left, right)	Bank Stability (left, right)	Water Appearance	Nutrient Enrichment	Barrier to Fish Movement	In-Stream Fish Cover	Overall Ranking
Raccoon Creek above Russell Mill Road	9	10	8	7, 7	8, 8	7	7	10	8	8.4
Raccoon Creek below Russell Mill Road	9	10	8	10, 10	8, 8	7	7	10	8	8.7
Basgalore Creek Branch above Russell Mill Road	9	10	8	7, 10	7, 7	7	7	10	7	8.35
Basgalore Creek Branch above Russell Mill Road	9	10	8	9, 10	9, 9	7	7	10	7	8.65

Source: SJLWT, 2006

Assessment Number	Rating
< 6	Poor
6.1–7.4	Fair
7.5–8.9	Good
> 9	Excellent

Causes of Water Quality Impairments

Point Sources of Pollution

Point sources of pollution, which come from a single source or “point,” such as an industrial pipe discharge, are regulated by NJDEP through the New Jersey Pollution Discharge Elimination System (NJPDES). New Jersey created NJPDES in response to the Federal Clean Water Act of 1972, which mandated that each state develop water quality standards and regulate the amount of pollution entering water bodies. The act classified all water pollution into one of two categories: “point source” pollution coming from a single source, such as an industrial pipe; and “nonpoint source” pollution, which comes from many diffuse sources. Although the Federal Clean Water Act only required states to regulate point sources, New Jersey also regulates nonpoint sources through the authority of the NJPDES rules. See **Nonpoint Sources of Pollution**.

NJDEP, through the Division of Water Quality and the Bureau of Point Source Permitting, administers the NJPDES program. Under NJPDES, any facility discharging over 2,000 gallons per day (gpd) of wastewater directly into surface water or groundwater (generally through a septic system) must apply for and obtain a permit for discharging. Rather than creating individually tailored permits for each and every facility, the Division of Water Quality uses scientific standards to create and issue general permits for different categories of dischargers. NJDEP enforces the terms of the NJPDES permit by visiting discharging facilities and requiring facilities to periodically conduct and submit water quality, biological and toxicological analyses, and thermal impact and cooling water assessments.

As of June 2010, one NJPDES permit for point source pollution was issued to a facility in Swedesboro, the Swedesboro Water Treatment Plant. Another permit was issued to a facility located just outside Swedesboro’s southern border, Grasso Foods. These are listed in **Table 15: NJPDES Permits for Point Source Pollution in or Bordering Swedesboro** and shown on **Map 20: Sewer Service Area and NJPDES Permits**. There are many other facilities with NJPDES permits with mailing addresses in Swedesboro, but which are actually located in neighboring municipalities.

Although the NJPDES program has made much progress in regulating point source discharges, a great number of minor discharges have been allowed without regard to their cumulative impact on surface water quality. Environmental Commissions and town clerks receive notice from NJDEP when anyone applies for a new permit to discharge to surface water under the NJPDES. The Commissions should examine the application and evaluate the proposal in terms of the need for the permit, the location of the discharge, and the potential negative impacts. They should communicate their findings to NJDEP, the applicant, and the town.

Table 15: NJPDES Permits for Point Source Pollution in or Bordering Swedesboro

NJPDES Permit Number	PI Number	Facility Name	Effective Start Date	Expiration Date	Discharge Category Code	Discharge Category Description
NJ0022021	46967	Swedesboro Water Treatment Plant	7/1/2009	6/20/2014	A	Sanitary Wastewater
NJG0107719	46402	Grasso Foods	2/1/2004	1/31/2009	EG	Land Appl/Food Processing Res (GP)

Source: NJDEP, 2010 Nonpoint Sources of Pollution

Nonpoint Sources of Pollution

Since the adoption of the federal Clean Water Act and the implementation of the NJPDES program in subsequent years, water pollution from point sources has decreased dramatically. However, as development has continued to spread throughout New Jersey, nonpoint source pollution has increased substantially in recent decades. Nonpoint source pollution, or stormwater runoff, has the largest effect on the water quality and channel health of streams in Swedesboro. According to US EPA, about half the pollution in New Jersey's surface water comes from nonpoint sources. Development dramatically increases nonpoint source pollution by increasing the volume of water and the level of pollutants in the runoff. Increased runoff causes erosion and sediment buildup in streams, carries nutrients from fertilizers, and washes toxics, bacterial contamination, road salt, motor oils, and litter into the stream.

The sources of polluted stormwater runoff are also the most difficult to identify and remediate because they are diffuse, widespread, and cumulative. Most nonpoint source pollution in Swedesboro derives from stormwater runoff from paved surfaces such as streets, commercial and industrial areas, residential sites (with and without detention basins), and agricultural fields lacking adequate vegetative buffers. The waterways in Swedesboro are affected by stormwater runoff both from within the borough and upstream municipalities.

An Impaired Stormwater Outfall on Church Run

NJDEP's new Stormwater Management Rules focus on reducing and controlling nonpoint sources of water pollution. The Municipal Stormwater Regulation Program was developed in response to the US EPA's Phase II rules published in December 1999. NJDEP issued final stormwater rules on February 2, 2004 and

established four NJPDES general permits: the Tier A Municipal Stormwater General Permit (Tier A Permit) for more populous municipalities; the Tier B Municipal Stormwater General Permit (Tier B Permit) for rural communities; the Public Complex Stormwater General Permit (Public Complex Permit); and the Highway Agency Stormwater General Permit (Highway Permit). Public complexes include certain large public colleges, prisons, hospital complexes, and military bases and highway agencies include county, state, interstate, or federal government agencies that operate highways and other thoroughfares.

Swedesboro holds a Tier A Municipal Stormwater General Permit for nonpoint source pollution with the NJPDES permit number NJG0150584 and PI number 223754. This permit is effective from March 1, 2009 until February 28, 2014. See **Figure 7** for Tier A requirements. There are no NJDPES permits for public complexes or highway agencies in Swedesboro, although Gloucester County holds a permit for county roads.

The NJPDES Stormwater Program lays out guidance and requirements for management of and education about stormwater at the local level. Municipalities were required to obtain the NJPDES general permit for the stormwater system and its discharges within their borders, which are considered to be owned and “operated” by the municipality. The general permits address stormwater quality issues related to new development, redevelopment, and existing development by requiring regulated entities to implement Statewide Basic Requirements (SBRs).

Under the 2004 NJPDES permit, a town must meet certain specific requirements in planning, ordinance adoption, education, management of municipal facilities, and investigation of parts of the stormwater system. Fulfillment of these statewide basic requirements was scheduled to occur over the course of five years. All of the requirements were intended to reduce the water pollution from stormwater runoff. In accordance, Swedesboro adopted a Municipal Stormwater Management Plan.

In Gloucester County, all municipalities have been aided in complying with the new rule by a program sponsored by the Gloucester County Board of Chosen Freeholders and managed through the Gloucester County Improvement Authority. This has included development of a stormwater management plan and ordinance and mapping of all stormwater outfall (discharge) pipes. The County also sponsored the South Jersey Land & Water Trust to conduct the annual education event and to assist with labeling storm drain inlets.

Figure 7: Stormwater Requirements for Municipalities

Stormwater Management Statewide Basic Requirements
Tier A Towns

1. Control post-construction stormwater management in new development and redevelopment through:
    - Adoption of a stormwater management plan in accordance with N.J.A.C. 7:8.
    - Adoption and implementation of a stormwater control ordinance in accordance with N.J.A.C. 7:8. This ordinance requires retention on site of 100% of preconstruction recharge, and use of low-impact design in stormwater facilities, among other features.
    - Ensuring compliance with Residential Site Improvement Standards for stormwater management. The RSIS has been revised to incorporate the low-impact design and other requirements of the stormwater control ordinance.
    - Ensuring long-term operation and maintenance of Best Management Practices on municipal property.
    - Requiring that new storm drain inlets meet new design standards.
2. Conduct local public education:
    - Distribute educational information (about stormwater requirements, nonpoint source pollution, and stewardship) annually to residents and businesses and conduct a yearly “event” (such as a booth with these messages at a community day).
    - Have all municipal storm drain inlets labeled with some type of “don’t dump” message.
    - Distribute information annually regarding fertilizer/pesticide application, storage, disposal, and landscaping alternatives and regarding proper identification, handling, and disposal of waste including pet waste and litter.
    - Adopt specific ordinances to control waste disposal and other nonpoint sources.
3. Control improper disposal of waste through improved yard waste collection and through adoption of ordinances (pet waste, litter, improper dumping, and wildlife feeding).
4. Control solids and floatables through increased street sweeping, retrofitting storm drain inlets during road repairs, and instituting programs for stormwater facility management, for roadside erosion control, and for outfall pipe scouring/erosion.
5. Improve maintenance yard operations, specifically for de-icing material storage, fueling operations, vehicle maintenance, and housekeeping operations.
6. Increase employee training about all of the above.

Impervious Coverage

The volume of stormwater runoff that is carried to a stream impacts the stream channel condition. Increased volume usually results from increased impervious surface within a subwatershed. As an area becomes developed, more stormwater is directed to the streams from neighborhood storm drains, residential and commercial stormwater facilities, and road drainage. In general, scientists have found that levels of impervious cover of 10 percent or more within a subwatershed are directly linked to increased stormwater runoff, enlargement of stream channels, increased stream bank erosion, lower dry weather flows, higher stream temperatures, lower water quality, and declines in aquatic wildlife diversity. When impervious cover reaches 25 to 30 percent, streams can become severely degraded.

As shown in **Table 16: Impervious Coverage by HUC 14 Subwatersheds**, impervious coverage is moderate in Swedesboro. The HUC 14 with the highest percentage of impervious coverage is the Raccoon Creek (Below Swedesboro Road/Birch Creek) subwatershed with about 10 percent impervious coverage. The other subwatershed, Raccoon Creek (Swedesboro Road – Russell Mill Road), located partially in Swedesboro, has about five percent impervious coverage. With low rates of impervious surfaces, precipitation is able to infiltrate into the ground and recharge aquifers, and streams are not inundated with polluted stormwater flows.

Table 16: Impervious Coverage by HUC 14 Subwatersheds

Watershed Name	Watershed ID (HUC 11 #)	Subwatershed Name	Subwatershed ID (HUC 14 #)	Amount Impervious
Raccoon Creek/Birch Creek	02040202150	Raccoon Creek (Swedesboro Road - Russell Mill Road)	02040202150050	4.58%
		Raccoon Creek (Below Swedesboro Road /Birch Creek)	02040202150060	9.87%

Source: NJDEP, 2002

Stream Buffers

The stream buffer is the region immediately beyond the banks of a stream that serves to limit the entrance of sediment, pollutants, and nutrients into the stream itself. Stream buffers are quite effective at filtering substances washing off the land. The vegetation of the buffer traps sediment and can actually utilize (uptake) a percentage of the nutrients flowing from lawns and farm fields. When forested, a stream buffer promotes bank stability and serves as a major control of water temperature. The buffer region also serves as a green corridor - a greenway - for wildlife to move between larger forested habitat areas. Residents can utilize these greenways for recreation with the addition of trails, bikeways, and access points to water for fishing and canoe/kayak launching.

The importance of a healthy, intact buffer zone (also referred to as a “riparian corridor”) has been well-documented scientifically over the past 20 years, especially for headwater streams. However, there is less agreement and much continuing research on the appropriate minimum width of a buffer. In the literature on this issue, a recommended minimum buffer width of 100 feet is most common, with differing activities permitted in each of three zones within the buffer. Buffers of up to 300 feet are recommended for wildlife corridors and potential passive recreational use, such as walking trails.

The New Jersey Freshwater Wetlands Protection Act incorporates buffer requirements into its wetland protection regulations. The width of the “transition zone” extending beyond a wetland is determined by the value of the wetland, based on its current use and on the documented presence/absence of threatened or endangered species. Municipalities may not establish buffers on wetlands that exceed those required by the state statute.

However, the municipality can make certain that those limits are accurate through its review of the wetlands delineation process, and it can also monitor use of the land within the transition area and take action against encroachments.

Currently, Swedesboro does not have a riparian buffer ordinance, also known as a stream corridor ordinance, regulating the protection of vegetated buffers in the borough. Consequently, vegetation along waterways in Swedesboro varies greatly. Church Run is bordered by some wetlands and upland forests, while Raccoon Creek and Lake Narraticon lack the surrounding tidal marshes and wooded wetlands that are important in protecting habitat and water quality. See **Map 16: Natural Vegetation (2007)** for a visual depiction of Swedesboro's stream buffers.

Protecting riparian areas from development and enhancing or maintaining healthy vegetation in the stream corridor can help improve water quality, reduce flooding, and encourage biodiversity. Environmental Commissions can encourage the preservation of existing vegetation and replanting of native vegetation along bare stream banks. Use of native vegetation in landscaping minimizes the need for pesticide and fertilizer use, and requires less frequent watering and mowing.

Church Run

A stream corridor ordinance would help protect the entire stream ecosystem. NJDEP and the Association of New Jersey Environmental Commissions (ANJEC) have model stream corridor ordinances that can provide guidance to interested municipalities. The ordinance should require developers to grant conservation easements on stream buffer areas as part of any site plan and subdivision approval. Regular easement inspections should also be established and enforced. Riparian buffer areas may also be acquired by municipalities as part of a recreational park, open space, or greenway plan.

Groundwater

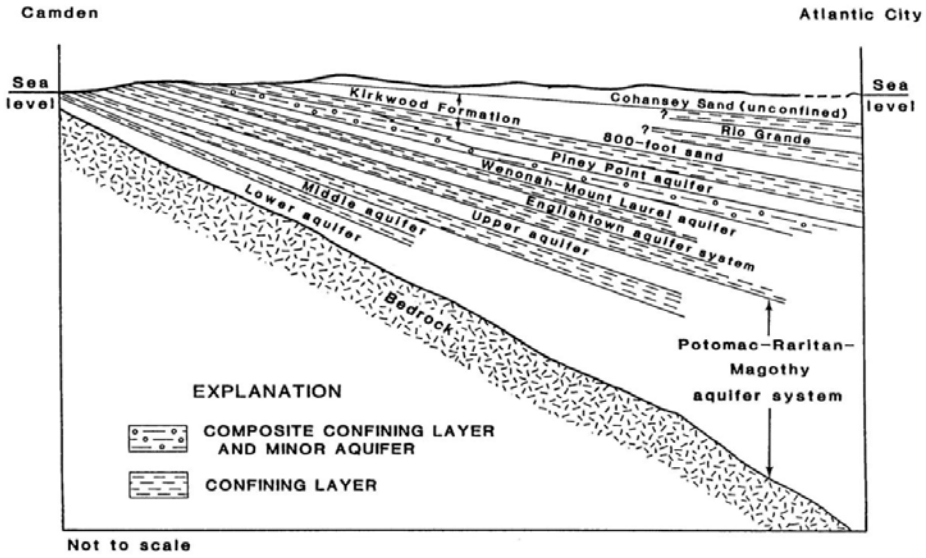
The geology of the New Jersey Coastal Plain can be visualized as a tilted layer cake, with its "layers," or strata, formed of gravels, sands, silts, and clays. The saturated gravel and sand layers, with their large pore spaces, are the aquifers from which water is drawn. The silt and clay layers, which impede the movement of water, are called confining beds.

A cross-section across southern New Jersey from west to east would show that the aquifers are not horizontal, but tilted toward the southeast, getting deeper as they cross the state toward the Atlantic Ocean. This cross-section is depicted in **Figure 8.** Because of this tilting, each aquifer emerges on the land surface in a sequential manner. The deepest strata emerge on the surface near the Delaware River.

Where each individual aquifer emerges on the land surface is called its “outcrop” area. Preventing contamination of the land in outcrop areas is extremely important in order to maintain a safe drinking supply. Confining units may also outcrop. Also known as an aquitard, a confining unit is an impenetrable layer of fine, compact clay that divides one aquifer from another.

The Potomac–Raritan–Magothy (PRM) formation is the deepest and most abundant aquifer in the region and is a major water source for Inner Coastal Plain communities like Swedesboro. Other smaller aquifers on top of the PRM are the Englishtown, the Wenonah-Mount Laurel, and the Kirkwood-Cohansey. The Kirkwood-Cohansey is a large formation that begins at the divide between the inner and outer coastal plain and is composed of two thick layers—-the Kirkwood (lower) and the Cohansey (upper)—-which overlie the older formations.

Figure 8: Aquifers of Southern New Jersey



Source: US Geological Service

Aquifers

Within Swedesboro, the Englishtown Aquifer outcrops in the northwest, while the Wenonah-Mount Laurel Aquifer outcrops in the south. In between these aquifers is one outcropping confining unit, the Marshalltown-Wenonah Confining Unit. As mentioned above, underlying these aquifers and confining unit is the important Potomac-Raritan-Magothy Aquifer system from which all of Swedesboro’s public water supply is drawn. See **Map 13: Geologic Outcrops**.

Potomac-Raritan-Magothy Aquifer System

The PRM is a deep geological formation underlying Swedesboro. This multiple aquifer is actually a large series of formations that have been combined and described as a single

unit because the individual formations–-the Potomac group and the Raritan and Magothy formations–are lithologically indistinguishable from one another over large areas of the Coastal Plain. That is, they are composed of materials of like kind and size laid down by both an advancing and retreating sea across southern New Jersey, and by deposits of material that came from the breakdown and erosion of the Appalachian and Catskill Mountains beginning in the Cretaceous Period.

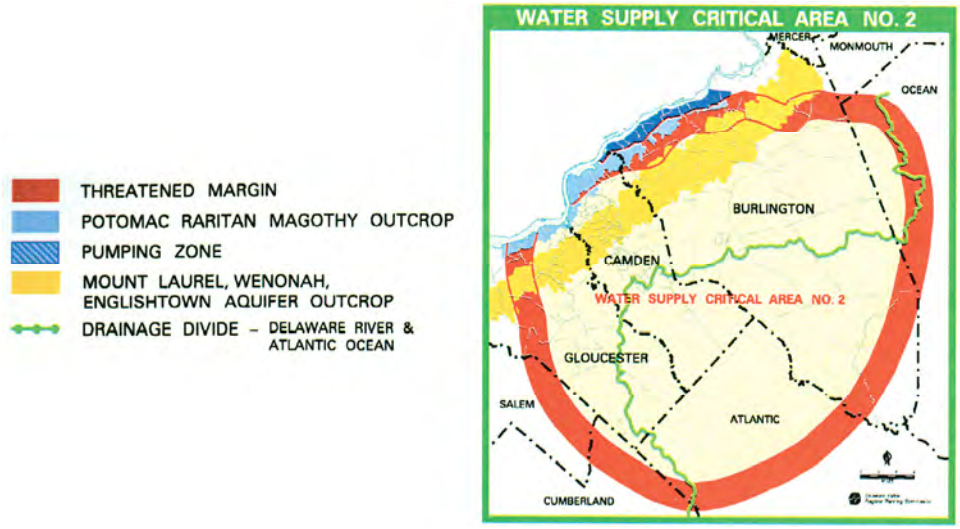
In the Delaware Valley, three aquifers have been distinguished within the PRM system, designated as lower, middle, and upper, and divided by two confining units or layers between the three water-bearing strata. The aquifers themselves are largely made up of sands and gravels, locally inter-bedded with silt and clay. The lower aquifer sits on the bedrock surface. Confining beds between the aquifers are composed primarily of very fine-grained silt and clay sediments, which are less permeable and thus reduce the movement of water between the aquifers. They also help to slow the entry of any contaminants on the surface down into the groundwater.

The PRM is the primary source of drinking water for New Jersey residents from Burlington to Salem counties, as well as communities in Delaware. Because of such high usage, PRM aquifer water levels have declined. This became so serious that the New Jersey Department of Environmental Protection established the Water Supply Critical Area No. 2 in 1986. All water supply companies within Critical Area No. 2 were given annual limits on water withdrawals in the PRM. Usage from the PRM was cut back by over 20 percent and no increases in pumping were allowed. Piping of treated Delaware River water filled the gap in much of the region. As shown in **Figure 9**, Swedesboro falls within this restricted water supply area.

There is increased concern that additional pumping from the aquifer in the borderline areas will necessitate the expansion of the Critical Area No. 2 boundaries. Water supply companies in Burlington, Ocean, Gloucester, and Salem counties have and will continue to have difficulty getting approvals from the New Jersey Department of Environmental Protection for any additional water allocations from the PRM.

Lake Narraticon Park

Figure 9: Water Supply Critical Area No. 2



Source: DVRPC

Englishtown Aquifer System

The Englishtown Formation, of the late Cretaceous age (65 to 100 million years ago), lies directly on top of the PRM. It outcrops in the Inner Coastal Plain in an irregular band that extends from Raritan Bay to the Delaware River. Within Swedesboro, the Englishtown Aquifer outcrops in the northwestern part of the borough. Where the Englishtown Formation is exposed, the primary component is fine-to-medium-grained sand. In parts of Burlington, Camden, Gloucester, and Salem counties, the aquifer is commonly less than 40 feet thick. It is not a major source of water in Gloucester County due to its small size and greater proportion of fine-grained sediment, resulting in lower yields.

Marshalltown-Wenonah Confining Unit

The Marshalltown and Wenonah Formations constitute a porous confining unit separating the Englishtown aquifer and the Wenonah-Mt. Laurel Aquifer. The Marshalltown Formation is a 10 to 20 foot thick layer of glauconitic silt and sand, while the Wenonah Formation is quartz sand, which is fine-grained near the Marshalltown formation and gradually becomes coarser-grained in its upper part. As the grain size of the Wenonah unit increases, the formation begins to hold more water, and the upper part of the Wenonah Formation becomes part of the Wenonah-Mt. Laurel Aquifer. This unit outcrops in a band in the central portion of Swedesboro.

Wenonah-Mount Laurel Aquifer System

On top of the Englishtown Aquifer lies the Wenonah-Mount Laurel Aquifer, of the late Cretaceous period (65 to 100 million years ago). The Wenonah-Mount Laurel Aquifer is composed of the Wenonah Formation and the more dominant Mount Laurel Sand. Although each is a distinct geologic formation, ranging from fine to coarse-grained sand,

they are linked hydraulically. This aquifer outcrops mainly in the southern half of Swedesboro. It is thickest in Burlington, Camden, Gloucester, and Salem counties, reaching 100 to 120 feet, with its top and base being approximately 175 feet and 205 feet below sea level, respectively.

Groundwater Recharge

Groundwater levels are highly variable, based on precipitation and climate. There are two USGS Groundwater Observation Sites directly located within Swedesboro and four sites located in Woolwich Township. The groundwater levels at these sites are recorded every five years, and they all tap the PRM, which has had pumping restrictions since 1986, as previously discussed in **Potomac-Raritan Magothy Aquifer System (PRM)**.

Over the last few decades, groundwater levels in the majority of the observation wells within and surrounding Swedesboro have remained relatively stable. As seen in **Table 17: USGS Groundwater Observation Sites**, the water level depth below surface (in feet) in four of the six wells increased, indicating that the groundwater level may have diminished somewhat. This means that water is found at a greater depth below the land surface. With increased water level depth, wells must be drilled deeper to reach sizable and usable quantities of water.

Table 17: USGS Groundwater Observation Sites

USGS Observation Site	Site Name	Primary Aquifer	Depth of well (feet)	Depth of hole (feet)	Date of First Observation	Depth to Water Level (feet)	Date of Last Observation	Depth to Water Level (feet)
394434075184301	Swedesboro PW3	PRM	312		12/22/69	93.0	12/05/08	94.4
394510075183802	Swedesboro Ind 9	PRM	231		05/01/63	47.0	11/17/08	50.9
394433075201201	Woolwich MW-1	PRM	216	629	03/06/98	117.0	12/03/08	115.6
394433075201101	Woolwich MW-2	PRM	220	229	03/09/98	117.0	11/10/03	118.2
394434075201201	Woolwich MW-3	PRM	300	310	11/06/98	118.4	12/03/08	119.7
394433075201202	Woolwich MW-4	PRM	525	540	06/25/98	122.0	12/03/08	121.1

Source: USGS, 2010

Recharge of groundwater is an important issue in southern New Jersey because of the dependence on aquifers for drinking supply and for agricultural use. The amount of rainwater that actually enters an aquifer is a function of many factors, including the nature and structure of the aquifer itself. The amount of precipitation that infiltrates the soil and reaches the saturated zone to become groundwater–the recharge of the aquifer–-is also dependent on climatic conditions, the nature of the soil, and the vegetation of an area.

Using precipitation records, soil surveys, and land use/land cover data, the New Jersey Geological Survey (NJGS) has developed a methodology for evaluating land areas for their ability to transmit water to the subsurface. NJDEP has used this methodology to map

and rank land areas throughout the state as to groundwater potential. Recharge is equivalent to the amount of precipitation that will reach the water table in an area with a particular combination of soils and land use. It is expressed as inches per year.

Land in Swedesboro experiences rates of recharge from less than 1 inch per year to up to 11 inches per year as seen in **Table 18: Groundwater Recharge.** See **Map 14: Groundwater Recharge** for locations of each of these recharge areas.

Table 18: Groundwater Recharge

Recharge Rate (Inches Per Year)	Area (Acres)	Percent of Borough
0 to 1	69.81	14.11%
2 to 6	67.29	13.60%
7 to 10	300.48	60.75%
11 or greater	57.06	11.54%
Total	**494.64**	**100.00%**

Source: NJDEP, 1997

In general, lands immediately adjacent to a creek's floodplains, marshes, and wetlands exhibit less groundwater recharge. In addition, large amounts of paving and impervious cover on high recharge lands will have the most detrimental impact, although these areas are also usually the places most suitable for building because they are well drained.

As recharging of groundwater resources is important in a developed area, the use of stormwater Best Management Practices (BMPs) is necessary. BMPs, such as tree trenches, bioswales, rain gardens, rain barrels, and porous pavement can be used with great success to capture, treat, and infiltrate precipitation in developed areas from all but the most significant storm events.

Water Supply Wells

Wells that provide drinking water may be either private or public water supply wells. Private water supply wells are those that serve less than 25 people and are not regulated by the EPA or DEP. On the other hand, public water supply wells–which may be publically or privately owned–are those that serve at least 25 people or 15 service connections for at least 60 days per year. According to the EPA, public water supply wells serve 90 percent of the people of the United States with drinking water. Public water supply wells are further defined as being either community or non-community. A public community water supply well serves 15 or more service connections used by year-round residents or at least 25 year-round residents. Public community water supply wells may serve municipalities, subdivisions, nursing homes, or other areas or institutions.

There are three active public community water supply wells serving Swedesboro, which are all owned and operated by the Swedesboro Water Department. They are listed in **Table 19** and shown on **Map 15: Public Water Supply Wells**.

Table 19: Public Community Water Supply Wells

Well Permit #	Original Owner	Address of Well	Depth of Bottom of Well (Feet)	Primary Aquifer
3001177	Swedesboro Water Department	Chestnut Street	315	PRM
3008730	Swedesboro Water Department	Chestnut Street, next to water tower	284	PRM
5000036	Swedesboro Water Department	Park Avenue & East Avenue	244	PRM

Source: NJDEP, 2009

Public non-community wells are another part of a public water system. These systems are at places such as rest stops, gas stations, restaurants, schools, factories, or office parks. However, Swedesboro does not have any public non-community wells.

As required by federal and state regulations, public water supply wells (both community and non-community) in the state are monitored by NJDEP on a regular basis. The monitoring schedules for the public water supply wells in Swedesboro as well as the annual drinking water quality report are shown in **Appendix A: Swedesboro Water Department Water Quality Data**.

Sampling requirements for a water system may change at any time for several reasons, including analytical results, changes in population, and/or inventory. It is generally the responsibility of the public water system and its licensed operator to make sure proper monitoring is performed for the entire distribution system and each point of entry for all parameters. Sampling requirements may be confirmed by referring to the Code of Federal Regulations (40 CFR 141) and the New Jersey Safe Drinking Water Act Regulations (N.J.A.C. 7:10).

Air Quality

Air quality is one of the most difficult environmental resources to measure because its sources are diffuse and regional in nature. For example, the burning of coal in Ohio, Michigan, and western Pennsylvania to generate electricity sends pollutants such as sulfur, nitrogen, and particulate matter all the way to the East Coast. Common locally produced sources of air pollution include daily roadway traffic and industrial facilities.

Criteria Pollutants

Ground level ozone (O_3) is formed when volatile organic compounds (VOCs) and nitrogen oxides react with sunlight and heat. It is produced more in the summer months and is the primary constituent of smog. Ground level ozone is a pulmonary irritant, which, even in low levels, can be dangerous to sensitive populations such as people with asthma or emphysema, and the elderly. It can also affect plant growth and is responsible for hundreds of millions of dollars in lost crop production.

Particulate matter (PM), or particle pollution, is made up of dust, ash, smoke, and other small particles formed from the burning or crushing of materials such as wood, rocks, and oil. When ingested, particulate matter can lodge deep in the lungs and can contribute to serious respiratory illnesses such as asthma or lung disease. Particulate matter also creates haze, reduces visibility, and covers buildings in dirty soot.

Carbon monoxide (CO) is a colorless, odorless gas that is formed when carbon fuel is not burned completely. It is a component of motor vehicle exhaust; therefore, higher levels of CO generally occur in areas with heavy traffic congestion. The highest levels of CO typically occur during the colder months when air pollution becomes trapped near the ground beneath a layer of rising warm air.

Nitrogen oxides (NOxs) are a group of highly reactive gases that contain nitrogen and oxygen in varying amounts. Motor vehicles, electric utilities, and homes and businesses that burn fuels emit nitrogen oxides; they can also be found naturally. Nitrogen oxides are primary components in ground-level ozone (smog), acid precipitation, and other toxic chemicals. Acid precipitation can cause lung ailments in humans, property damage, harm to aquatic life, and other environmental and human health problems.

