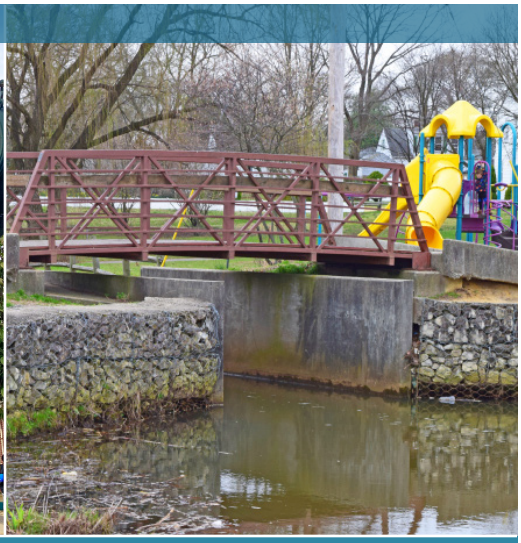
Borough of Westville

ENVIRONMENTAL RESOURCE INVENTORY



WESTVILLE ENVIRONMENTAL COMMISSION

JUNE 2024

DELAWARE VALLEY dvrpc REGIONAL PLANNING COMMISSION

The Delaware Valley Regional Planning Commission is the federally designated Metropolitan Planning Organization for the Greater Philadelphia region, established by an Interstate Compact between the Commonwealth of Pennsylvania and the State of New Jersey. Members include Bucks, Chester, Delaware, Montgomery, and Philadelphia counties, plus the City of Chester, in Pennsylvania; and Burlington, Camden, Gloucester, and Mercer counties, plus the cities of Camden and Trenton, in New Jersey.

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DELAWARE VALLEY dvrpc REGIONAL PLANNING COMMISSION

DVRPC's vision for the Greater Philadelphia Region is a prosperous, innovative, equitable, resilient, and sustainable region that increases mobility choices by investing in a safe and modern transportation system; that protects and preserves our natural resources while creating healthy communities; and that fosters greater opportunities for all.

DVRPC's mission is to achieve this vision by convening the widest array of partners to inform and facilitate data-driven decision-making. We are engaged across the region, and strive to be leaders and innovators, exploring new ideas and creating best practices.

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Acknowledgements

The Borough of Westville Environmental Resource Inventory (ERI) was funded by the Borough of Westville and through the Work Program of the Office of Climate and Environment at the Delaware Valley Regional Planning Commission.

The Work Program of the Office of Climate and Environment assists local governments in completing plans and studies that balance the natural resources of communities in our region with transportation and development needs. The program identifies and addresses local environmental issues such as land use, water quality and quantity, flooding, wildlife habitat, natural vegetation, open space, and recreation.

The following individuals were instrumental in the development of the ERI.

The Borough of Westville Environmental Commission

- Joyce A. Lovell, Chair
- Jeffrey Storms Sr., Vice-Chair
- Lenore Adams, Recording Secretary
- Anita Fritz, Corresponding Secretary
- Brian Waters, Land Use Board Representative
- Virginia Horn, Member
- Allison Lucci, Member
- Harry Blaschke, Alternate Member 2
- Mike Herrmann, Alternate Member 1
- Marie T. Callaghan, Retired

The Borough of Westville

- Fritz H. Sims Jr., Mayor
- Charles D. Murtaugh, Council President
- Bruce Nordaby, Council Member
- Travis R. Lawrence, Council Member
- Donna D. Domico, Council Member
- Timothy P. Young, Council Member
- Matthew M. Gayle, Council Member
- Paul C. Mailley, Retired
- Ryan Giles, Administrator/Clerk

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- Ronald Kegel, Gloucester County Christmas Bird Count
- Westville Environmental Comission Members, Researchers and Proofreaders

Table of Contents

FIGURES

TABLES

APPENDICES

CHAPTER 1:

Executive Summary

An Environmental Resource Inventory (ERI) identifies and describes the natural resources of a community — its soil, water, air, plants, and animals — which are fundamental to its character. The protection and wise use of those resources is essential to the health, safety, and welfare of current and future residents. The ERI provides a basis for municipal actions to preserve and use those resources, although it does not include recommendations to those ends. It is, instead, a compendium of existing information about a community's natural resources, presented in a form that is useful to a broad audience.