Sulfur dioxide (SO_2) is released into the atmosphere when fuel containing sulfur, such as coal and oil, is burned, and when gasoline is refined from oil. Sulfur dioxide dissolves in water vapor to form acid precipitation.

Lead (Pb) is a pollutant that was historically released by cars and trucks burning leaded fuel, but metal processing plants and trash incinerators are the major source of emissions today. Lead tends to be a localized air pollutant, found in urban or high traffic areas, and is deposited in soil and water, harming fish and wildlife.

As early as the 1950s, increasing public awareness regarding air pollution initiated the passage of a number of state and federal laws. The Clean Air Act of 1963 (CAA 63) became the first piece of federal legislation to monitor and control air pollution by authorizing a research program within the U.S. Public Health Service. The CAA 63 identified six principal pollutants, called criteria pollutants, which are destructive to human health and to the built and natural environment. These criteria pollutants include: ozone, particulate matter, sulfur dioxide, nitrogen oxides, carbon monoxide, and lead (see inset for explanation of Criteria Pollutants).

Less than a decade later, the Clean Air Act of 1970 (CAA70) established a more comprehensive plan for federal and state regulations to limit air pollution from stationary and mobile sources. This created four major regulatory programs: the National Ambient Air Quality Standards (NAAQS), State Implementation Plans (SIPs), New Source Performance Standards (NSPS), and National Emission Standards for Hazardous Air Pollutants (NESHAPs).

The enforcement authority of the CAA 70 was also greatly expanded as the National Environmental Policy Act (NEPA) was passed, creating the EPA in 1971. The EPA is responsible for setting two kinds of NAAQS for criteria pollutants. The primary standard sets the maximum limit for exposure to a pollutant by sensitive public groups, including asthmatics, children, and the elderly. The secondary standard sets the maximum limit for exposure to a pollutant by the general public, including protection against decreased visibility, damage to animals, crops, vegetation, and buildings.

In 1990, the Clean Air Act (CAA 90) was amended and expanded by Congress and is still considered the legal authority on air pollution control in the U.S. These amendments included a market approach to

reducing air pollution by allowing certain companies to buy and sell emission “allowances,” or “credits.” The CAA 90 required transportation projects receiving federal funding to conform to state air quality goals. The CAA 90 also revised the way that air toxins are regulated, increasing the number of regulated toxic air pollutants from seven to 187.

In New Jersey, the EPA allows NJDEP’s Bureau of Air Quality Planning (BAQP) to be responsible for the development of the SIPs (see NJAC 7:27). The SIP includes an emission inventory control strategy evaluation and coordination with other states, state agencies, regional organizations, and the public.

Between 1970 and 2008, total emissions of the six criteria air pollutants decreased by more than 50 percent in the United States. The industrial sector reduced its toxic air emissions by 70 percent during this time period. Stricter emission standards in the auto industry have made cars 90 percent “cleaner” since 1970. Cars also pollute less because refineries are required to produce cleaner fuels, and leaded gasoline was completely banned in 1996.

Air Quality Monitoring

NJDEP’s Bureau of Air Monitoring maintains a network of 42 continuous monitoring stations across the state and has proposed the establishment of two new sites. Most of the monitoring stations are clustered in the New York metropolitan area. Each station monitors at least one of 23 different parameters, including many air pollutants, as well as wind speed, wind direction, solar radiation, or other parameters. Several of these parameters (carbon monoxide, nitrogen oxides, ozone, sulfur dioxide, smoke shade, particulate matter, and various meteorological data) are measured continuously and data is available instantaneously.

The closest continuous monitoring station to Swedesboro is located in Clarksboro, Gloucester County, approximately six miles (10 kilometers) to the northeast. In 2008, the Clarksboro monitoring station tracked ozone and sulfur dioxide concentrations at the “urban” scale. This scale is designed to create an effective air monitoring zone of 10 to 100 kilometers from the station, which would include all of Swedesboro.

Air Quality Monitoring Spatial Scales

Neighborhood scale (1--10 km): monitors do not show significant differences in pollutant concentrations over areas of a few kilometers. A particular scale location can represent not only the immediate neighborhood but also neighborhoods of the same type in other parts of the city. Neighborhood scale monitors provide good data for trend analysis studies and compliance with NAASQ because their zones of representation are often found in areas where people commonly reside.

Urban scale (10--100 km): monitors show consistency among pollutant measurements with monitor separations of at least 10 kilometers. Urban scale sites are usually located at higher elevations and away from highly traveled roads and industries. These locations are ideal for evaluating concentrations over an entire metropolitan and/or rural area.

The next continuous monitoring station closest to Swedesboro is located in Winslow Township, Camden County at the Ancora State Hospital, approximately 24 miles (39 kilometers) to the east. In 2008 this station monitored four different parameters: ozone, carbon monoxide, sulfur dioxide, and acid. This station also monitors at the "urban" scale and encompasses Swedesboro.

Another nearby station is located in Camden City, Camden County. This station, called Camden Lab, is 17 miles (27 kilometers) to the northeast of Swedesboro and also monitors ozone at the "urban" scale, as well as carbon monoxide, nitrogen oxides, sulfur dioxide, smoke shade, and particulate matter at the "neighborhood" scale representative of one to 10 kilometers from the station, which is not inclusive of Swedesboro.

Carbon Monoxide

Carbon monoxide (CO) is a colorless, odorless, poisonous gas formed when carbon in fuels is not burned completely. It is a by-product of automobile exhaust, which contributes over 56 percent of all CO emissions in the United States. Carbon monoxide levels are typically higher in the winter because fuel combustion is less efficient in cold weather and during the increased frequency of atmospheric inversions. Atmospheric inversions occur when warm air traps cooler air near ground-level overnight, thus preventing pollutants from mixing into the atmosphere.

Under the CAA 70, the EPA was required to set up NAAQS for the six criteria pollutants, including carbon monoxide. There are currently two NAAQS: an eight-hour average of nine parts per million (ppm), and a one-hour average of 35 ppm. These standards are rated for primary effects, based upon public health implications, and cannot be exceeded more than once a calendar year.

The state of New Jersey is slightly different as it also sets standards for secondary effects, based on welfare implications such as visibility impairment or damage to animals, trees, crops, or materials. It also uses different measuring units, but the standards still match that of the national level, for both primary and secondary effects. The state also uses a rolling year unit instead of a calendar year.

Carbon monoxide levels have improved drastically since the implementation of the CCA 70. The last time the state of New Jersey exceeded the standards was in January 1995. Since 2002, the entire state has been declared in attainment.

In 2008, of the 12 stations within the state that monitored carbon monoxide, none exceeded the standards. The Ancora State Hospital station had the highest average

concentrations of carbon monoxide of all state-wide stations. (State-wide averages for carbon monoxide are not provided). See **Table 20: Carbon Monoxide Averages, 2008** for more details.

Table 20: Carbon Monoxide Averages, 2008

Monitoring Site	1-hr Max ppm	2nd Highest 1-hr Max ppm	8-hr Max ppm	2nd Highest 8-hr Max ppm
Ancora State Hospital	5.9	5.6	4.4	2.0
Primary NAAQS	*35.0*		*9.0*	

Source: NJDEP, 2008

Ground-Level Ozone

In the atmosphere, ozone (O_3) occurs naturally to protect the earth from ultraviolet rays. At the ground level, it can have detrimental health and environmental effects and is considered an air pollutant. Ground-level ozone needs warm temperatures and sunlight to form, which is why it is mainly a concern during daylight hours in summer months.

Under the CCA 70, the EPA established a NAAQS for ozone of a one-hour concentration at 0.12 ppm. In 1997, the EPA revised the original standard because it was not sufficient to protect public health. Therefore, they created a second standard, an eight-hour average concentration at 0.08 ppm. In 2008 this standard was restricted to 0.075 ppm. Each standard is also rated for both primary and secondary effects, which are the same at the national level. State standards for New Jersey are similar except they have tightened the one-hour concentration standard for secondary effects to 0.08 ppm.

In New Jersey, the amount of ozone has decreased greatly since the 1980s. The maximum one-hour concentration in 2008 was 0.124 ppm in comparison to the 1988 maximum one-hour concentration of 0.218 ppm. One-hour concentrations have not exceeded 0.200 parts per million (ppm) since 1988.

For ozone, the entire state of New Jersey is in moderate nonattainment, meaning it does not meet the primary or secondary NAAQS, but is within the 0.092 ppm to 0.106 ppm range. In order for New Jersey to reach attainment for ozone under the current standards, the design level, the average of the fourth highest daily maximum eight-hour average concentration that is recorded each year for three years, must be below the NAAQS.

Ozone was monitored at 14 stations throughout New Jersey in 2008 with 11 operating year-round and three operating only during ozone season (April 1st through October 31st). The three stations near Swedesboro – Clarksboro, Ancora State Hospital, and Camden Lab stations – all operated year-round.

In 2008, the new eight-hour standard of 0.075 ppm was exceeded on 30 days at four statewide stations, including the Ancora State Hospital and Camden Lab monitoring sites. There were 17 days on which the old standard of 0.08 ppm was exceeded. The one-hour

standard of 0.12 ppm was exceeded on zero days. For more specific data from the four monitoring stations near Swedesboro, see **Table 21: Ozone One-Hour Averages, 2008** and **Table 22: Ozone Eight-Hour Averages, 2008**

Table 21: Ozone One-Hour Averages, 2008

Monitoring Site	1-hr Max ppm	2nd Highest 1-hr Max ppm	4th Highest 1-Hour Average 2005 - 2007 ppm	# of Days with 1-Hour Averages above 0.12 ppm
Ancora State Hospital	0.101	0.095	0.107	0
Camden Lab	0.112	0.109	0.113	0
Clarksboro	0.118	0.107	0.107	0
Statewide	*0.142*	*0.134*		*0*
Primary NAAQS	*0.12*			
Secondary NAAQS	*0.08*			

Source: NJDEP, 2008

Table 22: Ozone Eight-Hour Averages, 2008

Monitoring Site	1st Highest ppm	2nd Highest ppm	3rd Highest ppm	4th Highest ppm
Ancora State Hospital	0.086	0.086	0.083	0.082
Camden Lab	0.095	0.093	0.088	0.083
Clarksboro	0.101	0.096	0.094	0.089
Statewide	*0.101*	*0.100*	*0.95*	*0.94*
Primary NAAQS	*0.075*			
Secondary NAAQS	*0.075*			

Source: NJDEP, 2008

Sulfur Dioxide

Sulfur dioxide (SO_2) is a heavy, colorless gas with a very distinctive odor that dissolves in water to form sulfuric acid. Emissions are often released into the air when fuels containing high sulfur content are burned, particularly electric utilities burning coal. It is also formed when gasoline is extracted from oil at locations such as oil refineries. Sulfur dioxide tends to be more prevalent during the winter months when emissions from heating sources increase. It is also more present during the late morning hours before wind speeds increase and atmospheric mixing occurs.

Similar to carbon monoxide, sulfur dioxide levels have greatly decreased in recent decades since the implementation of regulation. The last date on which the state of New Jersey exceeded the NAAQS was in 1980. In 2008, both the Ancora State Hospital and

the Clarksboro stations did not exceed these standards. For more specific data from these two monitoring stations, see **Tables 23** and **24**.

Table 23: Sulfur Dioxide Three-Hour and Annual Averages, 2008

Monitoring Site	3-Hour Average Max ppm	3-Hour Average 2nd Highest ppm	12-Month Average Max ppm	Average Calendar Year ppm
Ancora State Hospital	0.020	0.019	0.002	0.001
Clarksboro	0.025	0.023	0.003	0.002
Primary NAAQS	*n/a*		*0.030*	
Secondary NAAQS	*0.500*		*n/a*	

Source: NJDEP, 2008

Table 24: Sulfur Dioxide 24-Hour and Daily Averages, 2008

Monitoring Site	24-Hour Average Max ppm	24-Hour Average 2nd Highest ppm	Daily Average Max ppm	Daily Average 2nd Highest ppm
Ancora State Hospital	0.009	0.008	0.008	0.008
Clarksboro	0.011	0.011	0.010	0.009
Primary NAAQS	*0.140*			

Source: NJDEP, 2008

Manual Air Quality Monitoring Network

In addition to the continuous monitoring network, the NJDEP Bureau of Air Monitoring operates a manual air quality monitoring network of 25 stations that measures a greater number of parameters. At these stations, samples are taken that are then analyzed in a laboratory for respirable particulate matter, lead, total suspended particulate matter, atmospheric deposition, ozone precursors, and a number of other contaminants. These stations are located across the state, but are generally concentrated in the New York metropolitan area.

The manual air quality monitoring station closest to Swedesboro is the Ancora State Hospital station. This station monitors acid deposition at the “urban” scale representative of 10 to 100 kilometers from the station, which would include all of Swedesboro. However, this data was unavailable at the time of publication.

Air Quality Index

The Air Quality Index (AQI) is an index for reporting daily air quality. The EPA created the AQI to indicate a region's air quality by measuring levels of five of the six criteria pollutants (excluding lead). The AQI is focused on the potential human health hazards experienced by breathing unhealthy air. Scores for the AQI range from 0 to 500 and are divided into six color-coded categories, as shown in **Figure 10**. The higher the AQI value, the greater the level of air pollution and associated health concerns.

Figure 10: Air Quality Index (AQI)

Numerical Air Quality Index (AQI) Rating	Descriptive Rating: Levels of Health Concern	AQI Color Code
0 to 50	Good	Green
51 to 100	Moderate	Yellow
101 to 150	Unhealthy for Sensitive Groups	Orange
151 to 200	Unhealthy	Red
201 to 300	Very Unhealthy	Purple
301 to 500	Hazardous	Maroon

Source: NJDEP, 2005

The daily score is based on the highest individual pollutant score reported. For example, if ozone scored 150 and particulate matter scored 100, the daily AQI would be 150, which is considered "Unhealthy for Sensitive Groups." The index is used to measure overall air quality by counting the number of days per year when the AQI of each metropolitan region exceeds 100. An AQI value of 100 generally corresponds to the national air quality standard for the pollutant, which is the level the EPA has set to protect public health.

New Jersey is divided into nine regions, which report their respective AQI. Swedesboro is located in Region 8: Southern Delaware Valley, which includes Camden and Gloucester counties. The monitoring stations for Region 8 are located at Ancora State Hospital, Camden Lab, Clarksboro, and South Camden. In 2008, the most recent year of annual data, Region 8 reported 224 good (green) and 111 moderate (yellow) days, 28 days that were unhealthy for sensitive groups (orange), and 2 unhealthy (red) days.

Point Sources of Air Quality Pollution

Under the CAA, the EPA limits the amount of other air pollutants and toxins that are emitted by point sources, such as chemical plants, industrial factories, power plants, and steel mills. The NJDEP Air Quality Permitting Program issues permits for stationary

sources of air pollution, such as power plants, oil refineries, dry cleaners, food processing centers, and manufacturing plants, and regulates and monitors their emissions. There are eight facilities with active air quality permits in Swedesboro, listed in **Table 25**.

Table 25: Facilities with Active Air Quality Permits

Facility Name	Address	PI Number
Express Gas & Auto Repair	1008 Kings Hwy	A3812
Fran Convery & Son Auto Body	Kings Hwy & Glen Echo Ave	G5553
Gas For Less	Kings Hwy & Glen Echo Ave	A9818
Margaret C Clifford School	601 Auburn Ave	55913
Pat's Service Station	1501 Kings Hwy	A5681
Swedesboro Boro Water & Sewer Dept	120 Chestnut St	55930
Verizon Swedesboro Co #35570	Broad St & Second Ave	55323
York Backman & Boris Kieymer	Main St & Glen Echo Ave	A5641

Source: NJDEP, 2010

NJDEP enacted the Emission Statement Rule in 1992, requiring certain sites that have an air quality permit to report specific air contaminants, including carbon monoxide (CO), sulfur dioxide (SO_2), ammonia (NH_3), respirable particulate matter (PM_{10} and $PM_{2.5}$), lead (Pb), total suspended particulate matter (TSP), volatile organic compounds (VOC), nitrogen oxides (NOx), and 38 other toxic air pollutants. Emission Statement reporting applies if a facility has a potential to emit: five tons or greater Pb, 10 tons or greater VOC, 25 tons or greater NOx, or 100 tons or greater of CO, SO_2, PM_{10}, $PM_{2.5}$, TSP, or ammonia.

There is one facility close to Swedesboro that is required to submit emission statements: Logan Generating Plant, located in nearby Logan Township. In 2009, the Logan Generating Plant released data on air emissions of the following 12 contaminants: ammonia, benzene, carbon monoxide, carbon dioxide, methane, nitrogen oxides, lead, respirable particulate matter, polycyclic organic matter, sulfur dioxide, total suspended particulate matter, and volatile organic compounds. The emissions of the following 10 other contaminants are also reported by the facility: acrolein, arsenic compounds, beryllium compounds, cadmium compounds, formaldehyde, hydrogen chloride, manganese compounds, mercury compounds, methylene chloride (dichloromethane), and nickel compounds. The 2009 statement of this facility is included in **Appendix B: Emissions Statements**.

CHAPTER 5

Biological Resources

The Trail in Lake Narraticon Park

When a community protects wildlife and habitat, it is also protecting biodiversity, which is important for the health and productivity of the ecosystem and its inhabitants. Biodiversity facilitates adaptation and evolution, improving a species' chance of survival as the environment changes. A diversity of plant and animal species is also necessary to maintain healthy human environments, working landscapes, and productive ecosystems. Lower organisms contribute to nutrient cycling, decomposition of organic matter, soil rehabilitation, pest and disease regulation, pollination, and water filtering. Once biodiversity declines, it is extremely difficult for an ecosystem to recover.

Swedesboro contains different types of habitats, all of which are important for maintaining biodiversity. Upland forests and wooded wetlands are the two most abundant natural ecosystems found in Swedesboro. Freshwater tidal marshes, herbaceous wetlands, and shrub/scrub wetlands are also present adjacent to Swedesboro's streams. In addition, a small percentage of Swedesboro is brush/shrubland. The following sections will identify and describe in more detail the plant and animal communities that inhabit these unique ecosystems within Swedesboro.

Natural Vegetation

A region's vegetation is dependent upon many factors, the most important of which are climate and soils. Swedesboro's climate is cool, temperate, and characterized by moderate temperatures, precipitation, and wind. The average annual temperature is 54.4°F and the average annual precipitation is 45.54 inches, which is fairly well distributed throughout the year. See the **Climate** section for more information on Swedesboro's variable climate. In addition, almost all of Swedesboro's soils are well-drained and moderately fertile, supporting a diversity of trees and crops. See the **Soils** section for a detailed description of Swedesboro's soils.

Swedesboro's natural vegetation types, along with human-influenced types of land cover, have been tabulated and mapped by NJDEP's 2007 land cover analysis. This data, based on infrared aerial photography, is the most recent available. The designation of a particular land cover as a vegetation type is based on definitions provided by the Anderson Land Use Classification System, created by the U.S. Geologic Survey. See **Table 26: Natural Vegetation** and **Map 16: Natural Vegetation (2007)**.

Table 26: Natural Vegetation

Vegetation Type	Area (Acres)	Percentage of Borough
Brush/Shrubland	5.10	1.03%
Brush/Shrubland - Oldfield	1.63	0.33%
Tidal Marshes - Freshwater	4.24	0.86%
Tidal Waters	18.10	3.66%
Upland Forest - Deciduous	33.49	6.77%
Water	11.22	2.27%
Wetlands - Herbaceous	1.54	0.31%
Wetlands - Phragmites Dominated	1.13	0.23%
Wetlands - Scrub/Shrub	1.05	0.21%
Wetlands - Wooded - Deciduous	18.65	3.77%
All Natural Vegetation	***96.15***	***19.44%***
Total Area of Swedesboro	**494.64**	**100.00%**

Source: NJDEP, 2007

Upland Forests

Upland areas are lands at somewhat higher elevations without water at or near the soil surface. Upland forests are located on drainage divides, terraces, and slopes where water is not the controlling factor and where drainage is sufficient so that soils do not become saturated for extended periods of time. Nearly all old growth forests in New Jersey, because of their natural fertility, were harvested for lumber and farmland during colonial times. Most upland areas in Swedesboro have since been converted to development, and current upland forests are mostly second- or third-growth woodlands. Upland forests are the most abundant natural vegetative land cover in Swedesboro comprising 34 acres (seven percent) of the borough.

All of the upland forest in Swedesboro is composed of deciduous forest. The composition of these upland deciduous forests is largely one of mixed oaks – white, black, red, chestnut, and scarlet – joined by black birch, American beech, mockernut hickory, and black walnut. Tulip tree and red maple are also common. The understory may be dominated by flowering dogwood, mountain laurel, American holly, greenbriar, black cherry, ironwood, and sassafras. Vines, such as Virginia creeper, wild grapes, Japanese honeysuckle, and poison ivy, may also be common. Spicebush, arrowwood, amelanchier,

Invasive Flowering Vines near Lake Narraticon

sweet pepperbush, and black haw may be common shrubs in moister locations.

Much of Swedesboro's upland forests have been cleared and converted to residential or industrial development. The remaining uplands are located along stream corridors, or are associated with agricultural land. Many of the upland forests are in areas with steep slopes, which are impractical for development.

The Swedesboro Shade Tree Commission has completed an inventory of tree varieties found in the borough, which is included in **Appendix D: Plants in Swedesboro, Shade Trees**.

Wetlands

Wetlands are a critical ecological resource, supporting both terrestrial and aquatic animals and boasting biological productivity far greater than that found on dry land. Wetlands play a vital role in maintaining water quality by naturally filtering surface and groundwater. The ecological importance of wetlands, however, has not always been appreciated. For over three centuries, people drained, dredged, filled, and leveled wetlands to make room for development and agriculture. Although the pace of wetland destruction has slowed markedly in the past three decades, human activities have destroyed approximately 115 million of the original 221 million acres of wetlands in the United States since the beginning of European settlement. See the section on Wetlands in **Surface Water Resources** for a definition of wetlands and information on New Jersey regulations.

New Jersey's wetlands are located around numerous interior stream systems, and along coastal rivers and bays. NJDEP, which employs USGS guidelines, classifies wetlands with naturally occurring vegetation into two major categories: (1) *tidal wetlands*, which are wetlands associated with tidal portions of the Delaware River system and waterways draining into the Atlantic Ocean; and (2) *interior wetlands*, which are wetlands found in nontidal lowlands associated with waterways, and isolated wetlands surrounded by uplands.

After upland forests, wetlands are the second most common natural vegetative land cover in Swedesboro, covering five percent of the borough's total land, or 27 acres. Most wetlands are found near Raccoon Creek and its tributaries. While Swedesboro has some tidal wetlands, called freshwater tidal marches, the majority are considered interior wetlands. Of the interior wetlands, the most abundant are deciduous wooded wetlands with smaller amounts of herbaceous, Phragmites-dominated, and scrub/shrub wetlands.

Freshwater tidal marshes occupy four acres (one percent) of Swedesboro and are located on the far side of Raccoon Creek near King's Highway. Wild rice (*Zizania aquatica*) is perhaps the most distinctive of the plants that grow in freshwater tidal marshes. This annual grass can grow to be nine feet tall and is an important food source for migratory waterfowl. It is often found in association with broad-leafed cattail. Other typical plants found in freshwater tidal marshes in New Jersey are water hemp, jewelweed, pickerelweed, arrow arum, nodding beggar ticks, sneezeweed, spatterdock, pond lily, Japanese knotweed (an invasive plant), and Joaquin sunflower.

Scattered throughout Swedesboro are deciduous wooded wetlands (sometimes referred to as wetland forests or, more typically, hardwood swamps). Deciduous wooded wetlands occupy approximately 19 acres (four percent) of Swedesboro's total land area and support mixed hardwoods that flourish in lowlands. The trees in Swedesboro's deciduous wooded wetlands may include American sycamore, river birch, white ash, swamp white oak, green ash, and sweetgum. Deciduous wooded wetlands provide important habitat for a wide variety of mammals, birds, reptiles, and amphibians. Many of the wooded wetlands are also found adjacent to the majority of Swedesboro's deciduous upland forests

Closely associated with deciduous wooded wetlands are scrub/shrub wetlands, occupying about one acre (less than one percent) of Swedesboro. These wetlands are generally composed of young, medium-height, primarily deciduous woody plants. Scrub/shrub wetlands are usually in early successional stages and will later become shrub-dominated wetlands or those dominated by canopy tree species. The trees in Swedesboro's scrub/shrub wetlands may include red maple, ash, and sweetgum, and may be dominated by shrub species like silky dogwood, buttonbush, winterberry, swamp rose, elderberry, southern arrowhead, and hazel alder. Multiflora rose is typically the most common invasive species in scrub/shrub wetlands.

Other types of wetlands found in Swedesboro include herbaceous (non-woody plants) wetlands, which cover less than one percent of the borough. Herbaceous wetlands generally occur along lake edges and open floodplains. Herbaceous wetland plants in New Jersey may include Jack-in-the-pulpit, jewelweed, ferns, rice cutgrass, reed canary grass, pond lily, tearthumb, broadleaf cattail, and the common reed (*Phragmites*). Other common herbaceous wetlands plants found in Swedesboro may include the common blue violet, dodder, skunk cabbage, marsh marigold, and Turk's cap lily.

Much of the herbaceous wetlands in Swedesboro are dominated by the invasive species *Phragmites*. *Phragmites* is a reed that colonizes easily and pushes into wetland areas from adjacent dry land areas, spreading through an underground root system that is difficult to eradicate. In addition to its tendency to aggressively spread, *Phragmites* often becomes a dominant monoculture and is therefore considered an invasive species.

Grasslands and Agricultural Lands

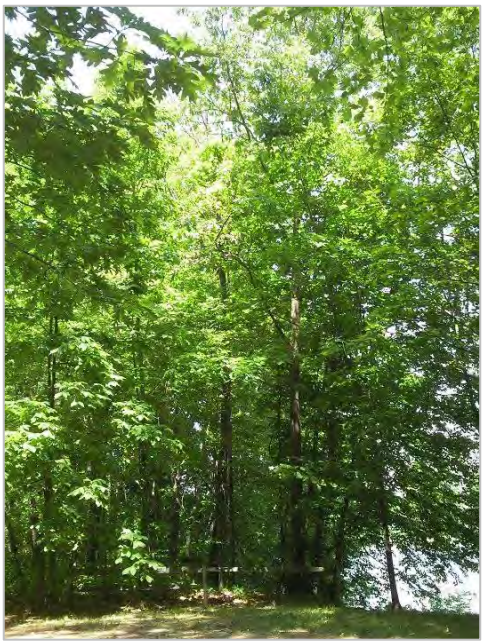
Grasslands are considered to be one of the most endangered ecosystems globally. They are threatened by human development, new agricultural technology, grazing, desertification, soil erosion, and invasive species. Grasslands are important because they provide habitat for specialized species such as grassland birds and shade-intolerant herbaceous plants. Many species of increasingly rare grassland birds require large contiguous patches of grassland for successful breeding and roosting.

NJDEP defines grassland habitat as brushland, shrubland, or old fields that were cleared or disturbed at one time and then abandoned. Following abandonment, old fields are overgrown by perennial herbs and grasses. These pioneer plants remain the dominant species for 3 to 20 years. Later, woody plants take over. This habitat is visible, especially

along wood edges, roadsides, and in landscapes where mowing is infrequent and where woody plants are not yet the dominant vegetation.

About seven acres (one percent) of Swedesboro's land cover consists of brushland, shrubland, or old field. Brushland and oldfield is generally found adjacent to residential and industrial development, and occurs more often near wetland areas. Small trees, such as sassafras, black cherry, red cedar, and white oak are common on old field lands. Meadow onion, broom-sedge, common dogbane, and vines of Japanese honeysuckle can also be found in grassland habitat.

Landscape Project Priority Habitats



Woodlands at Lake Narraticon

The Landscape Project, developed by the Endangered and Nongame Species Program of the NJDEP Division of Fish & Wildlife, documents the value of various types of habitats within New Jersey that may be home to rare species. It categorizes these habitats into one of five groups according to their importance (five being the highest). Categories three through five include habitats throughout the state that possess two exceptional conditions: (1) a documented occurrence of one or more species on either the federal or the state threatened and endangered species lists, and (2) a sufficient amount of habitat type to sustain these species. These habitats are collectively known as "critical habitat." Categories one and two include habitats that either have a documented occurrence of a Species of Special Concern[1] in New Jersey, or are deemed suitable for species on the state or federal threatened and endangered species lists, but for which there are no documented occurrences or sightings. These habitats are labeled "suitable habitats."

Approximately 15 percent (76 acres) of Swedesboro has been identified by the Landscape Project as critical or suitable habitat for threatened or endangered species. It is important to preserve both levels of habitat in order to maintain the diversity of species that still exists in the borough. The rankings in Swedesboro are the result of habitat being either critical or suitable for the bald eagle, an endangered species, or the great blue heron, a species of special concern. See **Map 17: Landscape Project Priority Habitat (2007)**.

[1] A Species of Special Concern is a formal definition that indicates a species that may be under consideration for listing as threatened due to documented population decline or habitat loss.

Table 27: Landscape Project Habitats

Category	Rank	Area (Acres)	% of Total Habitat	% of Swedesboro
Emergent Wetlands	Suitable Habitat (2)	4.24	5.61%	0.86%
Forested Wetlands	Suitable Habitat (2)	22.36	29.57%	4.52%
Upland Forest	Critical Habitat (4)	34.62	45.79%	7.00%
	Suitable Habitat (2)	13.75	18.19%	2.78%
	Total	*48.38*	*63.98%*	*9.78%*
Grassland	Suitable Habitat (1)	0.64	0.84%	0.13%
	Total Habitat	**75.62**	**100.00%**	**15.29%**
	Total Swedesboro Land	***494.64***		***100.00%***

Source: NJDEP, 2007

Landscape Project Wetland Habitat

The Landscape Project divides wetland habitats into two types–-emergent and forested wetlands. Emergent wetlands are marshy areas characterized by low-growing shrubs and herbaceous plants in standing water, while forested wetlands have denser tree growth. There are four acres (one percent of Swedesboro) identified as emergent wetlands habitat ranked at the suitable level. There are over 22 acres (five percent) of forested wetlands in Swedesboro that provide habitat for threatened and endangered species identified as suitable habitat by the Landscape Project. Suitable habitats of emergent and forested wetlands are located in areas adjacent to Raccoon Creek and its tributaries. Within Swedesboro, these emergent and forested wetlands provide suitable habitat for the great blue heron.

Landscape Project Upland Forest Habitat

The Landscape Project ranks almost 10 percent (48 acres) of Swedesboro's total land cover as priority upland forest habitat. Of this, seven percent (35 acres) provides critical habitat and three percent (14 acres) provides suitable habitat. Upland forest habitat can be found adjacent to many of Swedesboro's forested wetlands along Raccoon Creek and its tributaries. Upland forest in Swedesboro is ranked to protect the habitat of the endangered bald eagle.

Landscape Project Grassland-Dependent Species Habitat

The Landscape Project designates nearly one percent of Swedesboro (less than one acre) as suitable habitat for rare grassland-dependent species. There were no areas designated as critical habitat. The entire suitable grassland-dependent species habitat is located along the southwestern boundary of Swedesboro.

Grassland-dependent species (mostly birds) are the most threatened group of species in New Jersey, primarily because the most common form of habitat used by these species – agricultural fields – is also the most threatened habitat in the state. This is due to development pressure associated with rising land values as well as changes in agricultural practices on remaining agricultural lands.

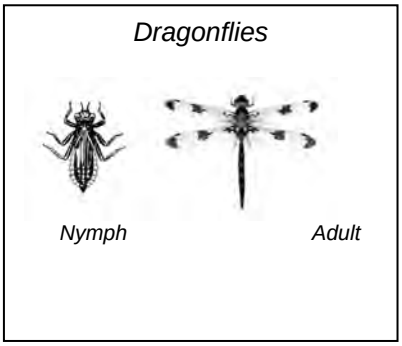
Many agricultural lands serve as habitat for grassland-dependent species since migrating birds cannot visually distinguish cropland from grassland, and because cropland evolves into grassland when it is fallow for one year or more. Additionally, some crops, like alfalfa and soybeans, provide suitable nesting habitat for small birds like sparrows. All or most threatened and endangered birds require large ranges that include agricultural "grasslands." The Landscape Project includes this land in its assessment because agricultural lands provide important disturbance buffers between the rare and endangered wildlife species and humans, and between the rare species and widespread predatory animals like dogs and cats.

Animal Communities

Although no comprehensive inventory of the different animal species within Swedesboro exists, there are records of sightings, biological studies of range, and assessments of endangered and threatened species status. Using federal, state, and other scientific sources, it is possible to identify and describe known and possible animal communities of Swedesboro. These are included in **Appendix C: Animals Known or Probable in Swedesboro**.

Invertebrates

Invertebrates are the basis of a healthy environment and are part of every food chain, either as food for amphibians and fish, or as a part of nutrient cycling systems that create and maintain fertile soils. Invertebrates consist of insects (beetles, butterflies, moths, dragonflies, ants, termites, bees, wasps, flies, and others), arachnids (spiders, ticks, and mites), crustaceans (crayfish and microscopic copepods), mollusks (mussels, clams, snails, and slugs), and worms.



The Dragonfly Nymph – a common macroinvertebrate found in southern New Jersey's waterways

Macroinvertebrates are invertebrates that are visible to the naked eye but smaller than 50 millimeters. Benthic (bottom-dwelling) macroinvertebrate communities provide a basis for ecological monitoring and are relatively simple to collect from shallow stream bottoms. These communities consist largely of the juvenile stages of many insects, such as dragonflies and mayflies, as well as mollusks, crustaceans, and worms. Monitoring for diverse assemblages of macroinvertebrates reveals the effect of pollutants over a longer period of time, as compared to chemical monitoring which measures water quality at one moment in time. The AMNET surveys streams for macroinvertebrate communities, which indicate certain levels of

water quality, discussed in the section on **Surface Water Quality**.

There are nine endangered invertebrate species (two beetle species, four butterfly species, and three mussel species) and eight threatened invertebrate species (three butterfly species and five mussel species) in New Jersey. Of those species on the New Jersey Endangered and Threatened List, one – the dwarf wedge mussel – is listed as endangered under the Federal Endangered Species Act.

Of particular interest in Swedesboro are freshwater mussels. At one time, freshwater mussels were abundant in the streams of the area and were a major food source for native peoples. Unfortunately, due to destruction of suitable aquatic habitats by dams and pollution, the native mussel population has sharply declined. The Center for Biodiversity and Conservation (CBC) had developed a handbook for mussel identification within the New York Metropolitan Region and New Jersey to aid the conservation of their local freshwater ecosystems. According to CBC, mussel habitat exists within Raccoon Creek as a part of the lower Delaware River watershed, and some species may still be present.

There is no survey data on invertebrates or any threatened or endangered invertebrate species for Swedesboro. However, the wetland and riparian areas around Raccoon Creek and its tributaries are likely to support diverse invertebrate communities.

Vertebrates

Vertebrates are less numerous than invertebrates, but their larger size makes them much more visible, and thus better studied and recorded. The habitat ranges of fish, amphibian, and reptile species are fairly well documented in New Jersey, as are mammals. Birds that nest in the borough have been inventoried, but migrants that depend on Swedesboro's wetlands and forests as stopover sites in which to rest and feed are not as thoroughly inventoried.

Mammals

Mammals appear to be abundant because they tend to be larger and live in habitats also ideal for human development. There are 90 mammal species in New Jersey, of which nine are listed as endangered and none are listed as threatened by the state. Some common mammals found in Swedesboro may include the brown rat, Eastern cottontail, Eastern chipmunk, gray squirrel, house mouse, opossum, red fox, raccoon, river otter, and white-tailed deer. There have been no threatened or endangered mammals documented in Swedesboro.

White-tailed deer are a common species in New Jersey, and their conflict with humans in suburban areas is an increasing concern. Officially, their state-wide population status is considered "decreasing" due to the combined impacts of habitat loss, crop damage, and vehicle collisions. However, many areas in the state are experiencing great increases in deer populations as herds are forced to find new habitat. Managing deer populations is difficult as herds have the ability to double, or even triple, their numbers within a single

year. Although highly dependent upon the ecological carrying capacity of the land, a healthy deer concentration is estimated to be 20 deer per square mile or less.

Deer thrive in fragmented “edge” conditions and altered areas since these habitats support the new plant growth and mixed vegetation that deer prefer. New Jersey’s agricultural and suburban landscapes are prime examples of these habitats, and they provide deer with food year-round. An overpopulation of deer will decimate plant communities through overgrazing, which destroys the growth of seedlings and young trees. This loss of habitat then causes the health of deer to decline, making them more susceptible to disease and malnutrition. Habitat loss through overgrazing also threatens the entire ecosystem since other animals depend upon the same plants for survival.

The Community-Based Deer Management Permit program in New Jersey allows alternative and traditional techniques to control deer populations in the state. Traditional and controlled hunting as well as bait and shoot tactics are lethal ways to sustain deer numbers. Minimizing the amount of edge habitat also controls numbers and is best achieved by preserving large, contiguous tracts of land. Another strategy is modifying habitat by planting deer-repellant plants such as lavender, shadbush, ornamental sage, yarrow, and plants with thorns. More costly deer management strategies can also be utilized, such as installing reflectors and reducing speed limits on roads, employing traps for relocations, and administering fertility control measures.

Birds

New Jersey has between 350 and 500 species of birds, which is an exceptional number given the state’s small size. New Jersey is an important location for migratory birds heading south for the winter. Not only is the state an important “rest stop” for birds migrating to warmer climates in Central and South America, but also the New Jersey Atlantic Coast and the Delaware Bay are major parts of the Eastern Flyway (established migratory air route) in North America.

Swedesboro is home to a great abundance and variety of birds, many of which are listed in **Appendix C: Animals Known or Probable in Swedesboro.** The New Jersey Audubon Society has published a book, *Birds of New Jersey,* which provides information on the occurrence, range, and habitat of breeding birds in the state. Some birds that may be numerous or commonly seen include the turkey vulture, wood duck, mallard, red-tailed hawk, killdeer, mourning dove, red-bellied woodpecker, downy woodpecker, hairy woodpecker, Northern flicker, great crested flycatcher, Eastern kingbird, blue jay, American crow, fish crow, purple martin, tree swallow, barn swallow, Carolina chickadee, tufted titmouse, Carolina wren, house wren, blue-gray gnatcatcher, wood thrush, American Robin, gray catbird, Northern mockingbird, brown thrasher, European starling, cedar waxwing, yellow warbler, common yellowthroat, Eastern towhee, chipping sparrow, field sparrow, song sparrow, Northern cardinal, indigo bunting,

Birds on Lake Narraticon

red-winged blackbird, common grackle, orchard oriole, Baltimore oriole, house finch, American goldfinch, and house sparrow.

Another common bird is the Canada goose. The State of New Jersey has a “resident” Canada goose population of approximately 100,000 birds that no longer migrate to more southern locales, and that number may double in the next 5 to 10 years. While geese are a pleasant component of the urban/suburban environment, providing enjoyable wildlife opportunities for the public, they can also cause property and environmental damage. Goose droppings that wash into lakes during storm events can elevate coliform bacteria to unhealthy levels, closing lakes to swimming. Goose droppings limit human use of grassy areas in parks, and because geese can be quite aggressive during the nesting season, they can also injure humans.

Removing geese or preventing them from residing in park areas is a difficult task. Because geese move freely, the most effective management solutions are best conducted at the community level. Canada geese are protected by the Migratory Bird Treaty Act. Therefore, a management program may require the US Department of Agriculture’s approval and permits. A new federal rule signed into law in December 2005 eases hunting restrictions and allows county and municipal officials to coordinate with state fish and wildlife departments to destroy birds and/or eggs that pose a threat to public health and safety. Management techniques include planting shrubby vegetation around streams, lakes, and ponds to block waterfowl access, discouraging humans from feeding geese, and removing geese eggs and replacing with decoys.

The marshes of the Raccoon Creek north of Swedesboro are known for large populations of migratory waterfowl that come in, especially to feed on the wild rice in late fall. Documentation of migratory birds that rely on Swedesboro’s habitats is quite limited, in comparison to breeding bird species.

Swedesboro is home to some rare birds that include endangered and threatened species. Many of these species have had documented sightings in the area. State endangered species sightings include the bald eagle and Northern harrier, while state threatened species, the Cooper’s hawk and grasshopper sparrow, have also been seen. Species of special concern have also been documented in the area including: the least bittern, great blue heron, American kestrel, horned lark, yellow-breasted chat, and the Eastern meadowlark. There have been several reported sightings of anhinga, a darter bird that although common in Florida and the southeast, infrequently migrates to the northeast and New Jersey.

Portions of Swedesboro also lie within the *Oldmans, Raccoon, Birch Creeks and Pedricktown Region Important Bird Area*. An Important Bird Area (IBA) is a site that provides essential habitat for one or more species of birds, and that are important to the long-term viability of native avian populations. This particular IBA covers over 28,093 acres, beginning at the Delaware River and running along the border of Gloucester and Salem Counties. The site includes the Oldmans, Raccoon, and Birch Creeks. The site provides several habitats, such as open waters, wetlands, deciduous woods and scrub-shrub habitats. These habitats attract a number of bird species, both for migrating and

breeding, including the least bittern, peregrine falcon, Northern harrier, and bald eagle, all of which are state endangered.

Reptiles and Amphibians

Reptiles and amphibians can be quite elusive when surveys attempt to document them. Some reptiles and amphibians are rare because they depend on vernal ponds, as discussed in the **Surface Waters Resources** section. Amphibians in particular tend to be very sensitive to environmental changes, offering a visible warning to humans that significant changes are occurring.

Eastern box turtle near Raccoon Creek

New Jersey is home to approximately 80 reptile and amphibian species, and NJDEP provides an online field guide documenting their ranges and habitats. Some common herpetological species (reptiles and amphibians) that may be present in Swedesboro include the red-backed salamander, Fowler's Toad, green frog, wood frog, common snapping turtle, common musk turtle, Eastern box turtle, Eastern painted turtle, Northern black racer, black rat snake, Northern water snake, Northern brown snake, and Eastern garter snake. See **Appendix C: Animals Known or Probable in Swedesboro** for a complete list of reptiles and amphibians that may be found in Swedesboro.

Fish

When European settlers arrived in present-day Swedesboro, they encountered Lenni Lenape Indians, who regularly fished along the inland streams and gathered shellfish in the Delaware River. Shad fishing was an important industry along the Delaware River until the early twentieth century. Due to the unintended consequences of overfishing, urban development, industrial advancement, and mechanized agriculture, the amount and diversity of aquatic life has decreased dramatically throughout most of New Jersey.

The New Jersey Division of Fish and Wildlife, under the Bureau of Freshwater Fisheries, monitors and actively aids the propagation, protection, and management of the state's freshwater fisheries. The bureau raises several million fish for stocking in suitable water bodies and conducts research and management surveys.

There are over 30 species of fish that may be found in Swedesboro's streams and lakes as documented in Rudolf G. Arndt's "Annotated Checklist and Distribution of New Jersey Freshwater Fishes, with Comments on Abundance." Some of the more common species include: American eel, goldfish, common carp, Eastern silvery minnow, common shiner, white sucker, Eastern mudminnow, white perch, and striped bass. See **Appendix C: Animals Known or Probable in Swedesboro** for the full list of fish species.

Endangered Vertebrates

The New Jersey Natural Heritage Program identifies the state's most significant natural areas through a comprehensive and continuously updated inventory of rare plant and animal species and representative ecological communities. The Natural Heritage Database compiles information on the distribution, biology, status, and preservation needs of these species and communities. The Natural Heritage Grid Maps show the general locations of rare plant species and ecological communities, without providing the sensitive detailed information that could place these resources at risk for vandalism or illegal collection. These maps are available to Environmental Commissions and for research projects but are otherwise not public. The Natural Heritage Database provides the foundation for the designation of Natural Heritage Priority (NHP) sites. NHP sites are exemplary natural communities within the state that provide critically important habitat for rare plant and animal species. Preserving these areas should be a top priority in efforts to conserve biological diversity in New Jersey.

Those threatened and endangered plants and animals identified in Swedesboro by the Natural Heritage Database are listed in **Appendix D: Plants in Swedesboro**. While there are no NHP sites located within Swedesboro, NJDEP does provide a list of rare plant species for Gloucester County. Many of these plants may be found around Raccoon Creek and its tributaries and are also listed in **Appendix D**. The disclaimer page for using the Natural Heritage Database geographic information is also included in **Appendix D**.

The Natural Heritage Database of the NJDEP lists two species of rare wildlife found in Swedesboro, both of which are birds. The bald eagle is an endangered species in the state, and the breeding great blue heron is a species of special concern. Neither species is included on the federal threatened and endangered species list. These birds are listed in **Table 28: Rare Animal Species** with brief descriptions below. See also **Appendix D: Plants in Swedesboro**.

Table 28: Rare Animal Species

Common Name	Scientific Name	State Status	State Rank
Bald Eagle	*Haliaeetus leucocephalus*	Endangered	S1B, S1N
Great Blue Heron	*Ardea herodias*	Special Concern (Breeding)/Stable (Nonbreeding)	S3B, S4N

Source: NJDEP Natural Heritage Database, 2009

State Rank	
S1	Critically Imperiled in New Jersey (>5 Occurrences)
S2	Imperiled in New Jersey (6--20 Occurrences)
S3	Rare in State (21 – 100 Occurrences)
S4	Apparently Secure in State
B	Refers to In-State Breeding Population
N	Refers to Nonbreeding Population

The **bald eagle** (*Haliaeetus leucocephalus*) is an endangered species in New Jersey, although it has been delisted on the federal level. Bald eagles mostly consume fish, and thus often choose to build nests in forested areas near water bodies. Population decline caused by shooting, poisoning, and egg collecting accelerated after the introduction of DDT into the environment. DDT was shown to cause thinning of the eggshells, which would crack under the weight of the incubating adult bird. The bald eagle was listed as an endangered species in New Jersey in 1974, and as endangered in the lower 48 states in 1978. It was removed from the federal endangered list in 2008, but remains on the New Jersey endangered list. Bald eagle populations in New Jersey have since increased from a single nesting pair recorded in 1970 to 69 nesting pairs in 2008. In addition to DDT, PCBs have been implicated in harming the bald eagle population. A nest recorded in 1989 near the mouth of Raccoon Creek had annual egg failure due to high levels of PCBs. Within Swedesboro, there is potential bald eagle foraging habitat along Raccoon Creek, especially in areas with forested edges.

The **great blue heron** (*Ardea herodias*) is a stable nonbreeding species in New Jersey but its breeding population is a species of special concern. A species of special concern can be listed for several reasons including some evidence of decline, inherent vulnerability to environmental deterioration or habitat modifications that would result in their becoming a threatened species, or the lack of knowledge of their current population status in the state. Population decline of the great blue heron in the early 1900s was a result of egg collection and hunting, and its return to New Jersey as a breeding species did not occur until the 1940s. Conservation of the great blue heron's foraging habitat is needed to help understand the size of areas necessary for the species during breeding season. These birds usually nest in trees, especially over fresh water or brackish wetlands, and it may be possible to sight them along the banks of Raccoon Creek. Pea Patch Island, located in the Upper Delaware Bay, is one of the largest nesting sites of large wading birds like the great blue heron and is likely the breeding site of herons found foraging in Swedesboro.

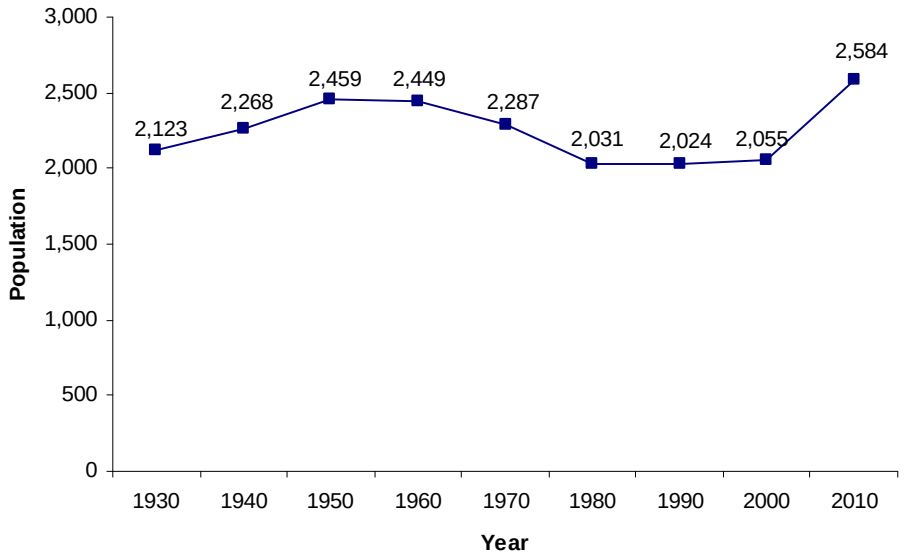
CHAPTER 6

The Built Environment

Population and Housing

The population of Swedesboro fluctuated between 1930 and 2000, before growing rapidly between 2000 and 2010, as shown in **Figure 11: The Population of Swedesboro, 1930 – 2010**. In 2010, there were 2,584 people living in Swedesboro, according to the U.S. Census Bureau. This is a 26 percent increase from the 2000 population of 2,055. This increase in population correlates to several new housing developments in the borough between 2005 and 2007. The Village at Spring Ridge is a new community of town homes located to the east of Kings Highway on South Avenue. Other new developments are Chestnut Hill at Swedesboro, and The Colony at Swedesboro. New streets in the borough include an extension of South Avenue, Chestnut Hill Court, Hatton Court, Horner Lane, Hurff Court, Cypress Street, and Shoemaker Court. Approximately 40 single family homes and 100 town homes have been constructed.

Figure 11: The Population of Swedesboro, 1930 – 2010



Source: U.S. Census Bureau, 1930 – 2010

Based on the 2010 U.S. Census, Swedesboro's population is somewhat ethnically diverse, with 64 percent of the population identifying themselves as white, 17 percent identifying themselves as Hispanic or Latino, 14 percent identifying themselves as Black or African American, and 0.3 percent identifying themselves as two or more races.

Table 29: Swedesboro Population by Race

Race	Population	Percent
White	1,664	64.4%
Hispanic or Latino (of any race)	441	17.1%
Black or African American	356	13.8%
Two or More Races	77	3.0%
Asian	35	1.4%
American Indian and Alaska Native	7	0.3%
Native Hawaiian and Other Pacific Islander	2	0.1%
Some Other Race	2	0.1%
Total	**2,584**	**100.0%**
Hispanic or Latino population is of any race. All other population numbers refer to those not identifying as Hispanic or Latino.		

Source: US Census, 2010

According to U.S. Census data from 2010, Swedesboro had 1,004 housing units, a 17 percent increase from the 2000 total of 860 units. Of the 2010 units, 938 (93 percent) were occupied and 66 (7 percent) were vacant.

Transportation

Swedesboro is located in a relatively accessible part of Gloucester County. It is approximately 25 miles from Philadelphia and 50 miles from Trenton. Swedesboro is located 2 miles west of Exit 2 on the New Jersey Turnpike, and 2 miles east of Exit 11 and 3 miles east of Exit 10 on Interstate 295. These highways run relatively parallel to each other on either side of the borough. Route 322 is just north of the borough and connects these limited access highways. A number of county routes cross through the borough and connect Swedesboro to neighboring municipalities. In addition to providing access to nearby commercial centers, these roads connect smaller residential streets within the borough.

Approximately 100 percent of the borough's employed population commutes to work by automobile according to the 2000 U.S. Census. The mean travel time to work for Swedesboro residents is between 20 and 24 minutes, slightly lower than the New Jersey average of 28 minutes and the national average of 24 minutes.

There is one New Jersey Transit bus stop in Swedesboro located in the southern portion of the borough at the intersection of Kings Highway (Route 620), Woodstown Road, and Centre Square Road. From this bus station, service is offered on Bus 401 to Salem, Camden, and Philadelphia.

Figure 12: Historic Railroads of the Swedesboro Area

Source: Rutgers Special Collections, 2010

Although there are currently no active passenger rail lines in the borough, historically there was rail service that connected the borough to Woodbury and Salem. In 1869, the Swedesboro Railroad opened and offered service from Swedesboro to Woodbury. As part of the West Jersey and Seashore Railroad (later a branch of the Pennsylvania Railroad system), service was extended to Salem in 1883. The historic railroads of the area are shown above in **Figure 12**.

Historic Resources

The National Register of Historic Places is the official list of the nation's historic places worthy of preservation. It was established by the U.S. Congress in 1935 through the Historic Sites Act. The New Jersey Register of Historic Places was established in 1970. Sites listed on the State and National Registers can include significant districts, sites, structures, buildings, and objects of local, state, and national interest. Swedesboro has four sites that are listed on these registers: Richardson Avenue School, the John C. Rulon House, Trinity Church, and the Vanleer Cabin. See **Table 30: Historical Sites on State and National Registers** and **Map 18: Historic and Cultural Resources**.

Table 30: Historical Sites on State and National Registers

Name	Location	ID#	Register
State and National Registers of Historic Places			
Richardson Avenue School	Richardson Ave.	NJRHP #3221 NRHP #98000703	NR: 6/18/1998 SR: 4/24/1998
John C. Rulon House	1428 Kings Hwy	NJRHP #3703 NRHP #00001404	NR: 12/12/2000 SR: 11/22/2000
Trinity Church	Kings Hwy & Church St	NRHP #73001098	NR: 1/29/1973
Vanleer Cabin	708 Kings Hwy	NJRHP #1416	SR: 3/30/1972
Eligible Sites for State and National Registers of Historic Places			
Swedesboro Borough Hall	1500 Kings Hwy	NJRHP #1414	SHPO Opinion: 9/8/1977

Source: NJ State Historic Preservation Office, 2010

The **Richardson Avenue School** (also known as the Mount Lebanon Lodge No. 47 and Masonic Hall) was built in 1931. The building was originally constructed as a Masonic Hall, but was later used as a school for African American children from 1933 until 1942, when it was forced to close. Students were then sent to a new segregated school in Swedesboro, which operated until federal legislation ended segregated education. The Richardson Avenue School is the only remaining historically segregated building in New Jersey that specifically served African American students. The building was listed on both the State and National Registers in 1998. The Swedesboro Historical Commission received a matching grant from the Garden State Historic Preservation Trust Fund to restore the building, and exterior renovations were completed in 2009. Interior renovations are on-going, which will restore part of the building to its original classroom state.

Richardson Avenue School

The **John C. Rulon House** (also known as the Dr. Charles Garrison House) was built in 1813 as a two-story, two-room house. Additions were put on in 1820 by John Rink, with further revisions in the 1840s and 1880s. The house was modified in 1884 by John Rulon to its existing Victorian style with ornate porch railing and Gothic cross gables. The building was listed on both the State and National Registers in 2000. Currently, this building is the site of the Swedesboro Historical Society, and contains many local historical artifacts.

Trinity Church (also known as Old Swedes Church) was built in 1786 by Rev. Nicholas Collin. It was designed to resemble Christ Church in Philadelphia. Originally founded in 1703 as a Lutheran parish, the church became Episcopal in 1789 and is the oldest continuing parish in the Episcopal Diocese of New Jersey. It is the first Swedish church in

New Jersey, and the third in the United States. The church has both Georgian and Federal features. The building has a gable roof, windows with wood inlay keystones, and an entry vestry. A bell tower was added in 1839 that is identical to the Independence Hall Tower. The church was listed on the National Register in 1973.

The **Vanleer Cabin**, also know as the Mortonson-Schorn Cabin, is a small log outbuilding dating from the 1600s and is an example of Swedish-Finnish cabin architecture brought over when the area was settled in 1642. It is constructed from cedar logs with carved joints and lime mortar caulking. It may have originally been used as a temporary dwelling, granary, or small animal shelter. The cabin is also thought to have been a stop on the Underground Railroad. The cabin was originally constructed near Swedesboro-Bridgeport Road and Raccoon Creek in Woolwich Township on the Grand Sprute Plantation. This property was purchased by Morton Mortonson from Andrew Robeson. Mortonson was the grandfather of John Morton, a signer of the Declaration of Independence. The cabin passed through many owners, including the Archer, Van Leer, Black, and Schorn families. The Schorn descendents deeded the cabin to the Gloucester County Historical Society. The cabin was moved to its current location near the Trinity Church cemetery in 1989, where it was reconstructed.

Opinions of Eligibility from the State Historic Preservation Office (SHPO) are given to historic properties and districts that meet 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, but are not on the National or State Register. The SHPO Opinion is given in response to a federally funded activity that will have an effect on historic properties not listed on the National Register. Other sites may have the potential to be listed as local, state, or national landmarks, but have not been nominated by local citizens or identified by SHPO for such a designation.

Swedesboro Borough Hall was constructed in 1915 to house the borough offices and Woolwich Fire Company. The building was remodeled in 1977, after the fire company moved into their own facility. There is a four-ton granite horse trough in front of the borough hall that is dedicated to John C. Rulon. The building was issued a SHPO Opinion in 1977.

In 1991, a SHPO opinion was issued for the **Locke Avenue Bridge**, a swing bridge constructed in 1911. However, the original bridge was replaced in 2002 due to outdated engineering and deterioration.

Hatton House, constructed circa 1770 along Kings Highway, is a locally important historic site. The two-story Colonial Revival home was built by John Hatton of Canterbury, England, who at one time served as the tax collector for New Jersey. The house is in excellent condition, and features three bay facades and a side gable roof with a denticulated wood cornice. A 1986 historic site survey conducted by the NJDEP Office of Historic Preservation identified Hatton House as eligible for state registration.

Additional properties of historic importance are listed in **Appendix E: Local Historic Properties, Historic Properties on Kings Highway,** and **Historic Streetscapes**. The

historic streetscapes of Franklin Street, Park Avenue, East Avenue, and Lake Avenue were identified by a 1986 survey from the NJDEP Office of Historic Preservation.

New Jersey municipalities are permitted to identify, designate, and regulate their own historic resources through the adoption of historic preservation ordinances, which are recognized as zoning laws under the New Jersey Municipal Land Use Law. The Swedesboro Historic Preservation Ordinance was passed on April 18, 2005 (#2005-005). Swedesboro also has a Historic Preservation Advisory Commission that meets five times per year, and is currently composed of nine members

The Swedesboro-Woolwich Historical Society's goal is to preserve the history of Swedesboro and Woolwich Township. The Society performs oral interviews, collects and archives artifacts, photos, family histories, documents, books, and items. In addition, they provide educational and cultural events, such as the Civil War Living History Day every fall. They also co-sponsor a historical walking tour with the Economic Development office.

The National Park Service and the New Jersey SHPO jointly administer the Certified Local Government (CLG) Program, which provides technical assistance and funding for community-based preservation efforts. As of May 2010, only three municipalities in Gloucester County – Harrison Township, Swedesboro, and Washington Township – are CLGs. Swedesboro became a CLG on July 12, 2006. To participate, municipalities must maintain a historic preservation commission, survey local historic properties, provide opportunities for public participation in preservation activities, and develop and enforce local preservation laws. Because Swedesboro is a CLG, it is eligible to draw from an exclusive pool of matching federal and state funds for program implementation or rehabilitation work.

There are also federal incentives for individuals, organizations, or firms that own historic properties and are interested in historic preservation. Interested parties can take advantage of the Rehabilitation Investment Tax Credit, a federal tax incentive to encourage the preservation and reuse of older income-producing properties, including offices, apartment buildings, and retail stores. The Rulon House in Swedesboro utilized this tax credit in its restoration.