The ERI is an important tool for environmental commissions, open space committees, planning boards, and zoning boards of adjustment, enabling these groups to identify and prioritize environmental challenges and opportunities. When adopted into the master plan, the ERI can support the development of resource protection ordinances and resource-based land use planning.

Daffodils at the Intersection of Highland Avenue and Delaware View Avenue

CHAPTER 2:

Overview of the Borough of Westville

The Borough of Westville is located along the Delaware River in the northernmost corner of Gloucester County, New Jersey. Encompassing 1.36 square miles of total area (871 acres) with 0.36 square miles of water area (228 acres), it is a small municipality relative to many of its neighbors, which include Deptford and West Deptford in Gloucester County and Gloucester City, Brooklawn, and Bellmawr in Camden County. The Borough of Westville is also located across the Delaware River from the City of Philadelphia, with which it has close historical ties.

Among the most densely populated municipalities in Gloucester County, the 2020 U.S. Census recorded 4,264 residents in the Borough of Westville. This is slightly higher than the 4,224 residents estimated in 2015 American Community Survey (ACS), slightly lower than the 4,288 residents recorded in the 2010 US Census, and significantly lower than the population at the middle of the Twentieth century when the Borough of Westville had around 5,000 residents. The median household income is $51,983 and the poverty rate is 11.8 percent (2019 ACS). Gloucester County as a whole has a median income of $89,056 and a poverty rate of 7%.

The Borough of Westville is well connected by roads and highways. Interstate-295 runs along and through the southern border of the borough and NJ-130 and NJ-47 bisect the borough from north to south. Several industrial areas are located nearby to take advantage of these road connections and Delaware River waterfront access for port operations.

While no passenger rail lines run through the Borough of Westville or Gloucester County, New Jersey Transit buses 401, 402, 408, 410, and 412 connect the Borough of Westville to Philadelphia, with which it has close historical ties, and the surrounding region. Gloucester County Municipal Shuttles are also available to connect residents to nearby shopping facilities, senior lunch programs and area malls.

The Borough of Westville is encompassed by several bodies of water. The Delaware River forms the northwestern border of the borough, Big Timber Creek runs along the northeastern border and Lake Martha forms the southwestern border. All water in the borough flows to the Delaware River.

17th Century Stone marker on King's Road to Salem

Source: Joyce Lovell

Thomas West House - oldest portion to viewer's left Circa 1746; main house on viewer's right finished 1819

Source: Matt Gayle, current owner

CHAPTER 3:

Brief Borough History

Early History

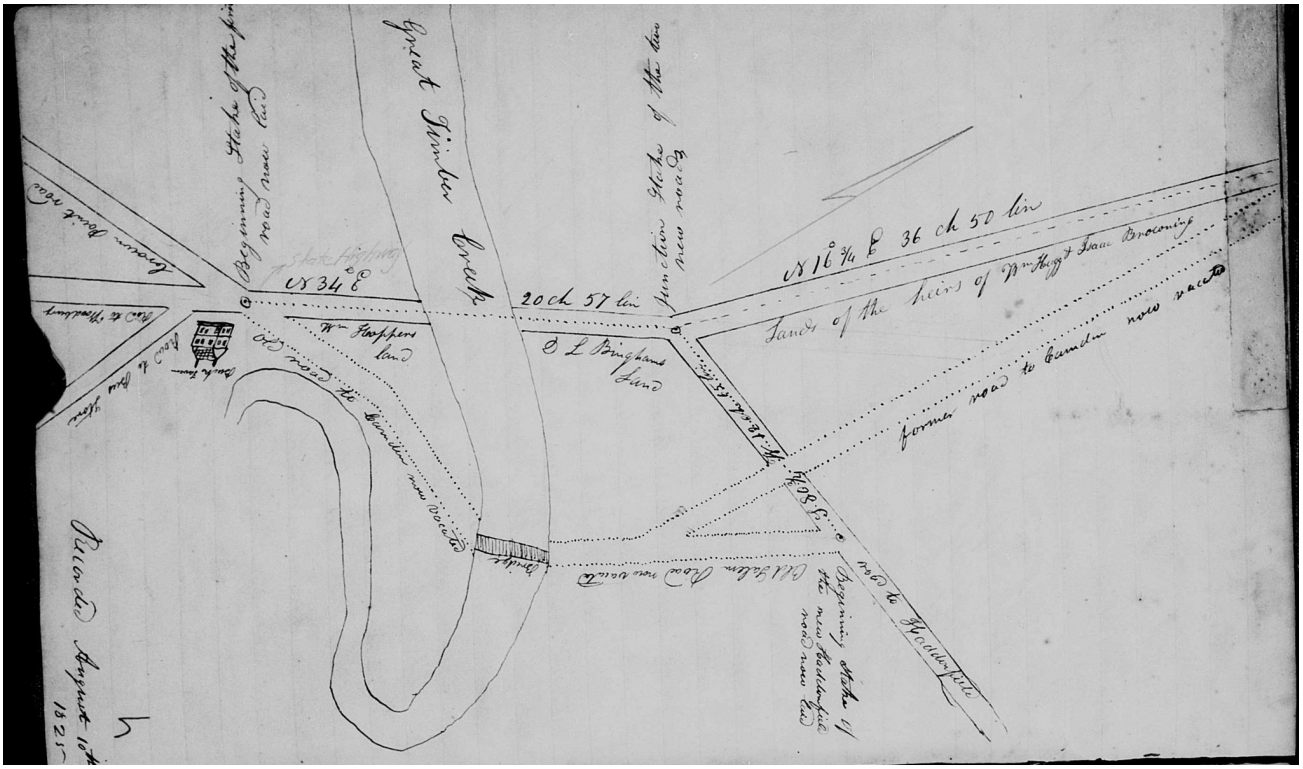
For many thousands of years, the land that makes up Westville and surrounding area was inhabited by generations of Lenni Lenape people. Their artifacts have been found in Westville and along Big Timber Creek and the Delaware River.

In 1624, Dutch colonists constructed Fort Nassau, the first permanent European-built structure in New Jersey, at the mouth of Big Timber Creek. This structure was either located in present day Brooklawn Borough or in the Borough of Westville itself. Swedish and Finnish settlers arrived in the 1630s and 1640s and Quakers from England started settling in the area in the 1680s.

The land making up the present day Borough of Westville was purchased by John Ladd in 1688 with money earned surveying the city of Philadelphia. The house he built in 1689, called Ladd's Castle, still stands in West Deptford.

In 1681, the legislature of West Jersey approved the construction of a roadway from Salem to Amboy. This route became known as the Kings Highway and passed through the land that would make up the Borough of Westville, where a bridge that crossed over Big Timber Creek was constructed in 1687. At this natural stopping point in the highway, Buck Tavern was constructed in the early 1700s by Thomas West, the namesake of the Borough of Westville. These developments are shown in Figure 1 below. The town officially became known as Westville in the 1840s, and by the late 1800s the population of the area had increased to 250 people.

Figure 1: 1825 Map of Westville Showing Roads, Bridges, and Buck Tavern



Source: Jeff Storms

For much of this time and through the early 1900s, Westville continued to grow and remained as an important transportation stop, business center and regional destination. Owing to its location at the confluence of Big Timber Creek and the Delaware River, ferries were able to travel to Philadelphia, railroad lines were constructed to connect the various towns in the region, and a toll road was established to bring produce from farms in southern New Jersey to the markets in Camden and Philadelphia.

Vacationers were also attracted to the natural setting and cooler temperatures by the water and the Washington Park resort was built in 1895 with waterfront piers, restaurants, beer gardens, an electric water fountain and a 100 foot tall Ferris wheel. A fire in 1909 destroyed most of the park. It was rebuilt, but caught on fire a second time in 1913. The park was never rebuilt again and parts of the land have subsequently been used as a packaging plant for gunpowder, as a refinery owned by Texaco and then Sunoco, and finally as the Wheelabrator Gloucester Waste-to-Energy Facility and Wildlife Refuge.