Investing in historic preservation efforts can provide a municipality with important and impressive returns. Private and public efforts to preserve and rehabilitate historic districts create attractive places to live, work, and play, and stimulate new investment in older residential and commercial centers. Although there have been attempts in the past to designate an historic district in Swedesboro, these efforts have not been successful. A historic district, like that in nearby Mullica Hill, can become a regional draw for tourists and boutique customers. Furthermore, historic preservation maintains a municipality's character, distinctly separating it from other rural and suburban communities, for both new and established residents.

Cultural Resources and Open Space

Libraries

A branch of the Gloucester County Library System is in Swedesboro. The Swedesboro Public Library is one of the oldest public libraries in New Jersey, established in 1783. The library, incorporated in 1937, was originally located in the Borough Hall. In 2005, it became one of the branches of the Gloucester County Library System. The library recently underwent renovations.

Open Space

Fishing at Lake Narraticon Park

Preserved open space in Swedesboro is depicted on **Map 19: Open Space**. The largest open space resources in Swedesboro are preserved wetlands. The borough owns an area of preserved forested wetlands north of Lake Narraticon on both sides of Church Run. A small area of tidal marshes to the north of Raccoon Creek is preserved by the New Jersey Natural Lands Trust, a non-profit organization. Other municipally preserved open space areas are used by the Swedesboro Water Department for the pumping and storage of drinking water. The Borough also owns two forested parcels; one is located between Horner Land and Church Run, and the other is located between Broad Street and Raccoon Creek.

The Swedesboro-Woolwich Parks and Recreation Committee coordinates a range of programs that are open to residents. These programs include summer camps, organized sports, before and after school programs, and other activities for residents of all ages. In addition, the committee operates three public parks: High Hill Park, Lake Narraticon Park, and Locke Avenue Park. These parks are all located in Woolwich Township. High Hill Park and Locke Avenue Park are located to the west of Swedesboro between Locke Avenue and High Hill Road. The parks have tennis courts, basketball courts, soccer fields, baseball fields, and other facilities. Lake Narraticon Park, located on the southern bank of the lake off Park Avenue, has a playground, gazebo, and a 1.5-mile walking trail. The park also offers opportunities for fishing and bird watching.

Borough Utilities and Services

Drinking Water and Sewer Service

The Swedesboro Water Department supplies public drinking water to all residences in the borough. According to the NJDEP, the Water Department has no outstanding violations. Drinking water is derived from three public supply wells that tap the Middle and Upper Potomac-Raritan-Magothy aquifer. Additional information on water supply wells is available in the **Water Supply Wells** section. The monitoring schedules for the public water supply wells and the annual drinking water quality report for Swedesboro are also available in **Appendix A: Swedesboro Water Department Water Quality Data**.

The Swedesboro Sewer Department provides sewer collection service to the entire borough. It maintains seven pumping stations in addition to many miles of piping. The Swedesboro Waste Water Treatment facility has an average daily flow of 0.19 to 0.20 million gallons per day (mgd), and has a design capacity of 0.35 mgd. It discharges treated wastewater to the Raccoon Creek. See **Map 20: Sewer Service Area and NJPDES Permits**.

Trash and Recycling

The Swedesboro Public Works Department maintains weekly solid waste collection on Fridays. Regular household trash, furniture, glass windows, and doors are accepted. In addition, metal items (appliances, desks, metal doors, siding, chairs, bikes, lawnmowers, garden equipment, car parts, pots, pans, etc.) are collected on Fridays from 6:00 am to 3:00 pm.

Single-stream recycling is collected weekly. Swedesboro participates in the RecycleBank program, which offers coupons to residents for local retailers based on the amount of materials recycled.

In addition, Swedesboro has a spring and fall leaf pick-up. During these times, residents are able to rake and pack leaves in bags not exceeding 30 pounds. Schedules of pick-up dates are posted in the *Gloucester County Times* and *Newtown Press*. NJDEP storm water regulations forbid the placement of leaves within 10 feet of a storm drain.

Tires, car batteries, motor oil, motor filters, button batteries, rechargeable batteries, fluorescent light bulbs, and other hazardous materials are not picked up by the borough. Hazardous materials, such as paints, oil, gasoline, pesticides, and fertilizer, can be disposed of at the Gloucester County Household Special Waste Collection Days. Motor oil can be disposed of at the local Jiffy Lube. Gloucester County prints a yearly Recycling Guide that provides information on recycling programs throughout the county.

The Swedesboro Public Works Department is responsible for road maintenance, street sweeping, snow removal, leaf and brush collection, maintenance of all Borough buildings and recreation areas, and mowing and maintenance of all borough open space.

Education

Since 1996, three new schools have opened and one school has been expanded to accommodate the growing number of students in the Swedesboro-Woolwich School District. In the 2009 – 2010 school year, the Swedesboro-Woolwich School District had 1,272 students.

There are four public elementary schools in the School District: the Margaret Clifford School (kindergarten), the Charles Stratton School (1 – 2), the Charles Harker School (3 – 5), and the Walter Hill School (6).

The Kingsway Regional School District is a comprehensive regional school district that serves students from grades seven through 12 from five municipalities: East Greenwich, Logan Township, South Harrison Township, Swedesboro, and Woolwich Township. Students attend the Kingsway Middle School (7 – 8), and the Kingsway Regional High School (9 – 12). The middle school and high school are located in Woolwich Township. There are no private schools in Swedesboro.

There are two early childhood education centers in Swedesboro: Blooming Buds Child Care Center and Alphabet Corner Preschool.

Rowan University is a public university located in Glassboro, approximately 10 miles to the southeast of Swedesboro. There are over 11,000 students in their undergraduate and graduate programs.

Gloucester County College is located in Sewell, approximately 12 miles to the east of Swedesboro. It is a two-year school with approximately 6,500 students.

CHAPTER 7

Environmental Issues

Soil Erosion

Soil erosion is one of the most important, yet least understood, environmental problems. Geologic, or “background,” erosion occurs at approximately the same rate as soil formation, leading to neither a net loss nor a net gain of soil. Background erosion is an important process in which rock materials are carried and deposited by wind and water. In areas with vegetative cover, the rock mixes with decomposed vegetation and creates more nutrient-rich soil.

Stairs to Lake Narraticon

Erosion caused by human activity has greatly increased the amount, and the rate, of soils lost. Unfortunately, human activity cannot significantly contribute to soil formation, a process that takes place over thousands of years. Human-caused erosion is a serious environmental problem across the world. In the United States, the most significant impacts are the loss of prime agricultural soils, increased flooding, and pollution of streams and rivers. Construction on or near steep slopes greatly increases the incidence of soil erosion. The loss of tree cover and plant material on steep slopes is especially damaging. Where steep slopes adjoin streams, erosion may contaminate the water and endanger wildlife habitat. In road-building, there are numerous means for managing roadside erosion during and after construction.

Signs of soil erosion on the banks of water bodies in Swedesboro indicate that soil erosion is a problem. While stream bank erosion is a natural process, acceleration can lead to adverse effects such as stream channel instability, land and habitat loss, and excess nutrients in the water. Indicators of stream bank erosion include exposed tree roots, general lack of vegetation near streams, cloudy, sediment-filled water, and overhanging or washed-out banks. Many of Swedesboro’s soil erosion issues may be a result of limited stream bank vegetation in combination with an increase in development surrounding its waterways, leading to higher areas of impervious surfaces and faster rates of water flow during storm events. Erosion and runoff during construction is also a problem. Although short-lived, the amount of soil loss can permanently affect a nearby stream.

However, soil erosion is a preventable problem. Preserving the natural vegetation and rock structure around a stream bank helps to prevent erosion. In locations where vegetation has been removed or has washed away, revegetating can be beneficial. Protecting buffer zones between streams and buildings as well as preventing run-off from impervious surfaces from flowing into streams also deters erosion. Also, limiting recreational activities near erosion-prone areas is another preventative measure.

In response to the environmental threat posed by erosion, New Jersey passed the Soil Erosion and Sediment Control Act in 1975, which regulated construction and land development activities. New rules adopted in 2006 pertain to single-family home exemptions, demolition activities, and increased enforcement possibilities. This state legislation is intended to protect water quality from the effects of erosion caused by certain construction activities. Monitoring and enforcement is necessary to ensure that development is occurring in line with these rules.

There are funding sources available for stabilization activities to vegetate and protect eroded stream banks. The main source of funding is the Section 319(h) Grant Program, administered by the NJDEP, which funds projects to reduce water quality impairment. Other funding sources may be available through nonprofits including Conservation Resources Inc., Conservation Wildlife Foundation of New Jersey, the South Jersey Land and Water Trust, and other organizations.

An Exposed Outfall at Lake Narraticon Park

Known Contaminated Sites

The New Jersey Known Contaminated Sites List, compiled by the NJDEP, includes former factory sites, landfills, locations of current or former leaking underground storage tanks; sites where chemicals or wastes were once routinely discharged; and places where accidents have resulted in spills and pollution. Contamination may have affected soil, groundwater, surface water, or a combination of site conditions.

In New Jersey, there are more than 20,000 contaminated sites. As of August 2010, there are eight active Known Contaminated Sites within Swedesboro seen in **Table 31: Known Contaminated Sites**. These are active sites with confirmed contamination of the soil, groundwater, and/or surface water. These sites include a gas station, warehouse and other businesses. Additionally, there are no pending sites and 18 closed sites in the borough. An active site has one or more active cases with confirmed contamination, and may have one or more pending or closed cases. A pending site has one or more cases with confirmed contamination, no active cases, and may include closed cases. Closed sites are those with remediated contamination and have no active or pending cases. See **Appendix F: Known Contaminated Sites in Swedesboro**. Some sites in this table have

more than one remedial level due to multiple cases. Nonresidential sites are shown on **Map 21: Known Contaminated Sites (2009)**. Exact addresses of private homes have been removed from all lists to protect resident privacy.

Table 31: Known Contaminated Sites

PI Number	PI Name	Address	Home Owner
253400	Del Monte Corp. Warehouse #1	3rd Street & Church Street	No
033695	Getty 56955 (Former)	1008 Kings Hwy.	No
G000027432	Locke Avenue	Locke Avenue	No
G000027305	Richardson Avenue	Richardson Avenue	No
025475	Nanak Auto Fuel, Inc. (AKA Shani Auto Fuel Corp.)	541 Kings Hwy.	No
G000005448	Swedesboro Coal Gas South Jersey Gas	Auburn Avenue & Bridgeport Avenue	No
292200	Swedes Inn	1301 Kings Hwy.	No
020922	Teledyne Packaging	20 Ashton Avenue	No

Source: NJDEP, 2010

The most dangerous contaminated sites, from a human health standpoint, can be listed on the National Priorities List (NPL). The NPL, established under the federal Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA), is an inventory of known releases or threatened releases of hazardous substances, pollutants, or contaminants throughout the United States that are considered a top national priority. CERCLA is commonly referred to as “Superfund” because sites on the NPL are eligible for federal and state cleanup funds. The EPA used the NPL as a guide in determining which sites warrant further investigation. Other sites may be remediated by state cleanup funds (via the New Jersey Spill Compensation and Control Act). The majority of the sites are remediated by the responsible parties as required pursuant to state and federal regulations. Responsible parties may be current or former owners or users of the site. There are no sites in Swedesboro currently on the NPL.

However, there is one site located just outside Swedesboro that is included in the Resource Conservation and Recovery Act (RCRA) Corrective Action Program. This program works to investigate and clean up facility sites where accidents have caused hazardous wastes to infiltrate into the soil, groundwater, surface water, and air. Matlack, Incorporated (EPA ID: NJD043584101) ran a 31-acre truck terminal and tank-trailer cleaning facility on the south side of U.S. Route 322 in Woolwich Township. Operations began in 1962 and closed in 1998, and the site is currently abandoned. Waste from this site consisted mainly of rinse water from the cleaning of tank-trailers, and it was disposed of into an unlined sand and gravel pit on site. Since operations ceased, the pit has been covered with demolition rubble and clean fill, and the affected soil was left untouched.

A variety of organic chemicals in the soils, groundwater, surface water, and sediments are the main concern of this site. Since June 2006, NJDEP has been pumping contaminated groundwater from the site and treating it, as well as developing a work plan to conduct additional investigation about the extent of the contaminated groundwater. This data will help determine if source removal will be necessary for the site, and additional cleanup activity is being monitored jointly by NJDEP and the EPA.

PCB contamination has also been discovered on the site and is being addressed by the New Jersey Department of Health and Senior Services (NJDHSS). NJDEP does not have authority over this issue because the threat is interior at the site and does not pose a continuous threat to the outside environment.

Underground Storage Tanks

As of August 2010, there are three active and compliant sites in Swedesboro with regulated underground storage tanks that contain hazardous substances, pursuant to N.J.A.C. 7:14B et seq. They are listed in **Table 32: Active and Compliant Underground Storage Tanks**. A hazardous material may be motor fuel, petroleum products, toxic pollutants, or other hazardous wastes or substances. If there is a known release to soil and/or groundwater, a site will also be listed in **Table 31: Known Contaminated Sites**.

There may also be private residences in Swedesboro that still have underground storage tanks, used primarily to hold home-heating oil. As these tanks age and rust, they often begin to leak, which becomes a serious threat to the groundwater below them. Those private residences are not publicly listed by NJDEP unless they pose a human health hazard. Underground storage tanks are not required to be removed, although removal may reduce any resulting environmental liabilities. See **Appendix F: Known Contaminated Sites in Swedesboro** for a list of all tanks in the borough, including terminated sites where tanks have been removed.

Table 32: Active and Compliant Underground Storage Tanks

PI Number	PI Name	Street Address	Expiration Date
010290	Express Gas	1008 Kings Hwy	12/31/2012
012779	Pat's Service Station	1501 Kings Hwy	12/31/2012
025475	Shani Auto Fuel Corp.	541 Kings Hwy	12/31/2012

Source: NJDEP, 2010

There is one site in Swedesboro where there is active remediation of underground storage tanks, shown in **Table 33: Underground Storage Tanks with Active Remediation**. This site also has active and compliant underground storage tanks.

Table 33: Underground Storage Tanks with Active Remediation

PI Number	PI Name	Street Address	Bureau
033695	Getty 56955 (Former)	Kings Hwy & Glen Echo Avenue	BUST

Source: NJDEP, 2010

Radon

Radon is a radioactive gas that comes from the natural decay of uranium found in nearly all soils. It is invisible, odorless, and tasteless. It moves up through the ground to the air above, and into all types of homes through cracks and other holes in foundations. A build-up of radon-contaminated air within a home can pose a long-term health hazard to residents, specifically for lung cancer. The only method of detection is to conduct a test of the air within a home. Fortunately, radon testing is inexpensive. All radon test results conducted in the state are reported to NJDEP by certified companies, which perform the tests or manufacture the test kits. This data is used to classify municipalities into a three-tier system, which identifies the potential for homes with indoor radiation problems.

NJDEP classifies municipalities into three categories according to the potential for indoor radon problems: high (Tier 1), moderate (Tier 2), and low (Tier 3). Swedesboro is classified as a Tier 1 municipality, indicating a high risk of high radon levels in homes. The average indoor radon level in the United States is about 1.3 picoCuries per liter (pCi/L). At the level of 4 pCi/L, NJDEP recommends a homeowner consider steps to reduce long-term exposure to radon gas. If radon levels are high in a home, NJDEP suggests that the homeowner take the following actions: (1) prevent radon from entering the house by repairing cracks and insulation; and (2) dilute radon concentrations currently in the house by installing a radon extraction system and/or frequently ventilating indoor air.

NJDEP provides information on testing, mitigation, radon's health effects, and additional information on their website at www.njradon.org. Free information packets are available upon request. They can also be reached for radon-related questions by phone at 800/648-0394. All companies conducting radon testing and mitigation are certified by NJDEP and are listed on their website.

The Environmental Commission in neighboring Woolwich Township provided free radon kits to residents for a period of time in 2003. Results from those tests showed higher levels of radon than expected and caused Woolwich to be reclassified from a Tier 2 to a Tier 1 level, like Swedesboro.

CHAPTER 8

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APPENDIX A

Swedesboro Water Department Water Quality Data

2010 Monitoring Schedule of Public Community Water Supply Systems

Contaminant	Required Months to Sample In	Required Year to Sample In	Sampling Requirements
Swedesboro Water Department (NJ0817001): *Population: 2,401*			
Distribution Systems (DS)			
Total Coliform Bacteria	1/1–12/31	Yearly	2 samples/month
Total THM-HAA5	7/1–9/30	2010	2 maximum samples annually
Lead/Copper	6/1–9/30	2010	10 samples/3 year period
120 Chestnut Street (TP001002)			
Inorganics	1/1–12//31	2012	1 sample/3 year period
Radiologicals	1/1–12/31	2015	1 sample/9 year period
Secondary	1/1–12/31	2012	1 sample/3 year period
VOCs	1/1–12/31	2012	1 sample/3 year period
Nitrate	1/1–12/31	Yearly	1 sample/year
120 Chestnut Street (TP002007)			
Inorganics	1/1–12/31	2012	1 sample/3 year period
Radiologicals	1/1–12/31	2015	1 sample/9 year period
Secondary	1/1–12/31	2012	1 sample/3 year period
VOCs	1/1–12/31	2012	1 sample/3 year period
Nitrate	1/1–12/31	Yearly	1 sample/year

Source: NJDEP, 2010.

2010 Annual Drinking Water Quality Report

Contaminant	Level Detected (Range)	Maximum Contaminant Level	Likely Source of Contamination
Swedesboro Water Department (NJ0817001): *Population: 2,401*			
Radioactive Contaminants			
Gross Alpha	<3.0–4.35 pCi/l	15 pCi/l	Erosion of natural deposits
Radium 228	<1.0–1.63 pCi/l	5 pCi/l	Erosion of natural deposits
Radium 226	<1.0–1.50 pCi/l	5 pCi/l	Erosion of natural deposits
Inorganic Contaminants			
Barium	0.100–0.128 ppm	2 ppm	Discharge of drilling wastes; discharge from metal refineries; erosion of natural deposits
Chromium	Non-detects – 2.0 ppb	100 ppb	Discharge from steel and pulp mills; erosion of natural deposits
Copper	0.202 ppm, no sample exceeded the action level	Action Level = 1.3 ppm	Corrosion of household plumbing systems; erosion of natural deposits
Lead	0.0025 ppb, no sample exceeded the action level	Action Level = 15 ppb	Corrosion of household plumbing systems; erosion of natural deposits
Disinfection By-Products			
TTHM - Total Trihalomethanes	4.0–9.0 ppb	80 ppb	By-products of drinking water disinfection
HAAS – Haloacetic Acids	2.0–3.0 ppb	60 ppb	By-product of drinking water disinfection
Contaminant	**Level Detected (Range)**	**Maximum Residual Disinfectant Level**	
Regulated Disinfectants			
Chlorine	0.62–0.76 ppm	4.0 ppm	

Source: Swedesboro Water Department, 2010.

Emission Statements

Air Emission Statements

PI Number	Facility Name	Address	City
55834	Logan Generating Plant	Box 169-C RT 130 South	Logan Township
Pollutant Name	**Ozone – Pounds per Day**	**Tons per Year**	**CO – Pounds per Day**
Acrolein		0.063	
Ammonia		1.570	
Arsenic compounds		0.002	
Benzene		0.281	
Beryllium compounds		9.0E-05	
Cadmium compounds		5.0E-04	
CO	1644.65	327.820	2930.44
CO2	0.00	1200000	0.00
Formaldehyde		0.025	
Hydrogen chloride		0.368	
Manganese compounds		0.004	
Mercury compounds		1.5E-04	
Methane		8.700	
Methylene chloride (Dichloromethane)		0.063	
Nickel compounds		0.010	
NOx (Total)	3858.42	777.840	
Pb		0.010	
PM-10 (Total)		92.340	
PM-2.5 (Total)		0.046	
Polycyclic organic matter		5.0E-05	
SO2		797.640	
TSP		36.700	
VOC (Total)	31.62	6.090	

Source: NJDEP, 2009

APPENDIX C

Animals

Status Codes for Mammals, Birds, Reptiles, & Amphibians	
E	Endangered: A species whose prospects for survival within the state are in immediate danger due to one or many factors, such as a loss of habitat, over- exploitation, predation, competition, disease. An endangered species requires immediate assistance or extinction will probably follow.
T	Threatened: A species may become endangered if conditions surrounding the species begin to or continue to deteriorate.
SC	Special Concern: A species that warrants 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.
INC	Increasing: A species whose population has exhibited a significant increase, beyond the normal range of its life cycle, over a long term period.
RP	Regional Priority: A species in regional conservation plans.
D	Declining: A species that exhibited a continued decline in population numbers over the years.
U	Undetermined: A species about which there is not enough information available to determine the status.
S	Stable: A species whose population is not undergoing any long-term increase/decrease within its natural cycle.
I	Introduced:
P	Peripheral: A species whose occurrence in New Jersey is at the extreme edge of its present natural range.
Bold *indicates threatened, endangered, or species of concern in NJ.*	
Additional Status Codes for Birds	
b	Breeding:
pb	Possibly Breeding:
m	Migrant
w	Winters
a	Accidental
*	present during breeding season - no confirmed nesting
Status for animals separated by a slash (/) indicates a dual status. First status refers to the state breeding population, and the second status refers to the migratory or winter population.	

Mammals

Common Name	Scientific Name	Habitat	Status
Order Marsupialia (Pouched Mammals)			
Opossum	*Didelphis marsupialis*	All habitats	S
Order Lagomorpha (Rabbits)			
Eastern Cottontail	*Sylvilagus floridanus*	All habitats	S
Order Rodentia (Rodents)			
Brown Rat	*Rattus norvegicus*	Fields, residential areas, wetlands	I
Eastern Chipmunk	*Tamias striatus*	Woodlands	S
Gray Squirrel	*Sciurus carolinensis*	Woodlands	S
House Mouse	*Mus musculus*	Residential areas	I
Order Carnivora (Flesh Eaters)			
Coyote	*Canis latrans, var.*	n/a	I
Raccoon	*Procyon lotor*	All habitats	S
Red Fox	*Vulpes vulpes*	All habitats	S
River Otter	*Lutra Canadensis*	Large streams	S
Order Ardodactyla (Even-Toed Hoofed Mammals)			
White-Tailed Deer	*Odocoileus virginianus*	All habitats	D
Order Chiroptera (Bats)			
Little Brown Bat	*Myotis lucifugus*	n/a	S

Sources: Swedesboro Environmental Commission, 2010; NJDEP Division of Fish and Wildlife, 2010.

Birds

Common Name	Scientific Name	Presence	Status	
Ardeidae – Bitterns, Egrets, Herons				
Least Bittern	***Ixobrychus exilis***	**Confirmed**	**SC**	**bm**
Great Blue Heron	***Ardea herodias***	**Confirmed**	**SC/S**	**bmw**
Great Egret	*Ardea alba*	Possible	RP	bm
Snowy Egret	*Egretta thula*	Possible	RP	bm
Green Heron	*Butorides virscens*	Confirmed	RP	bm
Cathartidae – Condors, Vultures				
Turkey Vulture	*Cathartes aura*	Confirmed	INC	bmw

Common Name	Scientific Name	Presence	Status	
Anatidae – Ducks, Geese, Swans				
Canada Goose	*Branta canadensis*	Confirmed	INC	bmw
Wood Duck	*Aix sponsa*	Confirmed	RP	bmw
American Black Duck	*Anas rubripes*	Confirmed	RP	bm
Mallard	*Anas platyrhynchos*	Confirmed	INC	bmw
Accipitridae – Eagles, Hawks, Kites, Harriers				
Bald Eagle	***Haliaeetus leucocephalus***	**Confirmed**	**E**	**bmw**
Northern Harrier	***Circus cyaneus***	**Confirmed**	**E**	**bmw**
Cooper's Hawk	***Accipiter cooperii***	**Confirmed**	**T**	**bmw**
Broad-Winged Hawk	***Buteo platypterus***	**Possible**	**SC**	**bm**
Red-Tailed Hawk	*Buteo jamaicensis*	Confirmed	INC	bmw
Falconidae – Caracaras, Falcons, Kestrels				
American Kestrel	***Falco sparverius***	**Confirmed**	**SC**	**bmw**
Odontophoridae –Quail				
Northern Bobwhite	*Colinus virginianus*	Probable	RP	bw
Charadriidae – Dotterels, Lapwings, Plovers				
Killdeer	*Charadrius vociferus*	Confirmed	S	bmw
Scolopacidae – Sandpipers				
American Woodcock	*Scolopax minor*	Probable	RP	bmw
Columbidae – Doves, Pigeons				
Rock Dove	*Columba livia*	Probable	I	bmw
Mourning Dove	*Zenaida macroura*	Confirmed	S	bmw
Cuculidae – Cuckoos				
Black-Billed Cuckoo	*Coccyzus erythropthalmus*	Probable	RP	bm
Yellow-Billed Cuckoo	*Coccyzus americanus*	Probable	RP	bm
Tytonidae – Barn Owls				
Barn Owl	***Tyto alba***	**Possible**	**SC**	**bmw**
Strigidae – Owls				
Great Horned Owl	*Bubo virginianus*	Confirmed	S	bw
Apodidae – Swifts				
Chimney Swift	*Chaetura pelagica*	Probable	RP	bm
Cerylidae – Kingfishers				
Belted Kingfisher	*Ceryle alcyon*	Probable	S	bmw
Picidae – Piculets, Woodpeckers, Wrynecks				

Common Name	Scientific Name	Presence	Status	
Red-Bellied Woodpecker	*Melanerpes carolinus*	Confirmed	INC	bw
Downy Woodpecker	*Picoides pubescens*	Confirmed	S	bw
Hairy Woodpecker	*Picoides villosus*	Confirmed	D	bw
Northern Flicker	*Colaptes auratus*	Confirmed	RP	bmw
Tyrannidae – Flycatchers				
Eastern Wood-Pewee	*Contopus virens*	Probable	RP	bm
Willow Flycatcher	*Empidonax traillii*	Probable	RP	bm
Eastern Phoebe	*Sayornis phoebe*	Probable	S	bm
Great Crested Flycatcher	*Myiarchus crinitus*	Confirmed	RP	bm
Eastern Kingbird	*Tyrannus tyrannus*	Confirmed	RP	bm
Vireonidae – Vireos				
White-Eyed Vireo	*Vireo griseus*	Probable	D	bm
Warbling Vireo	*Vireo gilvus*	Probable	S	bm
Red-Eyed Vireo	*Vireo olivaceus*	Probable	S	bm
Corvidae – Crows, Jays, Magpies, Ravens				
Blue Jay	*Cyanocitta cristata*	Confirmed	D	bmw
American Crow	*Corvus brachyrhynchos*	Confirmed	S	bmw
Fish Crow	*Corvus ossifragus*	Confirmed	S	bmw
Alaudidae – Larks				
Horned Lark	***Eremophila alpestris***	**Confirmed**	**SC**	**bmw**
Hirundinidae – Martins, Swallows				
Purple Martin	*Progne subis*	Confirmed	S	bm
Tree Swallow	*Tachycineta bicolor*	Confirmed	INC	bm
Northern Rough-Winged Swallow	*Stelgidopteryx serripennis*	Confirmed	S	bm
Bank Swallow	*Riparia riparia*	Confirmed	S	bm
Barn Swallow	*Hirundo rustica*	Confirmed	S	bm
Paridae – Chickadees, Tits				
Carolina Chickadee	*Poecile carolinensis*	Confirmed	S	bmw
Tufted Titmouse	*Baeolophus bicolor*	Confirmed	INC	bw
Sittidae – Nuthatches				
White-Breasted Nuthatch	*Sitta carolinensis*	Confirmed	INC	bw
Troglodytidae – Wrens				
Carolina Wren	*Thryothorus ludovicianus*	Confirmed	INC	bw
House Wren	*Troglogytes aedon*	Confirmed	S	bm

Common Name	Scientific Name	Presence	Status	
Marsh Wren	*Cistothorus palustris*	Confirmed	RP	bmw
Polioptilidae – Gnatcatchers				
Blue-Gray Gnatcatcher	*Polioptila caerulea*	Confirmed	S	bm
Turdidae – Thrushes				
Eastern Bluebird	*Sialia sialis*	Confirmed	INC	bmw
Veery	***Catharus fuscescens***	**Possible**	**SC**	**bm**
Wood Thrush	*Hylocichla mustelina*	Confirmed	RP	bm
American Robin	*Turdus migratorius*	Confirmed	S	bmw
Mimidae – Catbirds, Mockingbirds, Thrashers, Tremblers				
Gray Catbird	*Dumetella carolinensis*	Confirmed	RP	bmw
Northern Mockingbird	*Mimus polyglottos*	Confirmed	D	bmw
Brown Thrasher	*Toxostoma rufum*	Confirmed	RP	bmw
Sturnidae – Starlings				
European Starling	*Sturnus vulgaris*	Confirmed	I	bmw
Bombycillidae – Waxwings				
Cedar Waxwing	*Bombycilla cedrorum*	Confirmed	S	bmw
Parulidae – Warblers				
Yellow Warbler	*Dendroica petechia*	Confirmed	S	bm
Prairie Warbler	*Dendroica discolor*	Probable	RP	bm
American Redstart	*Setophaga ruticilla*	Probable	INC	bm
Ovenbird	*Seiurus aurocapillus*	Probable	D	bm
Common Yellowthroat	*Geothlypis trichas*	Confirmed	D	bm
Yellow-Breasted Chat	***Icteria virens***	**Confirmed**	**SC**	**bm**
Cardinalidae – Cardinals, Grosbeaks, Tanagers				
Scarlet Tanager	*Piranga olivacea*	Probable	RP	bm
Northern Cardinal	*Cardinalis cardinalis*	Confirmed	INC	bw
Blue Grosbeak	*Guiraca caerulea*	Confirmed	INC	bm
Indigo Bunting	*Passerina cyanea*	Confirmed	RP	bm
Emberizidae – Sparrows				
Eastern Towhee	*Pipilo erythrophthalmus*	Probable	RP	bmw
Chipping Sparrow	*Spizella passerine*	Confirmed	S	bmw
Field Sparrow	*Spizella pusilla*	Confirmed	RP	bmw
Savannah Sparrow	***Passerculus sandwichensis***	**Probable**	**T**	**bmw**

Common Name	Scientific Name	Presence	Status	
Grasshopper Sparrow	***Ammodramus savannarum***	**Confirmed**	**T**	**bm**
Song Sparrow	*Melospiza melodia*	Confirmed	D	bmw
Swamp Sparrow	*Melospiza georgiana*	Probable	D	bmw
Icteridae – Blackbirds, Grackles, Meadowlarks, Orioles				
Red-Winged Blackbird	*Agelaius phoeniceus*	Confirmed	S	bmw
Eastern Meadowlark	***Sturnella magna***	**Confirmed**	**SC**	**bmw**
Common Grackle	*Quiscalus quiscula*	Confirmed	D	bmw
Brown-Headed Cowbird	*Molothrus ater*	Confirmed	S	bmw
Orchard Oriole	*Icterus spurius*	Confirmed	S	bm
Baltimore Oriole	*Icterus galbula*	Confirmed	RP	bm
Fringillidae – Finches				
House Finch	*Carpodacus mexicanus*	Confirmed	S	bmw
American Goldfinch	*Carduelis tristis*	Confirmed	INC	bmw
Passeridae – Sparrows				
House Sparrow	*Passer domesticus*	Confirmed	I	bmw
Anhingidae - Darters				
Anhinga	*Anhinga anhinga*	Probable	-	-

Sources: Walsh et al., 1999; Swedesboro Environmental Commission, 2010; NJDEP Division of Fish and Wildlife, 2010.

Reptiles and Amphibians

Common Name	Scientific Name	Habitat	Status
Salamanders			
Spotted Salamander	*Ambystoma maculatum*	Deciduous uplands	D
Marbled Salamander	***Ambystoma opacum***	**Swampy woodland, dry uplands**	**SC**
Northern Dusky Salamander	*Desmognathus f. fuscus*	Waters edges	S
Four-Toed Salamander	*Hemidactylium scutatum*	Swampy woodlands	D
Red-Spotted Newt	*Notophthalmus v. viridescens*	Ponds, lakes	S
Northern Red Salamander	*Pseudotriton r. ruber*	Streams	D

Common Name	Scientific Name	Habitat	Status
Red-Backed Salamander	*Plethodon c. cinereus*	Woodlands	S
Frogs and Toads			
Northern Cricket Frog	*Acris c. crepitans*	Water edges	U
Fowler's Toad	***Bufo woodhousii fowleri***	**Sandy habitats**	**SC**
Northern Gray Treefrog	*Hyla versicolor*	Upland forests	S
Northern Spring Peeper	*Pseudacris crucifer crucifer*	Swampy woodlands	S
New Jersey Chorus Frog	*Pseudacris triseriata kalmi*	All habitats	S
Bullfrog	*Rana catesbeiana*	Lakes, ponds	S
Green Frog	*Rana clamitans melanota*	All water habitats	S
Pickerel Frog	*Rana palustris*	All habitats	S
Wood Frog	*Rana sylvatica*	Swampy woodlands	S
Southern Leopard Frog	*Rana utricularia*	Water edges	S
Eastern Spadefoot	*Scaphiopus h. holbrookii*	Sandy habitats	D
Turtles			
Common Snapping Turtle	*Chelydra s. serpentina*	Lakes, ponds	S
Eastern Painted Turtle	*Chrysemys p. picta*	Standing water	S
Spotted Turtle	*Clemmys guttata*	Swampy woodlands	U
Eastern Mud Turtle	*Kinosternon s.subrubrum*	Ponds, marshes	U
Red-Bellied Turtle	*Pseudemys rubriventris*	Ponds, lakes, streams, marshes	U
Red-Eared Turtle	*Pseudemys scripta elegans*	Ponds, marshes	I
Common Musk Turtle	*Sternotherus odoratus*	Shallow water	S
Eastern Box Turtle	*Terrapene c. carolina*	Uplands	S
Lizards			
Five-Lined Skink	Eumeces fasciatus	Wooded areas	U
Snakes			
Northern Black Racer	*Coluber c. constrictor*	Woodland, rural, semi-suburban areas	U
Eastern Worm Snake	*Carphophis a. amoenus*	Rural and suburban areas	U
Southern Ringneck Snake	*Diadophis p. punctatus*	Moist woodlands	S

Common Name	Scientific Name	Habitat	Status
Northern Ringneck Snake	*Diadophis punctatus edwardsi*	Woodlands	S
Black Rat Snake	*Elaphe o. obsoleta*	Rural, semi-suburban areas	U
Eastern Kingsnake	*Lampropeltis g. getulus*	Wetlands	U
Eastern Milk Snake	*Lampropeltis t. triangulum*	All habitats	S
Northern Water Snake	*Nerodia s. sipedon*	Wetlands	S
Rough Green Snake	*Opheodrys aestivus*	Vegetation over water	S
Northern Brown Snake	*Storeria d. dekayi*	Woodlands, rural, semi-suburban areas	S
Eastern Garter Snake	*Thamnophis s. sirtalis*	All habitats	S
Eastern Ribbon Snake	*Thamnophis s. sauritus*	Wetlands, streams	S

Sources: Swedesboro Environmental Commission, 2010; NJDEP Division of Fish and Wildlife, 2010.

Fish

Status Codes for Fish
E – Exotic
EX – Extirpated
N – Native
I – Introduced

Common Name	Scientific Name	Habitat	Status
Petromyzontidae – Lampreys			
American Brook Lamprey	*Lampetra appendix*	Streams	N
Sea Lamprey	*Petromyzon marinus*	River, streams	N
Anguillidae – Freshwater Eels			
American Eel	*Anquilla rostrata*	All waters	N
Clupeidae – Herrings			
Blueback Herring	*Alosa aestivalis*	Tidal streams	N
American Shad	*Alosa sapidissima*	Tidal rivers	N
Gizzard Shad	*Dorosoma cepedianum*	Lakes, ponds, tidal streams	N
Cyprinidae – Carps, Minnows			

Common Name	Scientific Name	Habitat	Status
Goldfish	*Carassius auratus*	Lakes, streams	E
Satinfin Shiner	*Cyprinella analostana*	Streams	N
Common Carp	*Cyprinus carpio*	Lakes, rivers, streams	E
Eastern Silvery Minnow	*Hybognathus regius*	Rivers, streams	N
Common Shiner	*Luxilus cornutus*	Streams	N
Comely Shiner	*Notropis amoenus*	Streams	N
Bridle Shiner	*Notropis bifrenatus*	Rivers, streams	N
Spottail Shiner	*Notropis hudsonius*	Rivers, streams	N
Blacknose Dace	*Rhinichthys atratulus*	Streams	N
Fallfish	*Semotilus corporalis*	Streams	N
Catostomidae – Suckers			
White Sucker	*Catostomus commersonnii*	Streams	N
Creek Chubsucker	*Erimyzon oblongus*	Streams	N
Ictaluridae – North American Catfishes			
Brown Bullhead	*Ameiurus nebulosus*	Lakes, rivers, streams	N
Tadpole madtom	*Noturus gyrinus*	Lakes, streams	N
Esocidae – Pikes			
Redfin Pickerel	*Esox americanus*	Lakes, ponds, streams	N
Chain Pickerel	*Esox niger*	Lakes, streams	N
Umbridae – Mudminnows			
Eastern Mudminnow	*Umbra pygmaea*	Streams	N
Aphredoderidae – Pirate Perches			
Pirate Perch	*Aphredoderus sayanus*	Streams	N
Fundulidae – Topminnows			
Banded Killifish	*Fundulus diaphanus*	Ponds, streams	N
Mummichog	*Fundulus heteroclitus*	Tidal streams	N
Moronidae – Temperate Basses			
White Perch	*Morone americana*	Lakes, ponds, rivers, streams	N
Striped Bass	*Morone saxatilis*	Tidal streams	N
Centrarchidae – Sunfishes			
Redbreasted Sunfish	*Lepomis auritus*	Lakes, streams	N
Pumpkinseed	*Lepomis gibbosus*	Lakes, ponds, streams	N

Common Name	Scientific Name	Habitat	Status
Bluegill	*Lepomis macrochirus*	All waters	I
Largemouth Bass	*Micropterus salmoides*	Lakes, ponds	I
White Crappie	*Pomoxis annularis*	All waters	I
Percidae – Perches			
Tessellated Darter	*Etheostoma olmstedi*	Streams	N

Source: Arndt, Rudolf G. "Annotated Checklist and Distribution of New Jersey Freshwater Fishes, with Comments on Abundance." *The Bulletin: New Jersey Academy of Science*, V. 49, No. 1, Spring, 2004; NJDEP Division of Fish and Wildlife, 2010.

Threatened and Endangered Wildlife Found in New Jersey

Birds			
Endangered		**Threatened**	
American Bittern	*Botaurus lentiginosos*	Bobolink	*Dolichonyx oryzivorus* BR
Eagle, bald	*Haliaeetus leucocephalus* BR **	Eagle, bald	*Haliaeetus leucocephalus* NB **
Falcon, peregrine	*Falco peregrinus*	Hawk, Cooper's	*Accipiter cooperii*
Goshawk, northern	*Accipiter gentilis* BR	Hawk, red-shouldered	*Buteo lineatus* NB
Grebe, pied-billed	*Podilymbus podiceps**	Night-heron, black-crowned	*Nycticorax nycticorax* BR
Harrier, northern	*Circus cyaneus* BR	Night-heron, yellow-crowned	*Nyctanassa violaceus*
Hawk, red-shouldered	*Buteo lineatus* BR	Knot, red	*Calidris canutus* BR
Owl, short-eared	*Asio flammeus* BR	Osprey	*Pandion haliaetus* BR
Plover, piping	*Charadrius melodus***	Owl, barred	*Strix varia*
Sandpiper, upland	*Batramia longicauda*	Owl, long-eared	*Asio otus*
Shrike, loggerhead	*Lanius ludovicianus*	Rail, black	*Laterallus jamaicensis*
Skimmer, black	*Rynchops niger* BR	Skimmer, black	*Rynchops niger* NB
Sparrow, Henslow's	*Ammodramus henslowii*	Sparrow, grasshopper	*Ammodramus savannarum* BR

Sparrow, vesper	*Pooecetes gramineus* BR	Sparrow, Savannah	*Passerculus sandwichensis* BR
Tern, least	*Sterna antillarum*	Sparrow, vesper	*Pooecetes gramineus* NB
Tern, roseate	*Sterna dougallii***	Woodpecker, red-headed	*Melanerpes erythrocephalus*
Wren, sedge	*Cistothorus platensis*		
Reptiles			
Endangered		**Threatened**	
Rattlesnake, timber	*Crotalus h. horridus*	Snake, northern pine	*Pituophis m. melanoleucus*
Snake, corn	*Elaphe g. guttata*	Turtle, Atlantic green	*Chelonia mydas***
Snake, queen	*Regina septemvittata*	Turtle, wood	*Clemmys insculpta*
Turtle, bog	*Clemmys muhlenbergii***		
Atlantic hawksbill	*Eretmochelys imbricata***		
Atlantic leatherback	*Dermochelys coriacea***		
Atlantic loggerhead	*Caretta caretta***		
Atlantic Ridley	*Lepidochelys kempi***		
Amphibians			
Endangered		**Threatened**	
Salamander, blue-spotted	*Ambystoma laterale*	Salamander, eastern mud	*Pseudotriton montanus*
Salamander, eastern tiger	*Ambystoma tigrinum*	Salamander, long-tailed	*Eurycea longicauda*
Treefrog, southern gray	*Hyla chrysocelis*	Treefrog, pine barrens	*Hyla andersonii*
Invertebrates			
Endangered		**Threatened**	
Beetle, American burying	*Nicrophorus mericanus***	Elfin, frosted (butterfly)	*Callophrys irus*
Beetle, northeastern beach tiger	*Cincindela d. dorsalis***	Floater, triangle (mussel)	*Alasmidonta undulata*
Copper, bronze	*Lycaena hyllus*	Fritillary, silver-bordered (butterfly)	*Bolaria selene myrina*
Floater, brook (mussel)	*Alasmidonta varicosa*	Lampmussel, eastern (mussel)	*Lampsilis radiata*

Floater, green (mussel)	*Lasmigona subviridis*	Lampmussel, yellow (mussel)	*Lampsilis cariosa*
Satyr, Mitchell's (butterfly)	*Neonympha m. mitchellii***	Mucket, tidewater (mussel)	*Leptodea ochracea*
Skipper, arogos (butterfly)	*Atrytone arogos arogos*	Pondmussel, eastern (mussel)	*Ligumia nasuta*
Skipper, Appalachian grizzled (butterfly)	*Pyrgus wyandot*	White, checkered (butterfly)	*Pontia protodice*
Wedgemussel, dwarf	*Alasmidonta heterodon***		
Mammals			
Endangered			
Bat, Indiana	*Myotis sodalis***		
Bobcat	*Lynx rufus*		
Whale, black right	*Balaena glacialis***		
Whale, blue	*Balaenoptera musculus***		
Whale, fin	*Balaenoptera physalus***		
Whale, humpback	*Megaptera novaeangliae***		
Whale, sei	*Balaenoptera borealis***		
Whale, sperm	*Physeter macrocephalus***		
Woodrat, Allegheny	*Neotoma floridana magister*		
Fishes			
Endangered			
Sturgeon, shortnose	*Acipenser brevirostrum***		
***** Federally Endangered or Threatened**			

Source: NJDEP, 2011

APPENDIX D

Plants in Swedesboro

Shade Trees

Species Code	Scientific Name	Common Name
ACCA	Acer campestre	Hedge maple
ACFR	Acer freemanii	Freeman maple
ACPL	Acer platanoides	Norway maple
ACRU	Acer rubrum	Red maple
BENI	Betula nigra	River birch
BEPO	Betula populifolia	Grey birch
CASP	Catalpa speciosa	Northern catalpa
CECA	Cercis canadensis	Eastern redbud
CEOC	Celtis occidentalis	Northern hackberry
CLLU	Cladrastis kentukea	Yellowwood
EUUL	Eucommia ulmoides	Hardy rubber tree
FRAM	Fraxinus americana	White ash
FRPE	Fraxinus pennsylvanica	Green ash
GIBI	Ginkgo biloba	Ginkgo
GLTR	Gleditsia triacanthos	Honeylocust
GYDI	Gymnocladus dioicus	Kentucky coffeetree
JUNI	Juglans nigra	Black walnut
JUVI	Juniperus virginiana	Eastern red cedar
LIST	Liquidambar styraciflua	Sweetgum
PIAB	Picea abies	Norway spruce
PIST	Pinus strobus	Eastern white pine
PLAC	Platanus x acerifolia	London planetree
PLOC	Platanus occidentalis	American sycamore
PRCE	Prunus cerasifera	Cherry plum
PRSE	Prunus serotina	Black cherry

Species Code	Scientific Name	Common Name
PRSU	Prunus subhirtella	Spring cherry
PSME	Pseudotsuga menziesii	Douglas-fir
PYCA	Pyrus calleryana	Callery pear
PYCO	Pyrus communis	European pear
QUCO	Quercus coccinea	Scarlet oak
QUMA	Quercus macrocarpa	Bur oak
QUPA	Quercus palustris	Pin oak
QURU	Quercus rubra	Northern red oak
SOJA	Sophora japonica	Japanese pagodatree
THOC	Thuja occidentalis	Northern white cedar
TICO	Tilia cordata	Littleleaf linden
ULAM	Ulmus americana	American elm
ULPA	Ulmus parvifolia	Chinese elm
ULPU	Ulmus pumila	Siberian elm
ZESE	Zelkova serrata	Zelkova

Source: Swedesboro Shade Tree Commission.

Rare Ecological Community

Common Name	G Rank	S Rank	Last Observed
Freshwater tidal marsh complex	G4?	G3?	1972

Source: NJDEP Natural Heritage Database, 2009.

Rare Plant Species found in Gloucester County, NJ

Scientific Name	Common Name	Federal Status	State Status	Regional Status	G Rank	S Rank
Aeschynomene virginica	Sensitive Joint-vetch	LT	E	LP, HL	G2	S1
Agastache nepetoides	Yellow Giant-hyssop			HL	G5	S2
Alopecurus carolinianus	Tufted Meadow-foxtail			HL	G5	S2
Amianthium muscitoxicum	Fly Poison			HL	G4G5	S2
Anemone canadensis	Canada Anemone			HL	G5	SX
Aplectrum hyemale	Puttyroot		E	LP, HL	G5	S1
Aristida dichotoma var. curtissii	Curtiss' Three-awn Grass			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
Asimina triloba	Pawpaw		E	LP, HL	G5	S1
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
Bouteloua curtipendula	Side-oats Grama Grass		E	LP, HL	G5T5	S1
Cacalia atriplicifolia	Pale Indian Plantain		E	LP, HL	G4G5	S1
Callitriche palustris	Marsh Water-starwort			HL	G5	S2
Cardamine longii	Long's Bittercress		E	LP, HL	G3	SH
Carex barrattii	Barratt's Sedge			LP	G4	S4
Carex frankii	Frank's Sedge			HL	G5	S3
Carex limosa	Mud Sedge		E	LP, HL	G5	S1
Carex mitchelliana	Mitchell's Sedge			HL	G3G4	S2
Carex polymorpha	Variable Sedge		E	LP, HL	G3	S1
Carex prairea	Prairie Sedge			HL	G5?	S2
Carex utriculata	Bottle-shaped Sedge			HL	G5	S2
Castanea pumila	Chinquapin		E	LP, HL	G5	S1
Castilleja coccinea	Scarlet Indian-paintbrush			HL	G5	S2
Corallorhiza wisteriana	Spring Coralroot			HL	G5	SX
Coreopsis rosea	Rose-color Coreopsis			LP, HL	G3	S2
Croton willdenowii	Elliptical Rushfoil			LP, HL	G5	S2
Cuphea viscosissima	Blue Waxweed			HL	G5?	S3

Scientific Name	Common Name	Federal Status	State Status	Regional Status	G Rank	S Rank
Cyperus engelmannii	Engelmann's Flat Sedge			HL	G4Q	S2
Cyperus lancastriensis	Lancaster Flat Sedge		E	LP, HL	G5	S1
Cyperus retrofractus	Rough Flatsedge		E	LP, HL	G5	SH
Dalibarda repens	Robin-run-away		E	LP, HL	G5	SH.1
Desmodium laevigatum	Smooth Tick-trefoil			HL	G5	S3
Desmodium strictum	Pineland Tick-trefoil			LP, HL	G4	S2
Desmodium viridiflorum	Velvety Tick-treefoil			HL	G5?	S2
Doellingeria infirma	Cornel-leaf Aster			HL	G5	S2
Draba reptans	Carolina Whitlow-grass		E	LP, HL	G5	SH
Eleocharis equisetoides	Knotted Spike-rush		E	LP, HL	G4	S1
Eleocharis tortilis	Twisted Spike-rush		E	LP, HL	G5	S1
Elephantopus carolinianus	Carolina Elephant-foot		E	LP, HL	G5	SH
Epilobium angustifolium ssp. Circumvagum	Narrow-leaf Fireweed			HL	G5T5	S1
Epilobium strictum	Downy Willowherb			HL	G5?	S2
Eriocaulon parkeri	Parker's Pipewort			HL	G3	S2
Eriophorum gracile	Slender Cotton-grass		E	LP, HL	G5TNR	SH
Eriophorum tenellum	Rough Cotton-grass		E	LP, HL	G5	S1
Eupatorium resinosum	Pine Barren Boneset		E	LP, HL	G3	S2
Glyceria laxa	Northern Manna Grass			HL	G5	S1
Gymnopogon brevifolius	Short-leaf Skeleton Grass		E	LP, HL	G5	SH
Helonias bullata	Swamp-pink	LT	E	LP, HL	G3	S3
Heteranthera multiflora	Bouquet Mud-plantain			HL	G4	S2
Lespedeza stuevei	Stueve's Downy Bush-clover			HL	G4?	S2
Ludwigia linearis	Narrow-leaf Primrose-willow			LP, HL	G5	S1
Luzula acuminata	Hairy Wood-rush		E	LP, HL	G5T4T5	S2
Lycopodiella inundata	Northern Bog Club-moss			HL	G5	S1
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

Scientific Name	Common Name	Federal Status	State Status	Regional Status	G Rank	S Rank
Muhlenbergia capillaris	Long-awn Smoke Grass		E	LP, HL	G5TNR	S1
Muhlenbergia torreyana	Pine Barren Smoke Grass			LP, HL	G3	S3
Nymphoides cordata	Floatingheart			LP, HL	G5	S3
Obolaria virginica	Virginia Pennywort			HL	G5	S2
Onosmodium virginianum	Virginia False-gromwell		E	LP, HL	G4	S1
Panicum aciculare	Bristling Panic Grass		E	LP, HL	G4G5	SH
Paspalum dissectum	Mudbank Crown Grass			HL	G4?	S2
Penstemon laevigatus	Smooth Beardtongue		E	LP, HL	G5	S1
Phaseolus polystachios var. polystachios	Wild Kidney Bean			HL	G4TNR	S2
Phlox maculata var. maculata	Spotted Phlox			HL	G5TNR	S2
Phoradendron leucarpum	American Mistletoe			LP, HL	G5	S2
Pinus serotina	Pond Pine			HL	G5	S2
Platanthera ciliaris	Yellow Fringed Orchid			LP, HL	G5	S2
Polygala incarnata	Pink Milkwort		E	LP, HL	G5	SH
Polygala mariana	Maryland Milkwort			LP, HL	G5	S2
Polygala polygama	Racemed Milkwort			HL	G5	S2
Polygonum hydropiperoides var. opelousanum	Opelousas Water-pepper			HL	G5TNRQ	S2
Prunus angustifolia	Chickasaw Plum		E	LP, HL	G5T4T5	S2
Puccinellia fasciculata	Saltmarsh Alkali Grass			HL	G3G5	S2
Pycnanthemum torrei	Torrey's Mountain-mint		E	LP, HL	G2	S1
Quercus imbricaria	Shingle Oak		E	LP, HL	G5	S1.1
Quercus muehlenbergii	Yellow Oak			HL	G5	S3
Ranunculus ambigens	Water-plantain Spearwort			HL	G4	S2
Ranunculus longirostris	Long-beak Water Buttercup			HL	G5	S2
Rhynchospora globularis	Coarse Grass-like Beaked-rush		E	LP, HL	G5?	S1
Rhynchospora inundata	Slender Horned-rush			LP, HL	G3G4	S2
Rhynchospora nitens	Short-beaked Bald-rush			HL	G4?	S2
Rhynchospora pallida	Pale Beaked-rush			HL	G3	S3
Rhynchospora scirpoides	Long-beak Bald-rush			HL	G4	S2
Rotala ramosior	Toothcup			HL	G5	S3

Scientific Name	Common Name	Federal Status	State Status	Regional Status	G Rank	S Rank
Sagittaria subulata	Awl-leaf Arrowhead			HL	G4	S2
Scheuchzeria palustris	Arrow-grass		E	LP, HL	G5T5	SH
Schizaea pusilla	Curly Grass Fern			LP, HL	G3	S3
Scutellaria nervosa	Veined Skullcap			HL	G5	S2
Sisyrinchium fuscatum	Sand-plain Blue-eyed Grass			HL	G5?	S2
Sphenopholis pensylvanica	Swamp Oats			HL	G4	S2
Spiranthes laciniata	Lace-lip Ladies'-tresses		E	LP, HL	G4G5	S1
Spiranthes odorata	Fragrant Ladies'-tresses			HL	G5	S2
Sporobolus compositus var. compositus	Long-leaf Rush-grass			HL	G5T5	S2
Stachys hyssopifolia	Hyssop Hedge-nettle			HL	G5	S2
Stachys tenuifolia	Smooth Hedge-nettle			HL	G5	S3
Thaspium barbinode	Hairy-joint Meadow-parsnip			HL	G5	SX
Tipularia discolor	Cranefly Orchid			HL	G4G5	S3
Trichostema setaceum	Narrow-leaf Bluecurls			HL	G5	S2
Utricularia biflora	Two-flower Bladderwort		E	LP, HL	G5	S1
Utricularia gibba	Humped Bladderwort			LP, HL	G5	S3
Utricularia purpurea	Purple Bladderwort			LP, HL	G5	S3
Valerianella radiata	Beaked Cornsalad		E	LP, HL	G5	S1
Verbena simplex	Narrow-leaf Vervain		E	LP, HL	G5	S1
Vernonia glauca	Broad-leaf Ironweed		E	LP, HL	G5	S1
Vulpia elliotea	Squirrel-tail Six-weeks Grass		E	LP, HL	G5	S1

Sources: NJDEP Natural Heritage Database, 2008.

Federal Status	
LT	Taxa formally listed as threatened.
State Status: Plants	
E	Native New Jersey plant species whose survival in the state or nation is in jeopardy.
Global (G Rank) Element Rank	
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 physio-graphic region in the East) or because of other factors making it vulnerable to extinction throughout its range; the number of occurrences are 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.
T	The status of infraspecific taxa (subspecies or varieties) are indicated by a “T-rank” following the species global rank.
NR	Species has not yet been ranked.
State (S Rank) Element Rank	
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 that are widely distributed in the state but with small populations/acreage or elements with restricted distribution, but locally abundant. Not yet imperiled in state but may soon be if current trends continue. Searching often yields additional occurrences.
S4	Apparently secure in 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.
.1	Elements only, ever documented from a single location.
B	Refers to the breeding population of the element in the state.
N	Refers to the nonbreeding population of the element in the state.
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).	

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

Local Historic Properties

Historic Properties on Kings Highway

Name	Address	Date Constructed	Style
Amos Hurff House	1455 Kings Highway	Unknown	Late Queen Anne Victorian
Ashton-Crispin Building	1422 Kings Highway	1911	Early 20th Century Commercial
Bank of America Building	1427 Kings Highway	1909	Classic Greek Revival
Bethesda United Methodist Church	1433 Kings Highway	1883	Gothic Revival
Davidson House	1446 Kings Highway	Late 1800s	Romanesque Revival
Dupper House	1514 Kings Highway	1908	20th Century Craftsman
Headley House	1447 Kings Highway	1894	Late Victorian
Herbert Sickler House	1220 Kings Highway	1928	20th Century Craftsman
Isaac Bradshaw House	1510 Kings Highway	1920	20th Century Craftsman
Kate Talman House	1316 Kings Highway	1810	Colonial
Lizzie Wallace House	1226 Kings Highway	1884	Victorian
Poinsett House	1214 Kings Highway	1892	Late Queen Anne Stick Victorian
Samuel Dyer House	1320 Kings Highway	1812	Federal
Samuel S Guest House	1128 Kings Highway	1890	Second Empire
Swedes Inn	1301 Kings Highway	1770	Second Empire Victorian
Swedesboro Grammar School	1225 Kings Highway	1909	Romanesque
Swedesboro Library	1442 Kings Highway	1914	Neoclassical
Trinity Church Parish House	1202 Kings Highway	1854	
Trinity Church Rectory	1208 Kings Highway	Late 1700s to 1846	Federal
William Talman House	1324 Kings Highway	1906	Queen Anne Victorian

Source: Swedesboro Economic Development, 2010.

Historic Streetscapes

Street Name	Cross Streets	Description	Approx. No. of Buildings	Threats to Street	Inventory No.
Franklin Street	Lake Ave., Echo Ave.	Semi-rural street, houses scattered on different sized lots; some farmhouses without buildings; florist, etc. with hothouses; otherwise, mostly very simple bungalows; all renovated but very good condition; some alterations; all early 20th century very simple houses; farmhouses may be closer to turn-of-the-century.	13	Deterioration	0817-18
Park Avenue	n/a	A variety of Victorian type medium-scale houses; some alterations; nearly all except a few are renovated, but most are in good condition; a few bungalows. Park Avenue runs along the edge of Lake Narraticon. Houses on the southeast side overlook the lake, which is no longer swimmable due to pollution. Typical house lots are 50 feet.	20	No threat	0817-18
East Avenue	n/a	Variety of very well-maintained late 19th century to early 20th century houses; almost all resided; over half are pattern book Victorian styles; others more simple with just large bungalows; many large trees on street. Houses are similar size and moderate scale; most are 2-1/2 stories high, on 60 foot lots. Part of the Narraticon Lake District.	28	No threat	0817-19
Lake Avenue	Kings Highway Allen St.	Especially the west side of the street - very good example of variations of Victorian turn-of-the-century houses including Queen Anne influence, gothic; also Second Empire with Mansard roof, etc.; large lots very good condition but some resided, but much decorative detail remains on some houses with eave trim, verge boards etc., especially #11, #12, and #18. Could be nominated as part of a group/thematic nomination for the Narraticon Lake District.	5	No threat	0817-17

Source: New Jersey Department of Environmental Protection, Office of New Jersey Heritage. Streetscape Survey Forms. July 1986.

Known Contaminated Sites in Swedesboro

Closed Known Contaminated Sites

Site ID	PI Number	PI Name	Street Address	Home Owner (Y/N)
377391	467726	Bethesda United Methodist Church	1435 Kings Hwy.	No
33809	001860	Del Monte Corp Plant 506	Locke Avenue	No
192941	253400	Del Monte Corp Warehouse #1	3rd St & Church St.	No
402657	503802	East Avenue	East Avenue	Yes
389275	486400	Franklin Street	Franklin Street	Yes
257805	330234	Franklin Street	Franklin Street	Yes
52987	020695	Hoerter Provisions	Leahy Ave & Fow Avenue	No
380399	474069	Kings Hwy.	Kings Hwy.	Yes
75860	G000060352	Kings Hwy.	Kings Hwy.	Yes
53466	021608	Margaret Clifford School	601 Auburn Ave.	No
42996	004360	Merrell & Garaguso, Inc.	Locke Avenue	No
7827	012779	Pat's Service Station	1501 King's Hwy.	No
72864	G000028330	Reliable Garage	Auburn Ave. & Locke Ave.	No
45153	012119	Ron-Son Foods, Inc.	Richardson Ave.	No
44684	010925	Sam's General Store	Auburn-Swedesboro Road	No
223808	292200	Swedes Inn	1301 Kings Hwy	No
20131	020922	Teledyne Packaging	20 Ashton Avenue	No
386551	482787	Weatherby Avenue	Weatherby Avenue	Yes

Source: NJDEP, 2010.

Regulated Underground Storage Tank Facilities

PI Number	PI Name	Street Address	Doc Status	Expiration Date
019286	AT&T	Rt.551	Terminated	11/16/2000
001860	Del Monte Corp. Plant 506	Locke Avenue	Terminated	11/16/2000
010290	Express Gas	1008 Kings Hwy.	Effective	12/31/2012
003946	Gahrs, Inc.	245 Broad Street	Terminated	11/16/2000
496432	GBH Fabricating & Packaging, Inc.	106 Fow Avenue	Terminated	
033695	Getty 56955 (Former)	King's Hwy & Glen Echo Ave.	Terminated	11/16/2000
011224	Grasso Foods, Inc.	Woodstown & Sharptown Rds	Terminated	11/16/2000
020695	Hoerter Provisions	Fow & Leahy Avenues	Terminated	11/16/2000
021608	Margaret Clifford School	Auburn Avenue	Terminated	11/16/2000
004360	Merrell & Garaguso, Inc.	Locke Avenue	Terminated	11/16/2000
014069	M&H Equipment Rental Co., Inc.	Rt. 322	Terminated	12/31/2003
012779	Pat's Service Station	1501 Kings Hwy.	Effective	12/31/2012
012119	Ron-Son Foods, Inc.	2nd & Richardson	Terminated	12/31/1997
010925	Sam's General Store	Swedesboro Auburn Road	Terminated	11/16/2000
025475	Shani Auto Fuel Corp.	541 Kings Hwy.	Effective	12/31/2012
021784	St. Joseph Regional School	140 Broad Street	Terminated	12/31/2001
024661	Swedesboro	124 Church Street	Terminated	11/16/2000
010779	Swedesboro Borough	500 Kings Hwy.	Terminated	11/16/2000
013655	Swedesboro Borough	King's Hwy. Raccoon Creek	Terminated	12/31/2003
292200	Swedes Inn	1301-1307 Kings Hwy.	Terminated	
020922	Teledyne Packaging	20 Ashton Avenue	Terminated	11/16/2000
013210	Towbin Chrysler S	945 Kings Hwy.	Terminated	11/16/2000
026310	US Drop Forge Co.	Rt. 551	Terminated	11/16/2000
007511	Verizon Swedesboro Co. (35570)	Broad and 2nd Streets	Terminated	12/31/2001
192548	Walter Hill Elementary School	815 Kings Hwy.	Terminated	
014298	Walter Hill School	Kings Hwy.	Terminated	12/31/1997

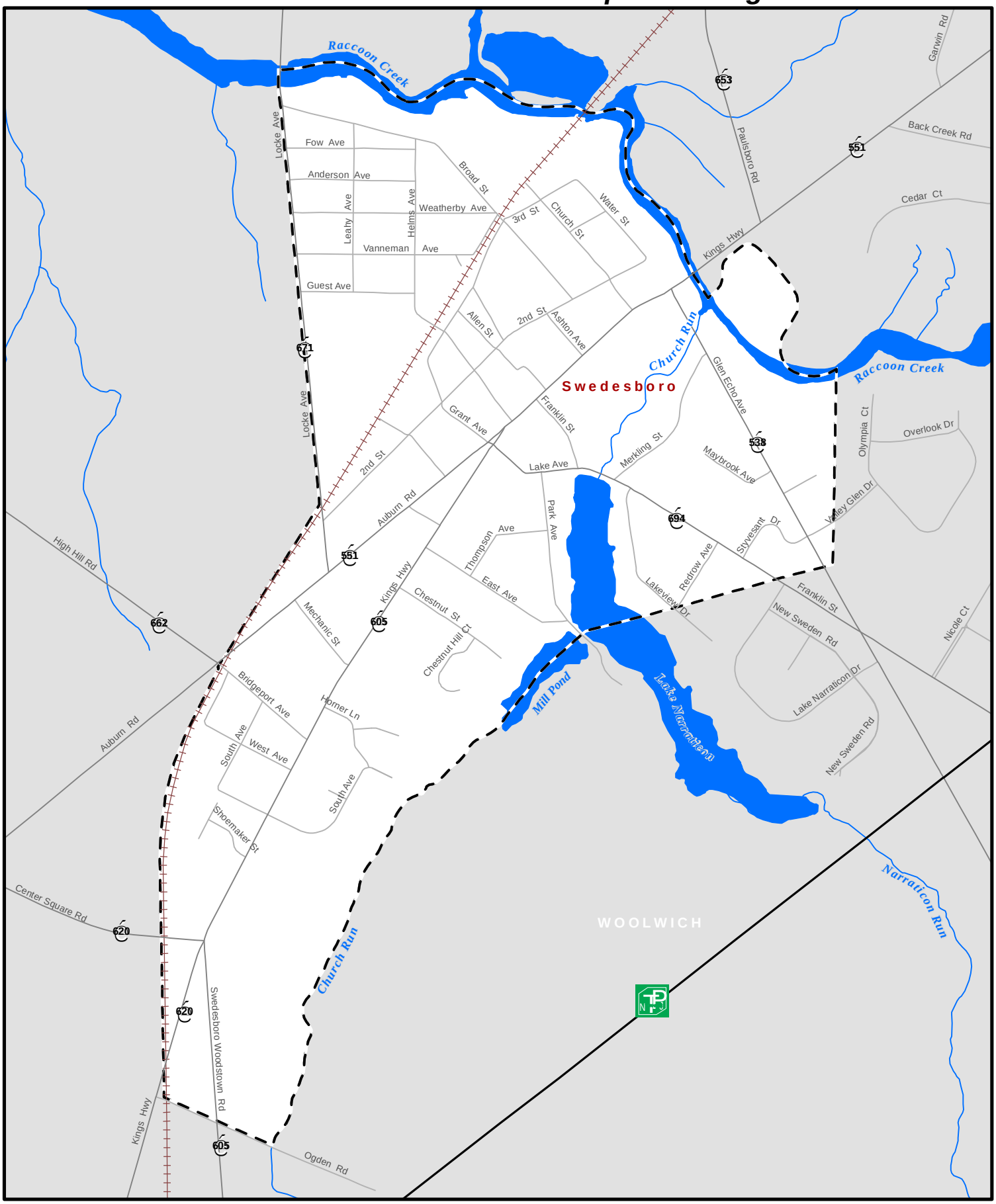
Source: NJDEP, 2010.

APPENDIX G

Maps

SWEDESBORO

Map 1: Borough of Swedesboro



Sources : NJDEP, NJDOT, DVRPC.
This map 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.

0.1 0.05 0 0.1
Miles

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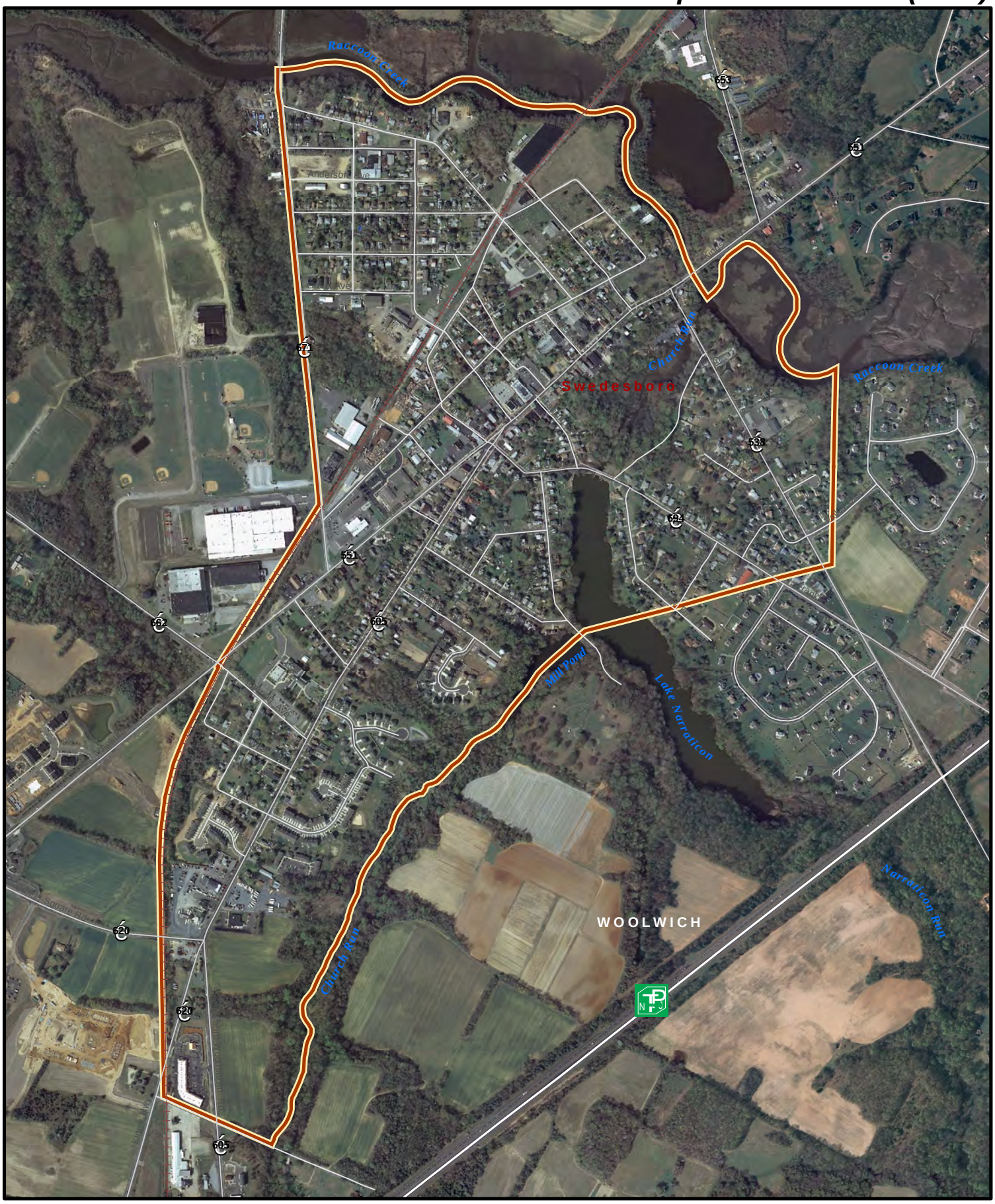
SWEDESBORO

Map 2: Aerial Photo (2007)



Sources : NJDEP, NJDOT, DVRPC.
This map 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.

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Miles

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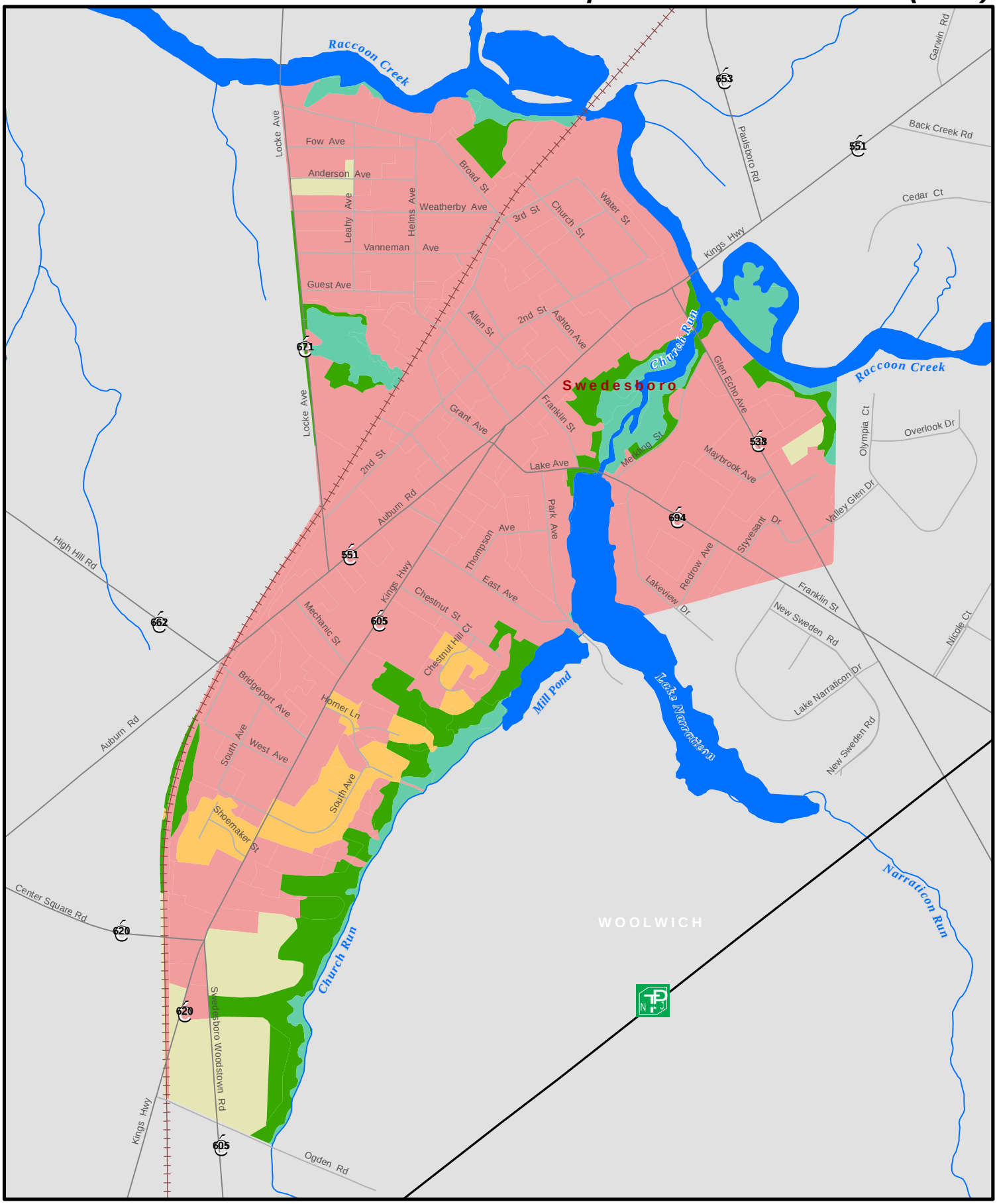
SWEDESBORO

Map 3: NJDEP Land Cover (2007)



Sources : NJDEP, NJDOT, DVRPC.
This map 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.

Land Cover Categories

Agriculture	Forest	Water
Barren Land	Developed	Wetlands

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Miles

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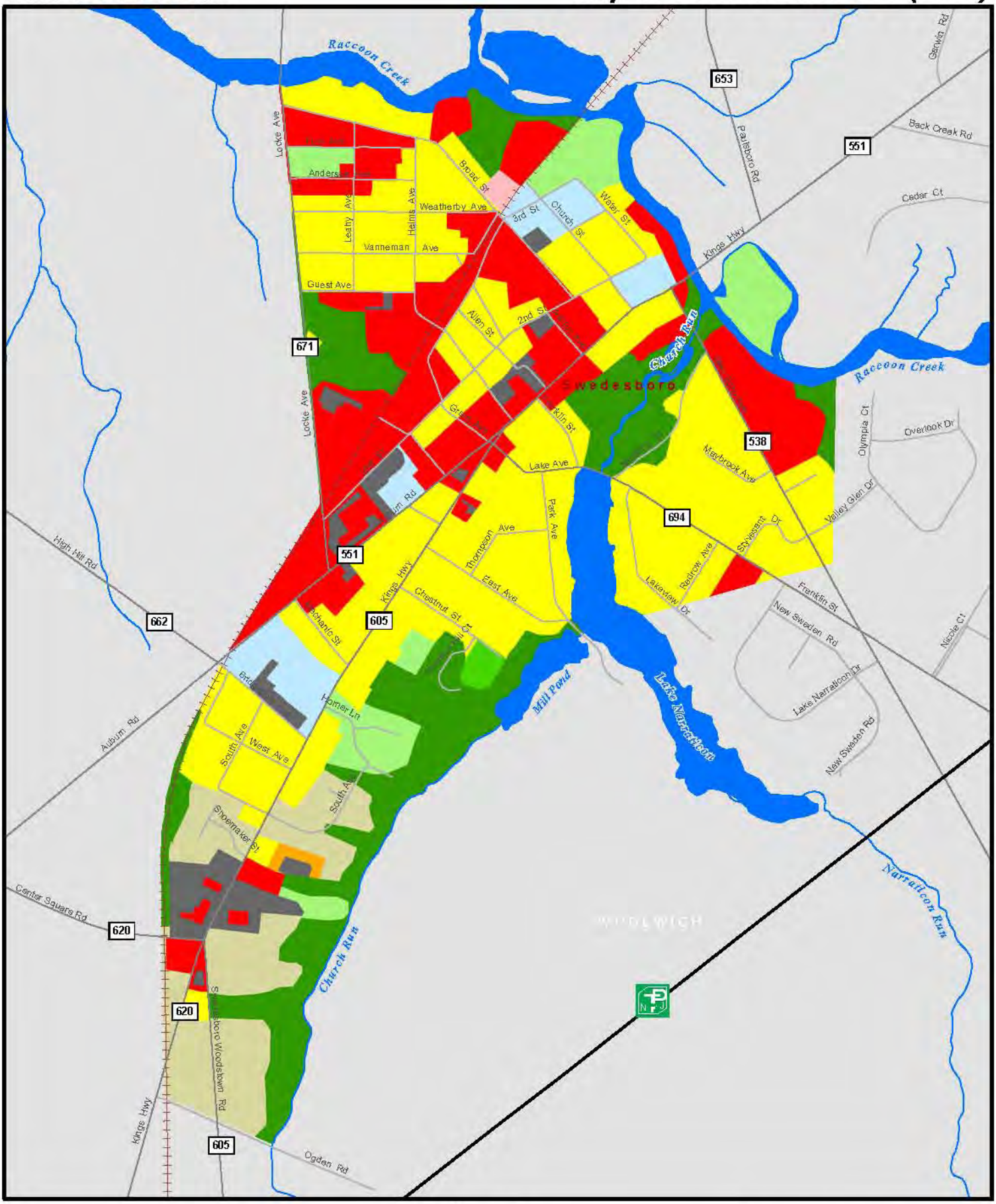
SWEDESBORO

Map 4: DVRPC Land Use (2005)



Sources: NJDEP, NJDOT, DVRPC.
This map 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.

Land Use Type

- Agriculture
- Commercial
- Community
- Residential: Multi-Family
- Residential: Single-Family
- Parking & Transportation
- Recreation
- Utility
- Vacant
- Water
- Wooded

N

0.1 0.05 0 0.1
Miles

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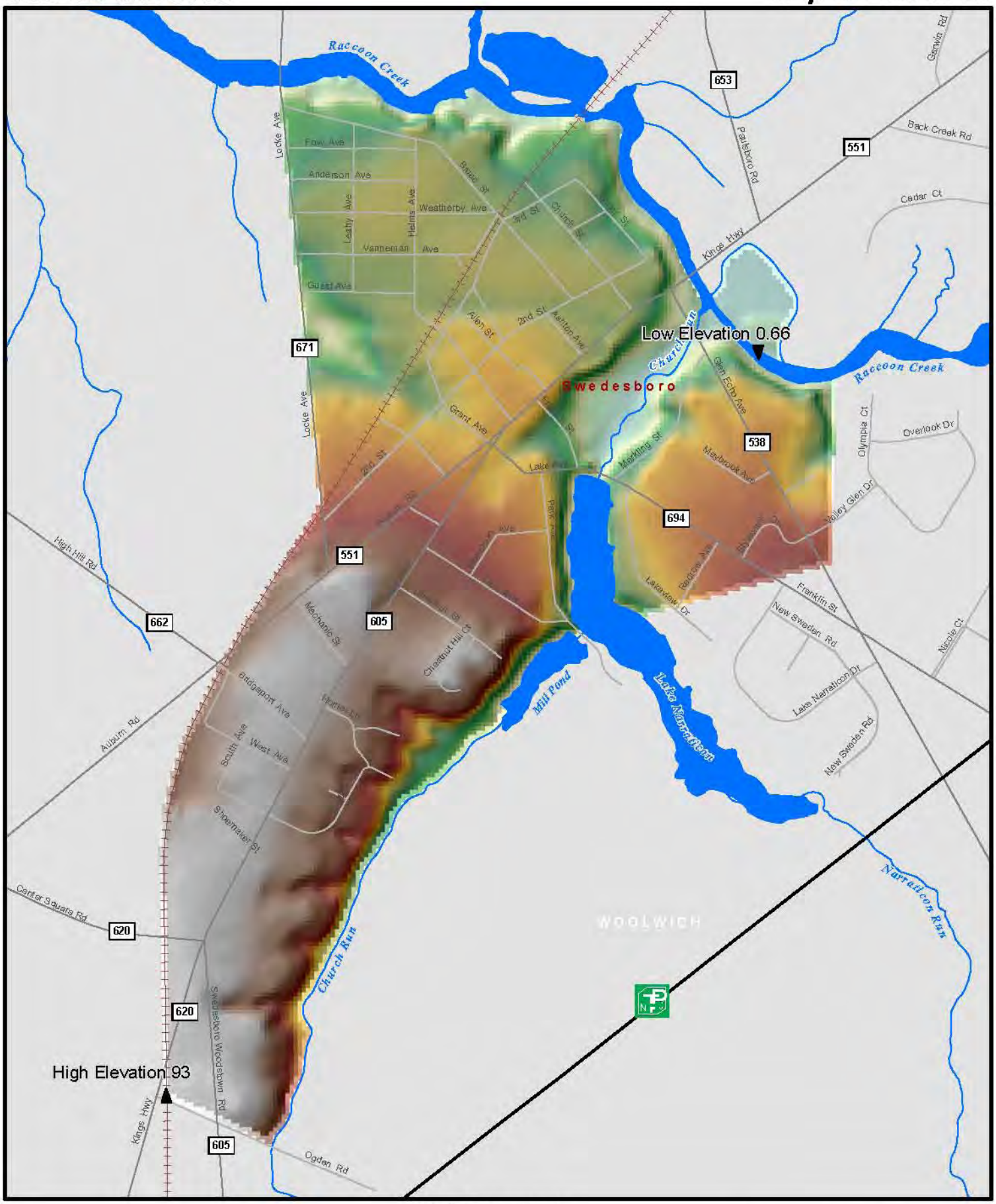
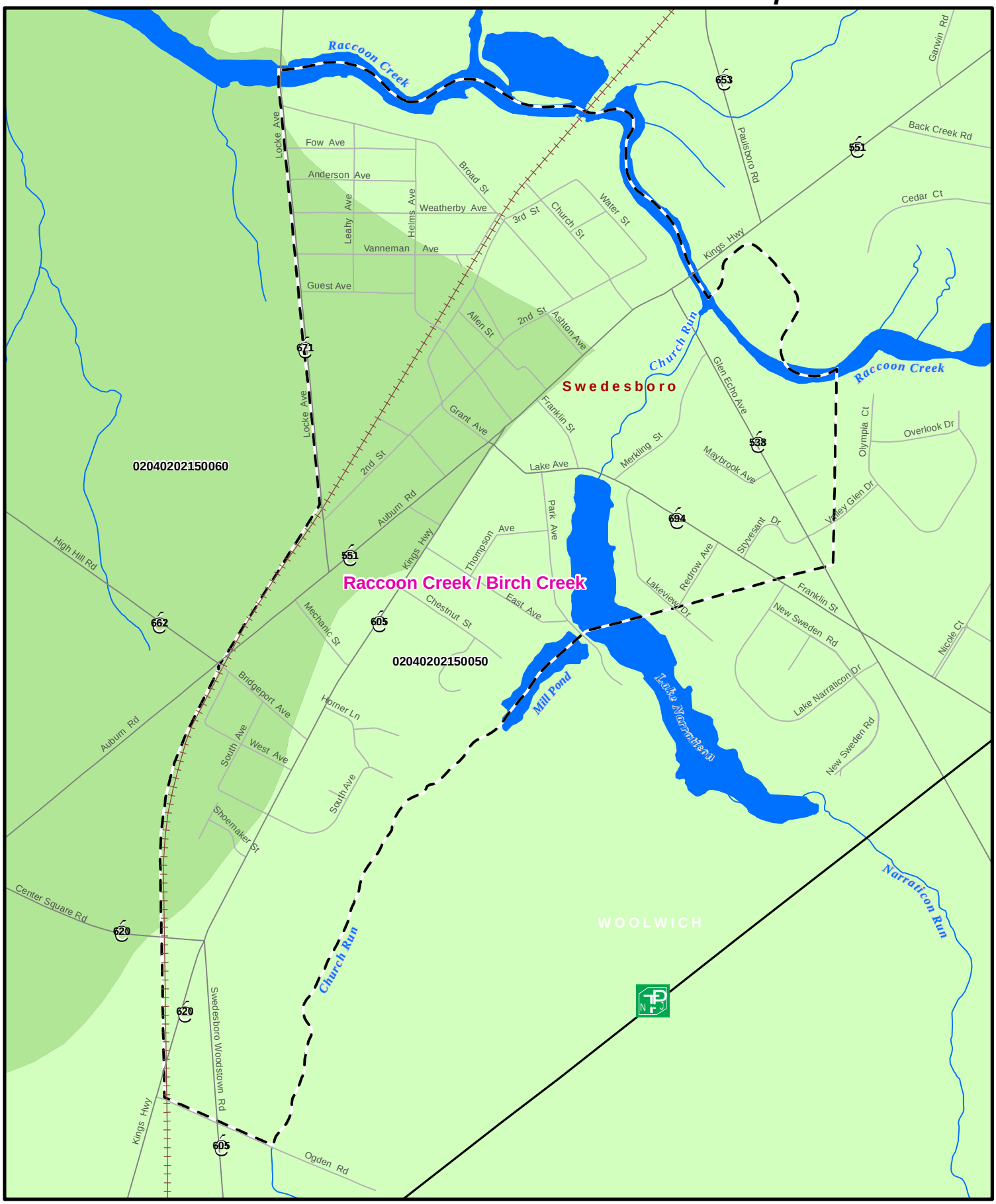
Map 5: Elevation



Sources : NJDEP, NJDOT, DVRPC.
This map 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.

SWEDESBORO

Map 6: Watersheds



Sources : NJDEP, NJDOT, DVRPC.
This map 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.

Raccoon Ck (Swedesboro Rd - Russell Mill Rd)

Raccoon Ck (below Swedesboro Rd / Birch Creek)

0.1 0.05 0 0.1

Miles

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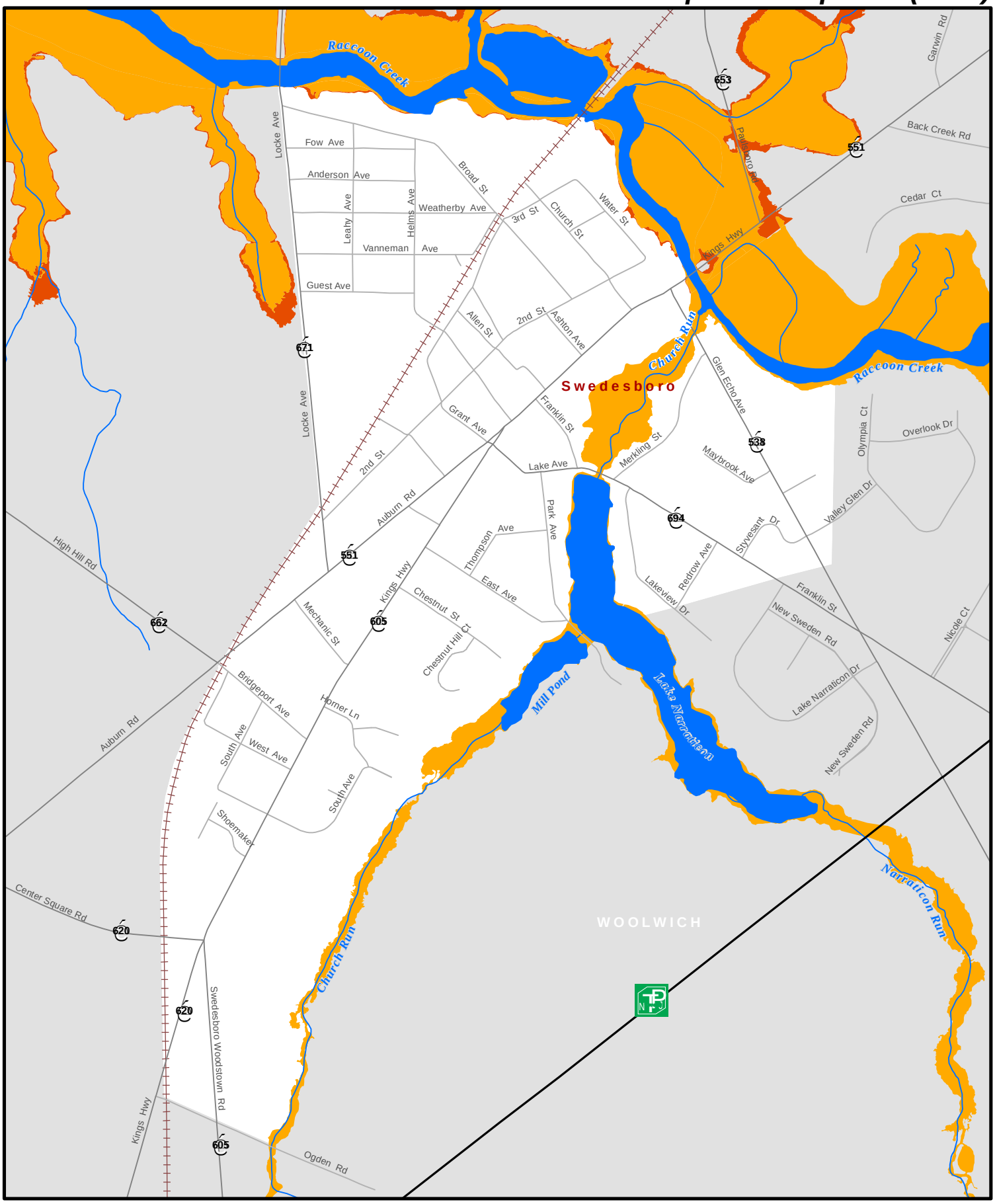
Map 7: Floodplains (2010)



Sources : NJDEP, NJDOT, DVRPC.
This map 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.

Flood Zone

- 100-Year Floodplain
- 500-Year Floodplain

0.1 0.05 0 0.1
Miles

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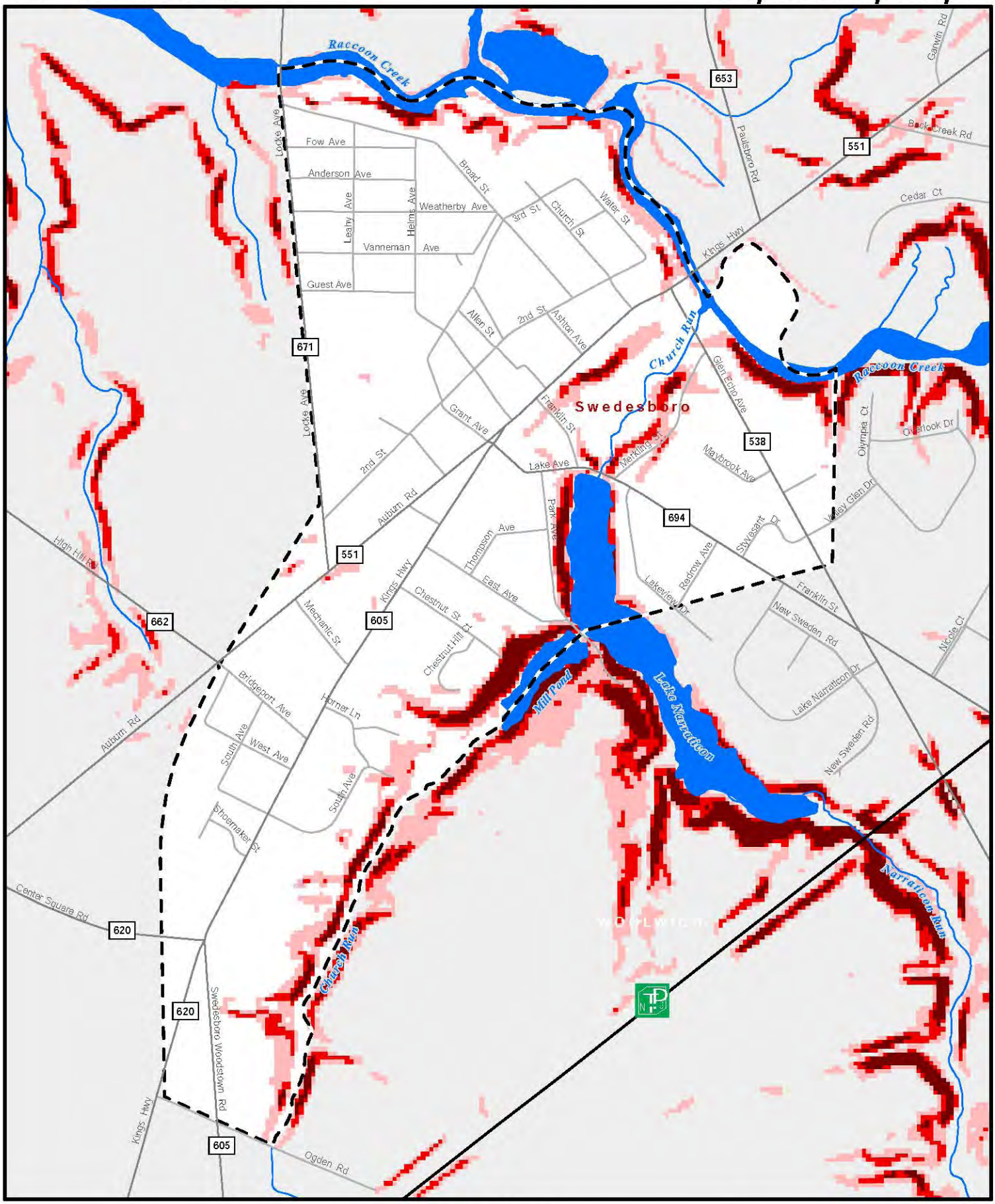
Map 8: Steep Slopes



Sources : NJDEP, NJDOT, DVRPC.
This map 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.

Steep Slopes

- Slope < 10%
- Slope = 10% - 14.99%
- Slope = 15% - 19.99%
- Slope ≥ 20%

N

0.1 0.05 0 0.1
Miles

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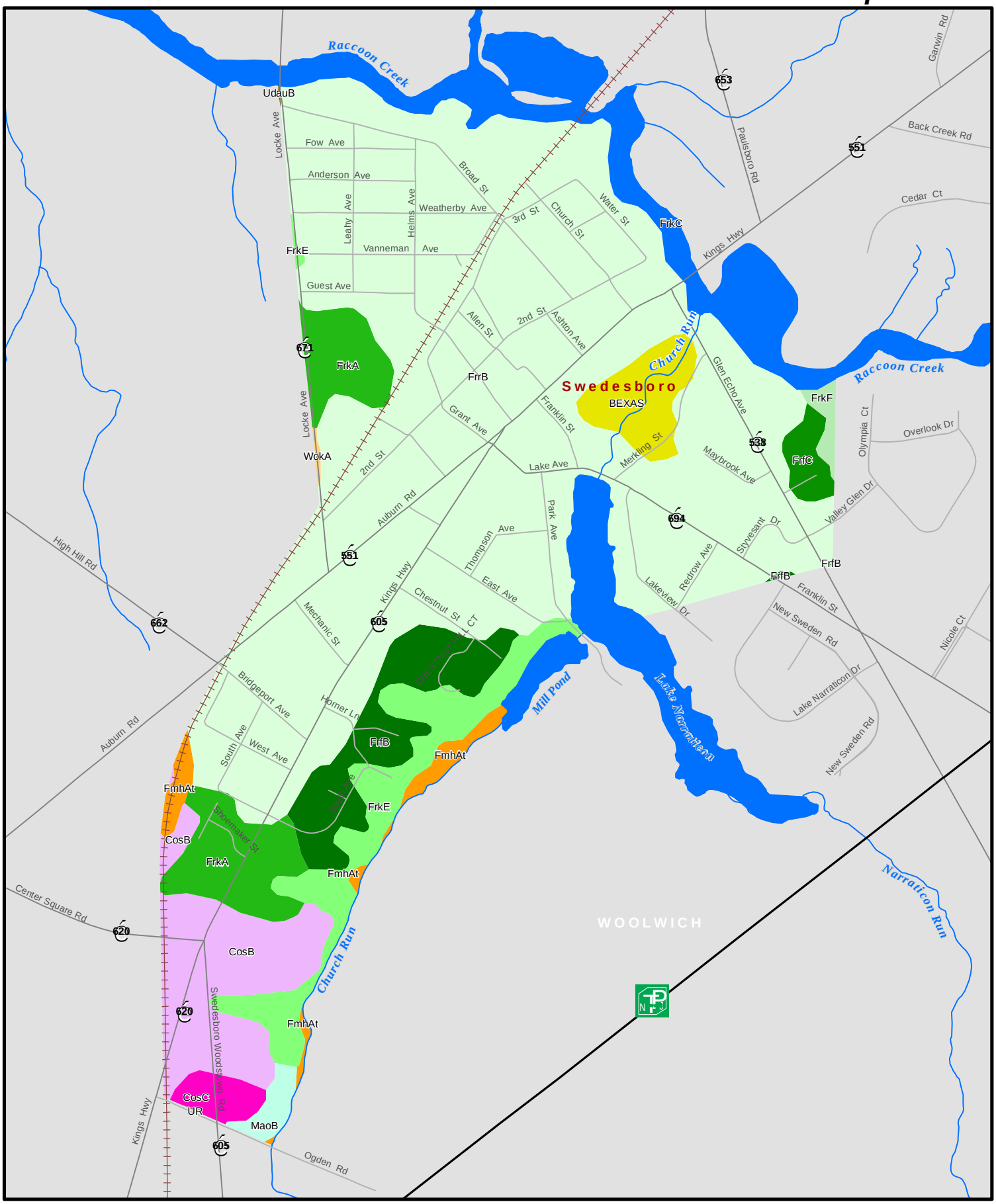
Map 9: Soils



Sources : NJDEP, NJDOT, DVRPC.
This map 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.

Soils

- Berryland and Mullica (BEXAS)
- Fluvaquents (FmhAt)
- Marlton (MaoB)
- Udorthents (UdauB)
- Woodstown-Glassboro (WokA)
- Urban Land (UR)
- WATER

Colts Neck
- CosB
- CosC

Freehold
- FrfB
- FrfC
- FrkA
- FrkC
- FrkE
- FrkF
- FrrB

0.1 0.05 0 0.1
Miles

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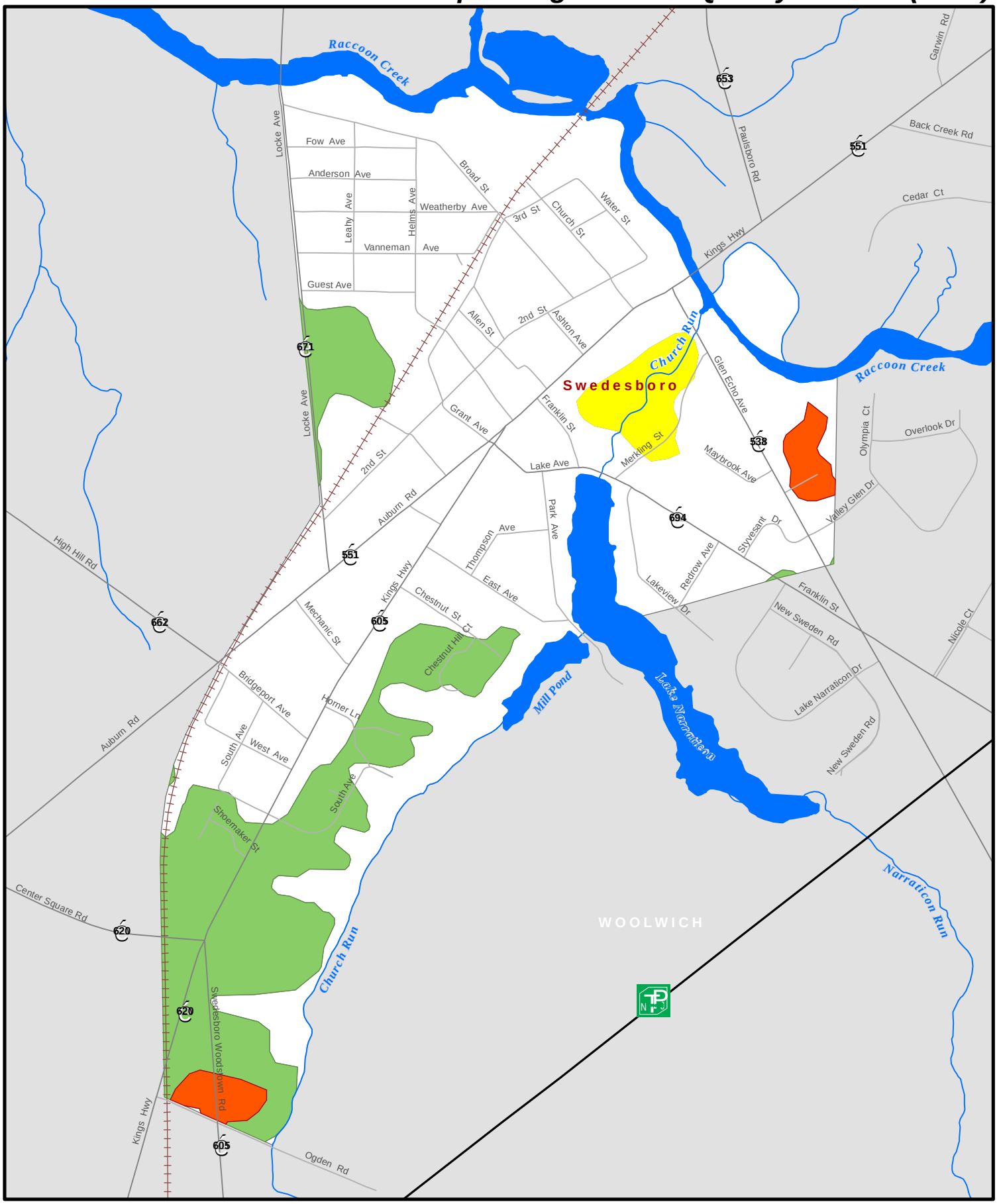
Map 10: Agricultural Quality of Soils (2006)



Sources : NJDEP, NJDOT, DVRPC.
This map 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.

Soil Designation

- Prime Farmland
- Farmland of Statewide Importance
- Unique Farmland
- Not Rated for Agricultural Use

0.1 0.05 0 0.1
Miles

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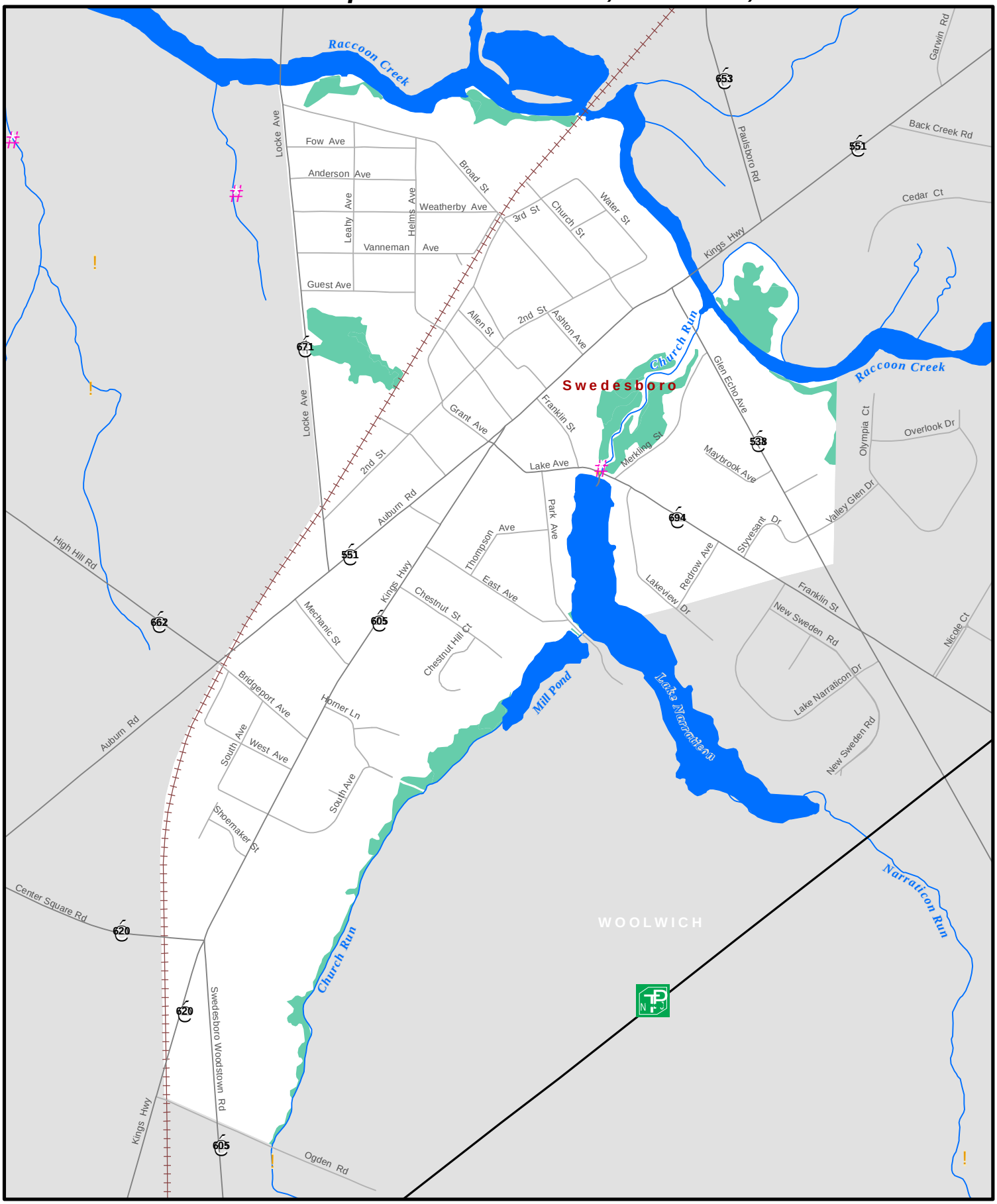
Map 11: Surface Water, Wetlands, and Vernal Pools



Sources : NJDEP, NJDOT, DVRPC.
This map 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.

Head of Tide
Dam
Potential Vernal Pool
Wetlands

0.1 0.05 0 0.1
Miles

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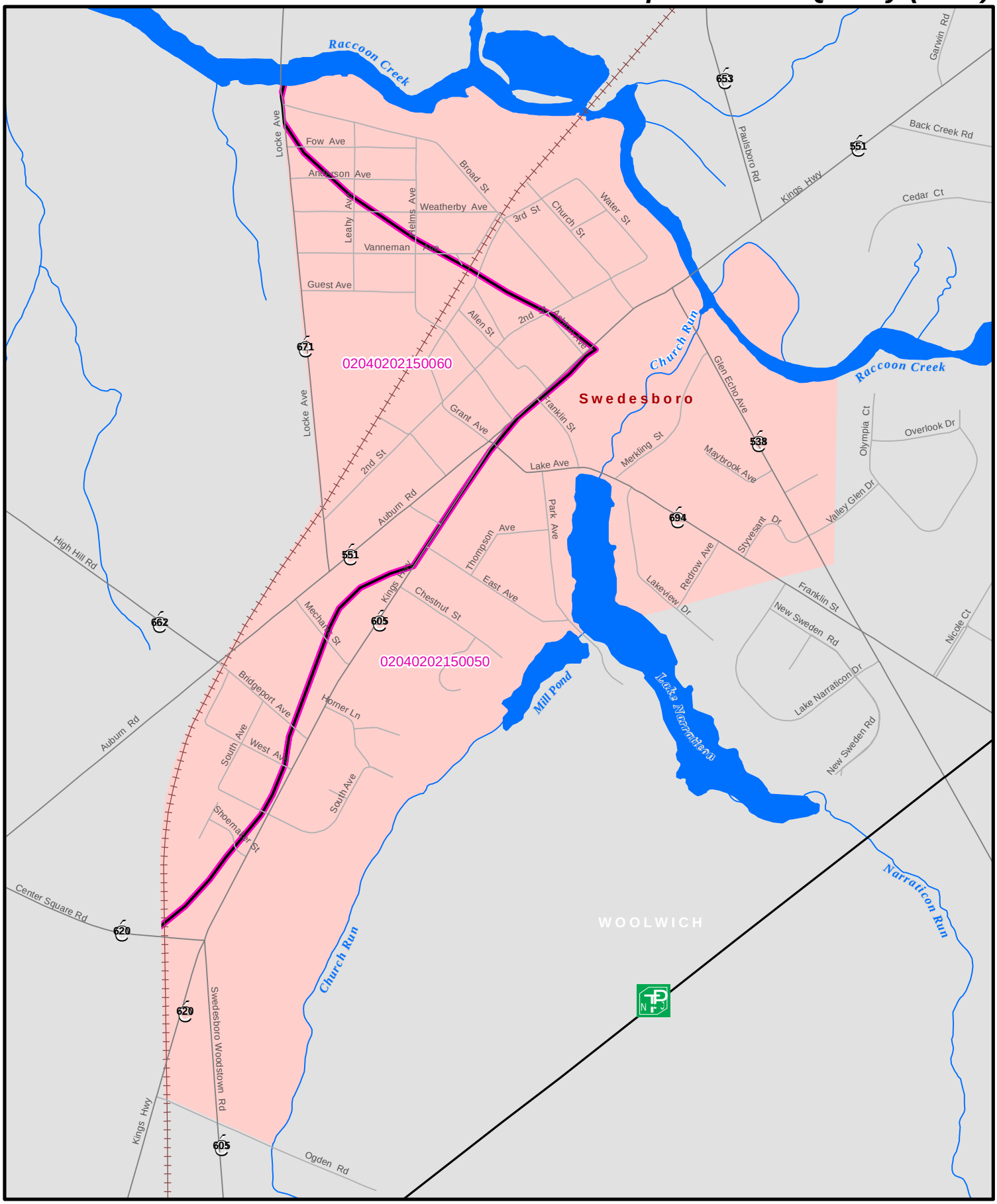
Map 12: Water Quality (2008)



Sources : NJDEP, NJDOT, DVRPC.
This map 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.

Subwatershed Boundary (HUC 14)

NJDEP Ambient Biomonitoring Network (AMNET) Sampling Site

2008 Integrated Water Quality Report
General Aquatic

Sublist 5 - Does not attain designated use and a TMDL is necessary

0.1 0.05 0 0.1
Miles

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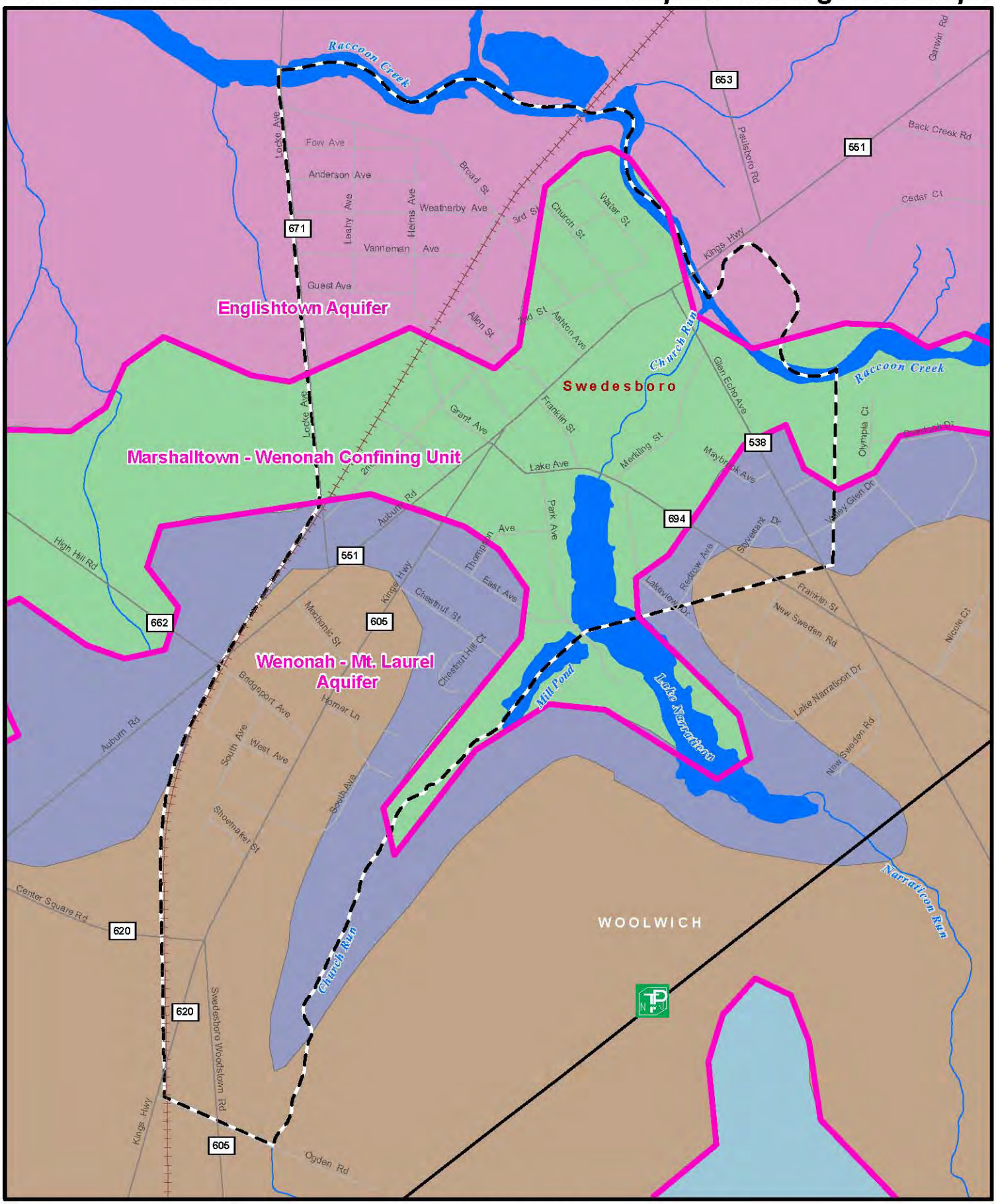
Map 13: Geologic Outcrops



Sources : NJDEP, NJDOT, DVRPC.
This map 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.

Outcrop Formation

- Aquifer Boundary
- Englishtown
- Marshalltown
- Mt. Laurel
- Navesink
- Wenonah

N

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Miles

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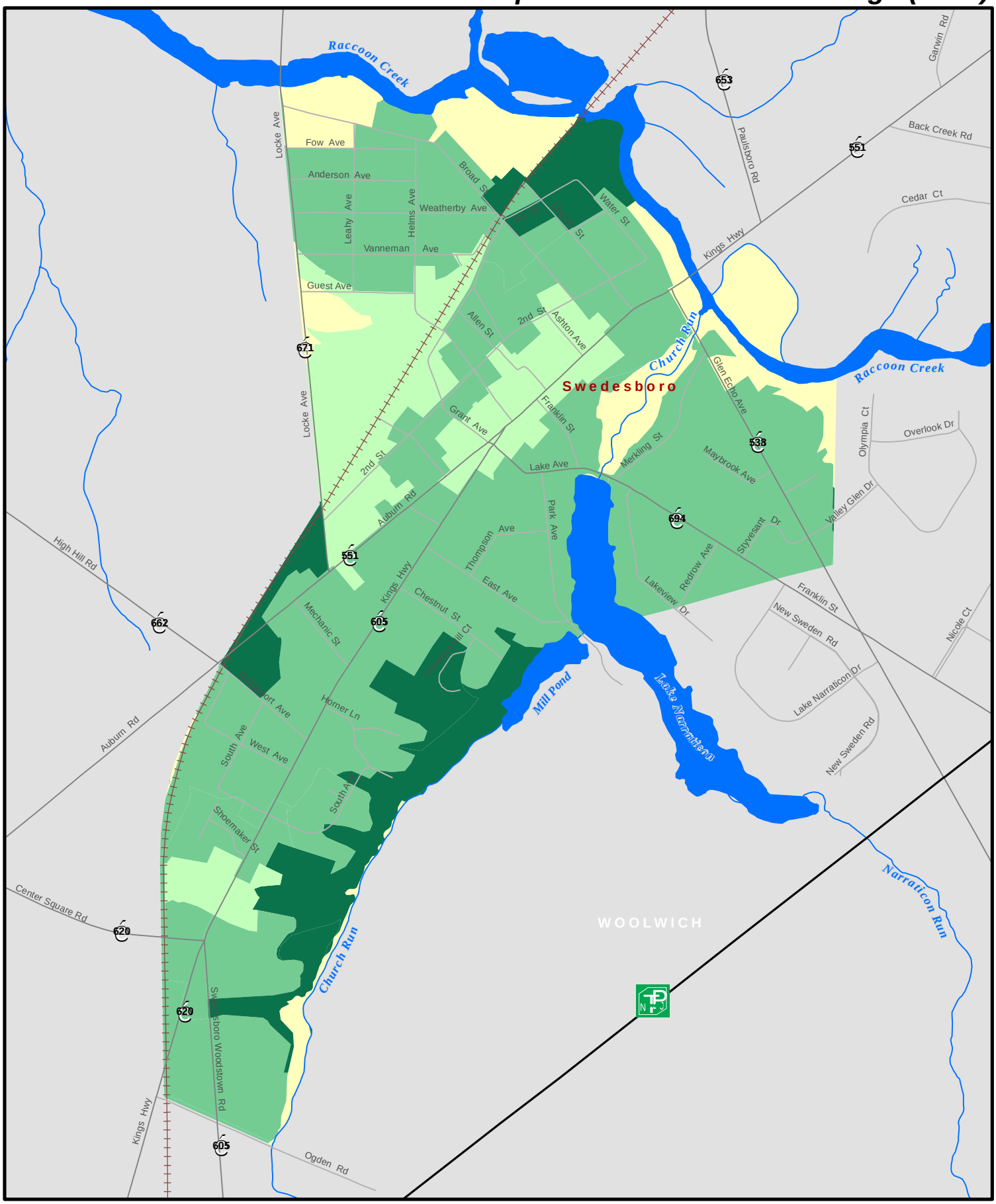
Map 14: Groundwater Recharge (1997)



Sources : NJDEP, NJDOT, DVRPC.
This map 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.

Inches per Year

0 - 1	7 - 10
2 - 6	11 - 18

0.1 0.05 0 0.1
Miles

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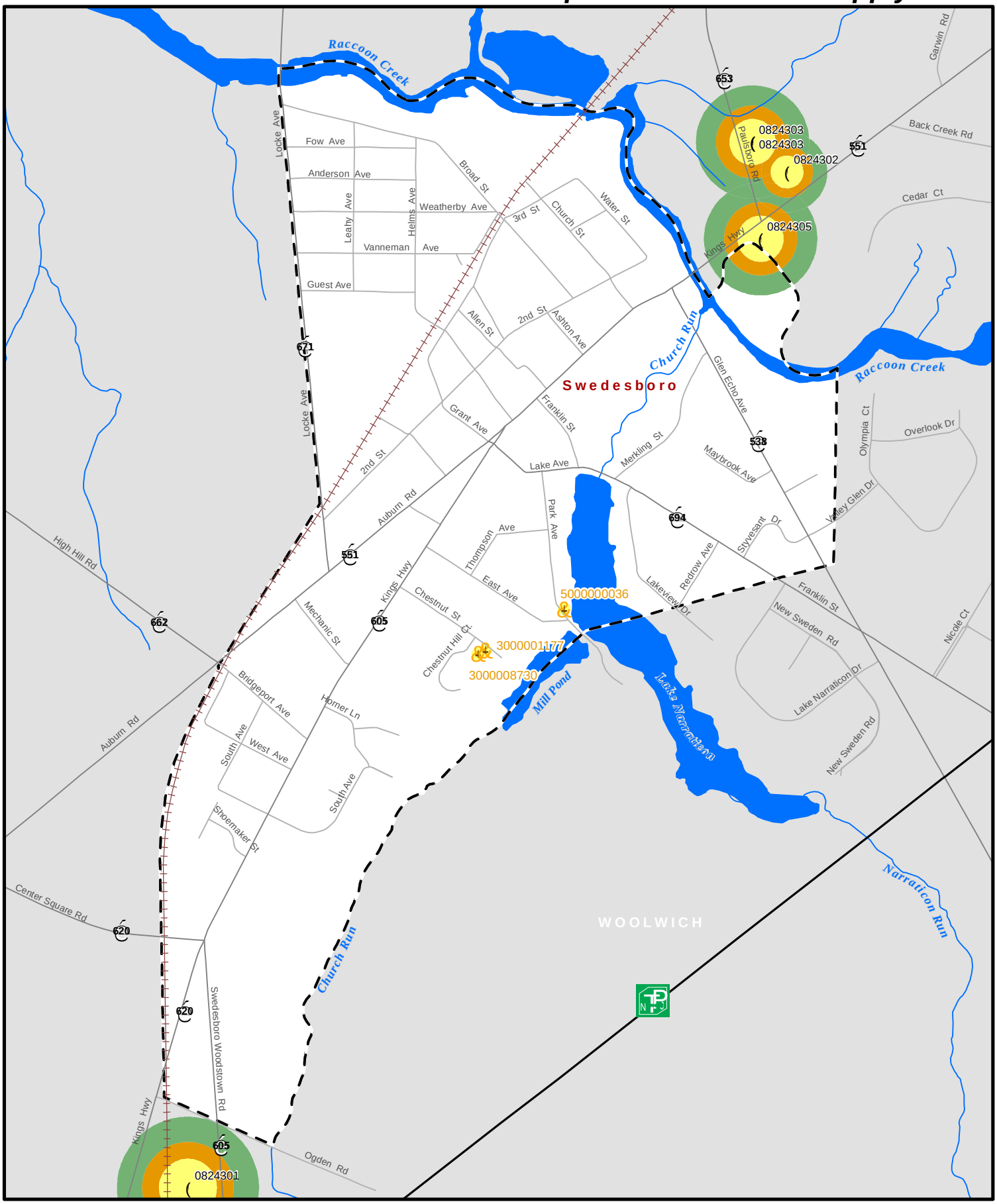
Map 15: Public Water Supply Wells



Sources : NJDEP, NJDOT, DVRPC.
This map 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.

(Public Non-Community Well
& Public Community Well

Wellhead Protection Areas
Public Community, 2006
Public Non-Community, 2004
2-year time of travel
5-year time of travel
12-year time of travel

0.1 0.05 0 0.1
Miles

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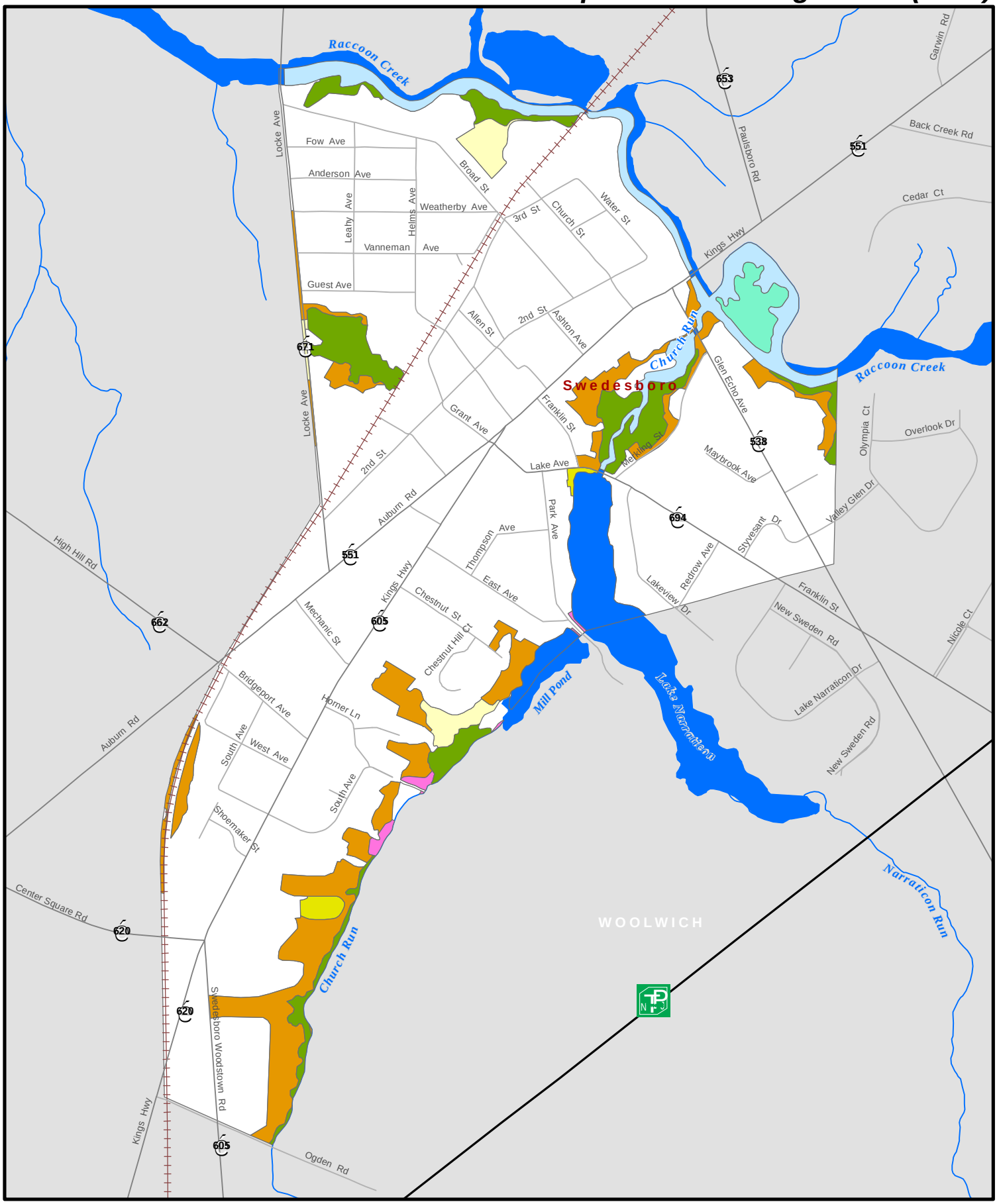
Map 16: Natural Vegetation (2007)



Sources : NJDEP, NJDOT, DVRPC.
This map 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.

Vegetation

- Brush/Shrubland
- Brush/Shrubland - Oldfield
- Upland Forest - Deciduous
- Water
- Tidal Waters
- Tidal Marshes - Freshwater
- Wetlands - Scrub/Shrub
- Wetlands - Wooded - Deciduous
- All other land cover

0.1 0.05 0 0.1
Miles

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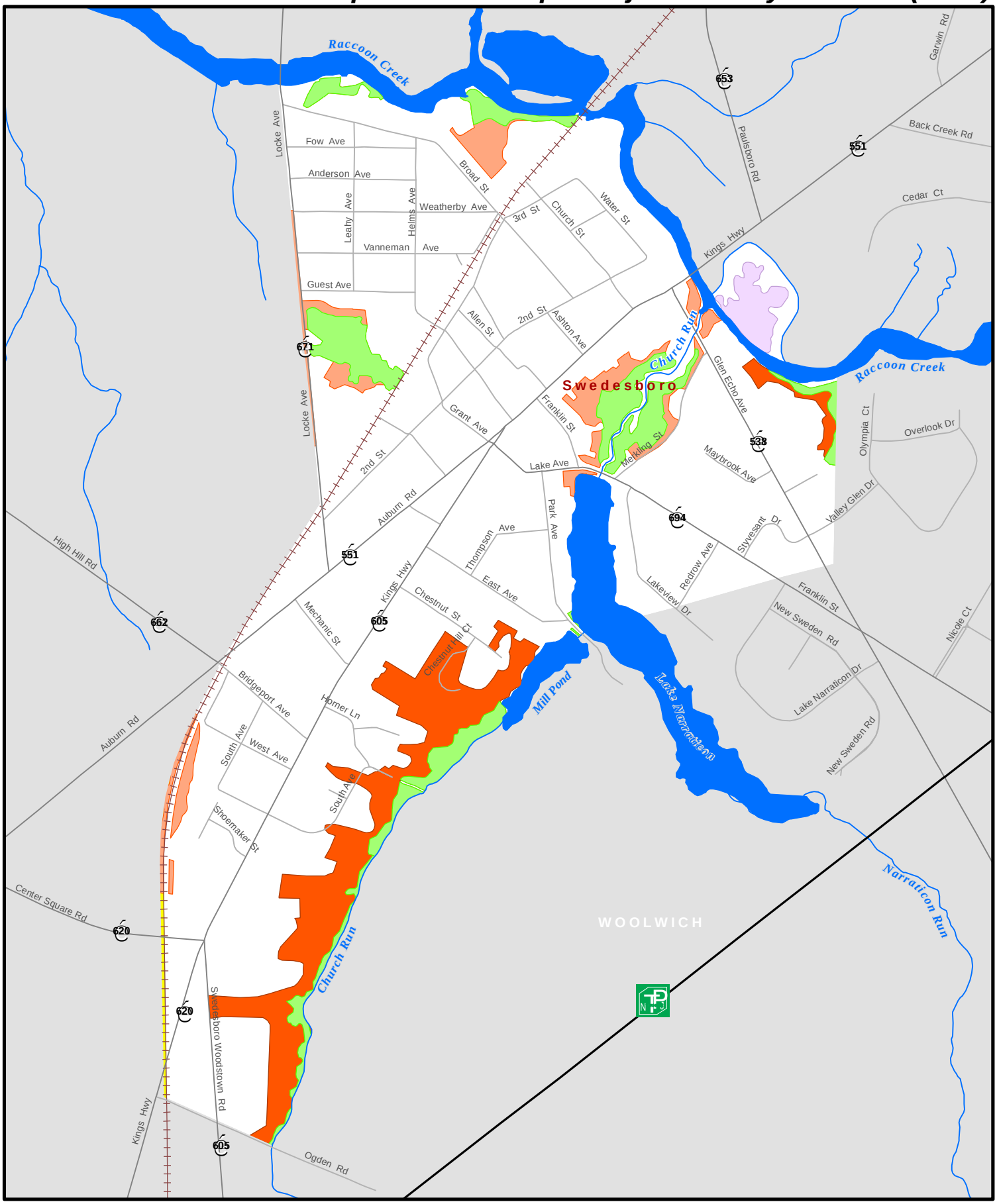
Map 17: Landscape Project Priority Habitats (2007)



Sources : NJDEP, NJDOT, DVRPC.
This map 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.

Conservation Priority Type

Upland Forest	Emergent Wetlands	Forested Wetlands	Grasslands
Critical Habitat	Suitable Habitat	Suitable Habitat	Suitable Habitat
Suitable Habitat			

0.1 0.05 0 0.1
Miles

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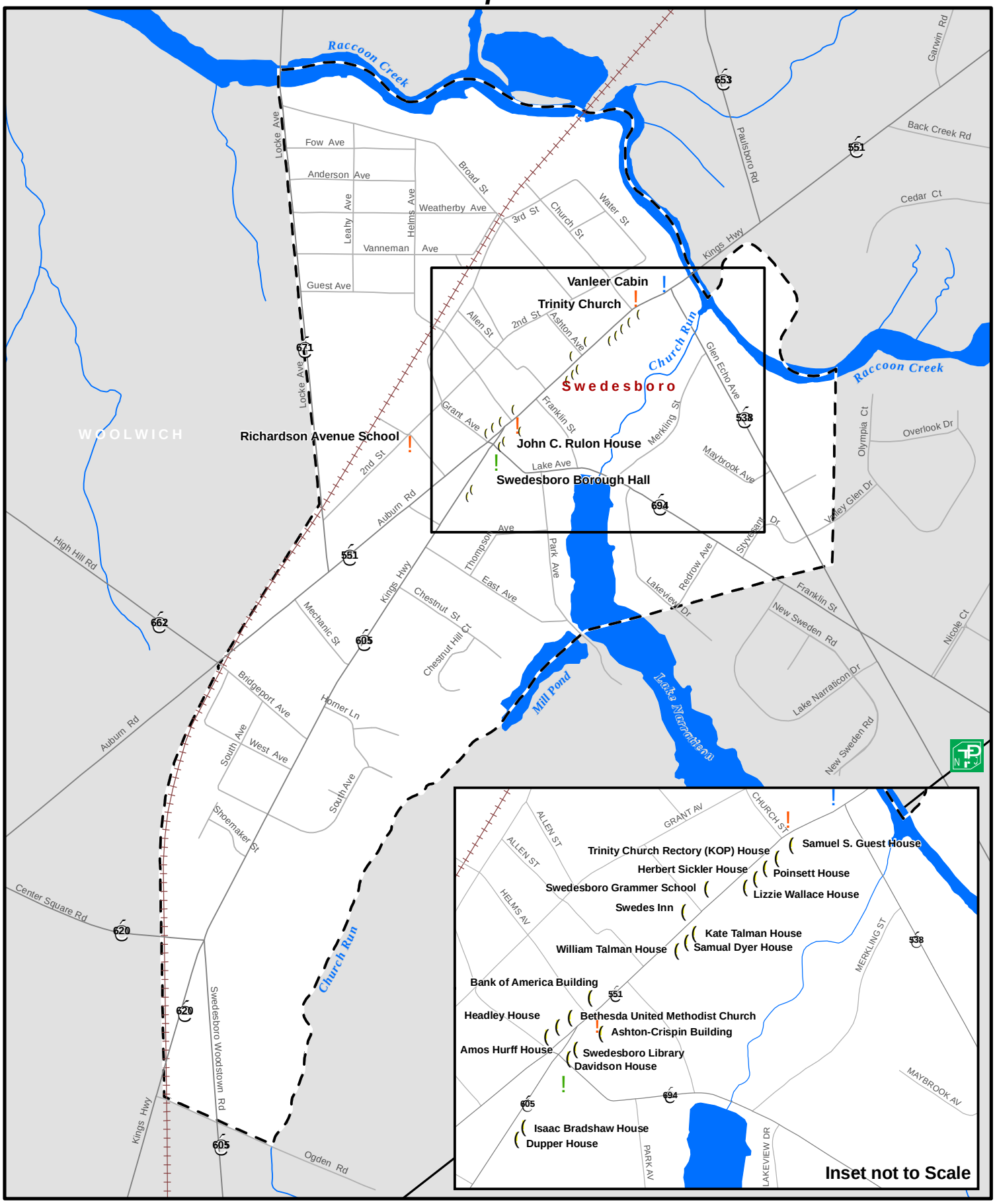
Map 18: Historic and Cultural Resources



Sources : NJDEP, NJDOT, DVRPC.
This map 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.

! National Register of Historic Places
! State Register of Historic Places
! State Historic Preservation Office Opinion
(Other Local Historic Properties

0.1 0.05 0 0.1
Miles

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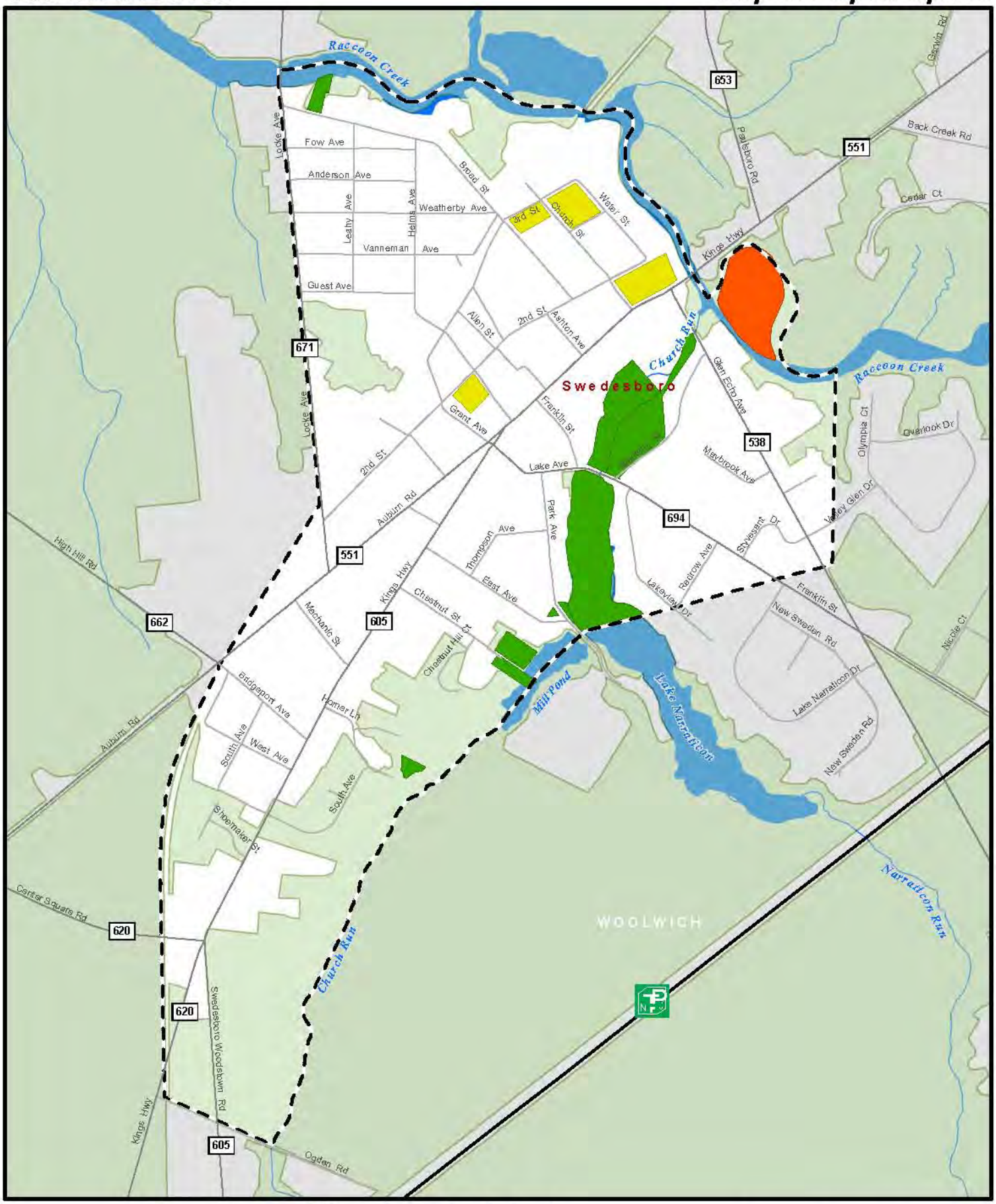
Map 19: Open Space



Sources : NJDEP, NJDOT, DVRPC, NJ Audubon. This map 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.

Oldmans, Raccoon, Birch Creeks and Pedricktown Region Important Bird Area

Preserved Open Space

Municipal

Non - Profit

Church or Charitable Property

N

0.1 0.05 0 0.1

Miles

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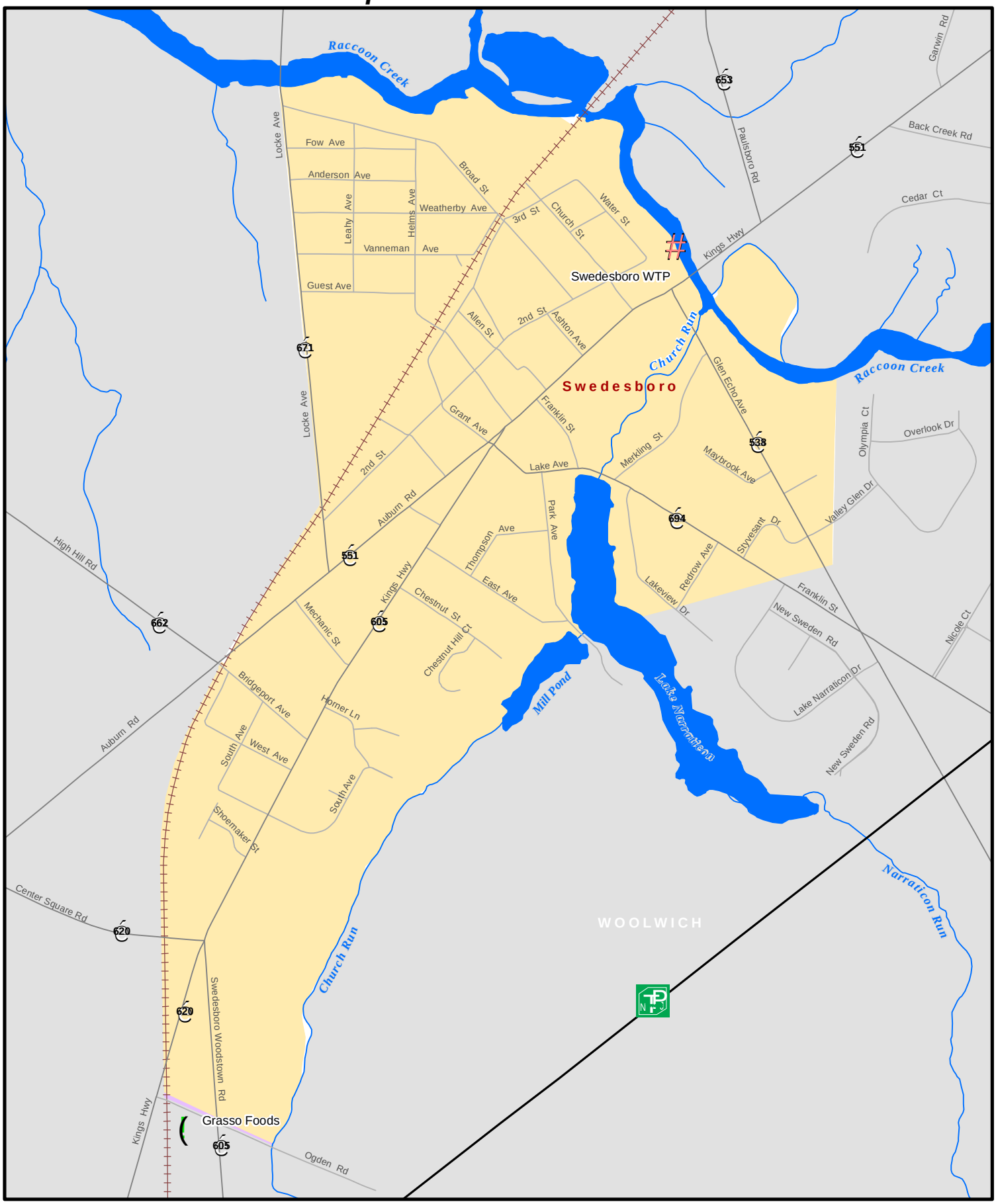
Map 20: Sewer Service Area and NJPDES Permits



Sources : NJDEP, NJDOT, DVRPC.
This map 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.

NJPDES Permit for Discharge to Ground Water (2007)

NJPDES Permit for Discharge to Surface Water (2009)

Approved Sewer Service Area (2010)

Swedesboro Sewer Department

0.1 0.05 0 0.1

Miles

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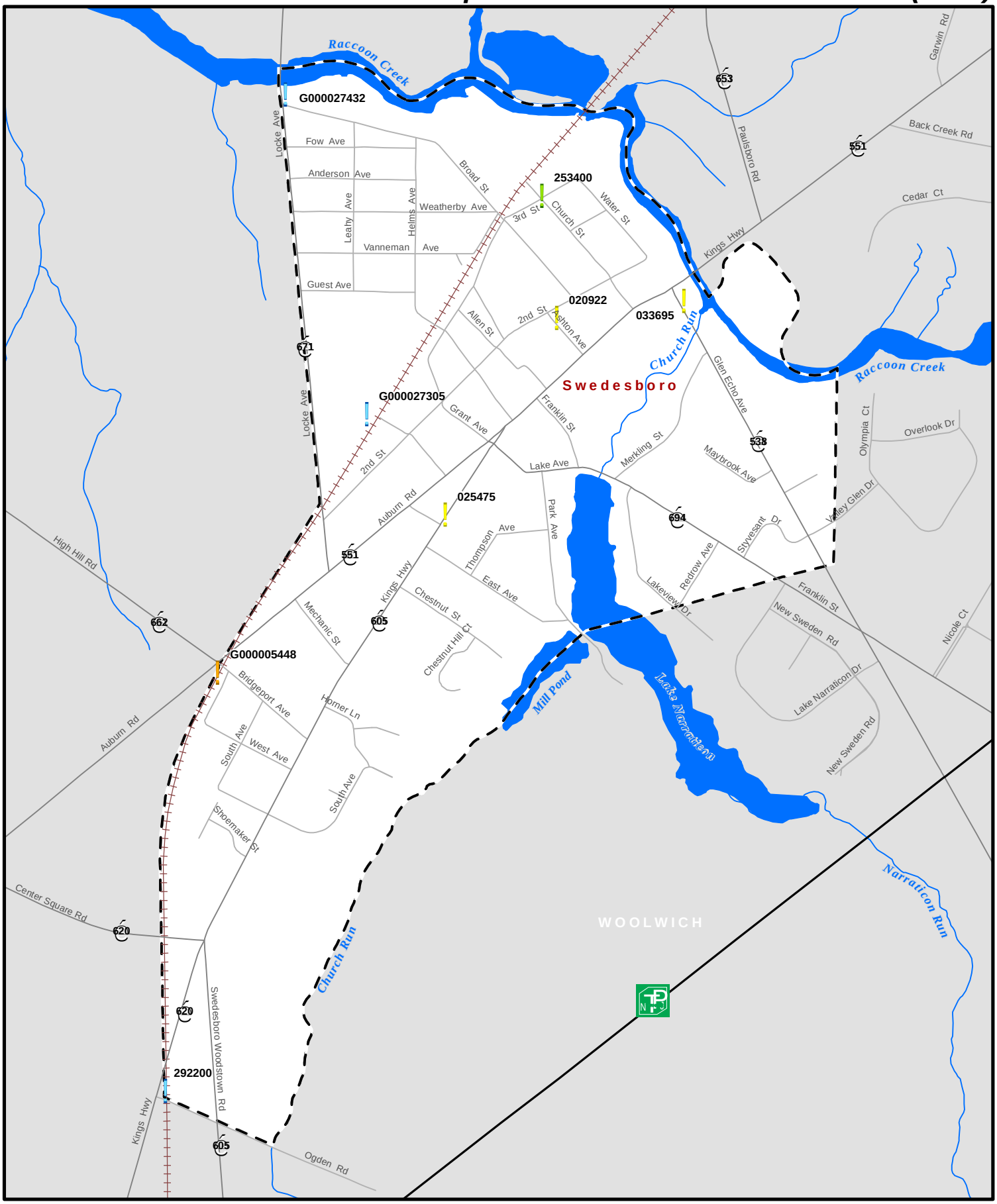
Map 21: Known Contaminated Sites (2009)



Sources : NJDEP, NJDOT, DVRPC.
This map 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.

B: Single Phase Remedial Action, Single Contamination Affecting Only Soils

C1: No Formal Design, Source Known Potential Groundwater Contamination

C2: Formal Design, Known Source with Groundwater Contamination

C3: Multi-Phased Remedial Action, Unknown or Uncontrolled Discharge to Soil or Groundwater

0.1 0.05 0 0.1
Miles

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Publication Title:	Swedesboro Environmental Resource Inventory
Publication Number:	10052
Date Published:	March 2012
Geographic Area Covered:	Swedesboro, Gloucester County, New Jersey

Key Words

Agriculture, air quality, aquifers, biodiversity, biological resources, built environment, Gloucester County, climate, conservation, development, endangered species, environmental issues, environmental resource inventory, floodplains, forests, grasslands, groundwater, habitat, land preservation, landscape project, master planning, natural resources, New Jersey, open space, Swedesboro, population, Raccoon Creek, soils, steep slopes, topography, U.S. Census, vernal pools, water quality, watersheds, wetlands.

Abstract

This publication documents the natural and community resources of Swedesboro, Gloucester County, New Jersey. The natural resource information includes descriptions, tables, and maps of: land use; soils; drinking water, aquifers, and wells; surface waters, including watersheds, streams, lakes, wetlands, and floodplains; impacts on water resources and surface water quality; impervious coverage; vegetation, including wetlands, forests, and grasslands; animal communities; threatened and endangered species; Natural Heritage Priority Sites; Landscape Project Priority Habitats; and known contaminated sites. Community resources that are briefly described include population, transportation, borough utilities and services, historic sites and buildings, and protected open space. A short history of the community is also included.

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