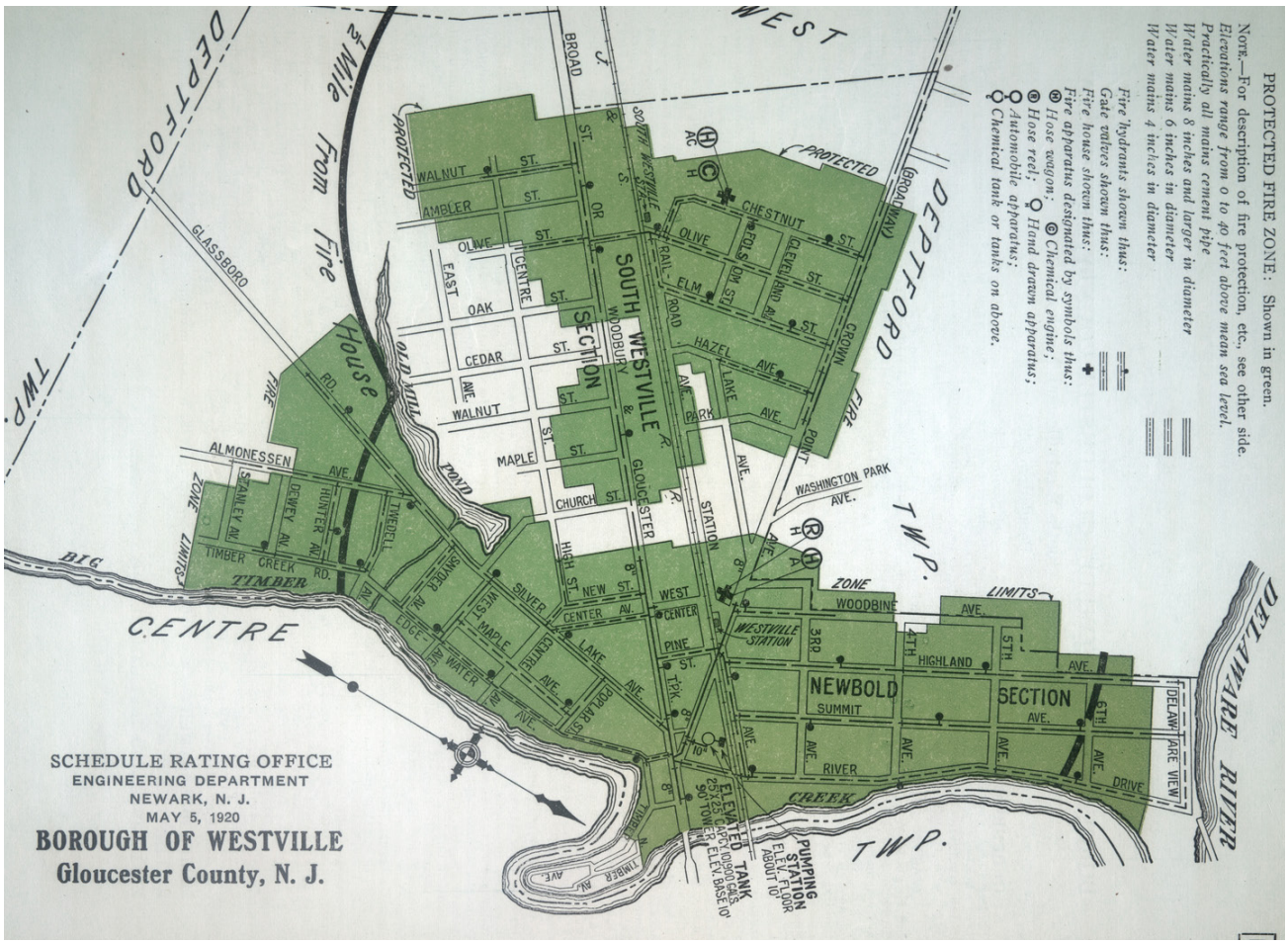
The Incorporation of the Borough of Westville

The Borough of Westville (Figure 4 on page 9) was incorporated by an act of the Senate and General Assembly of New Jersey on April 7, 1914. Prior to 1914, the land contained within the Borough of Westville boundaries was part of the townships of Deptford and West Deptford.

The Borough of Westville's History Since Incorporation

From 1914 to present day, the Borough of Westville as shown in Figures 2 and 4 continued to grow and evolve in a variety of ways. Significant road projects were completed: Olive Street was constructed to

Figure 2: 1920 Map of Westville showing fire protection districts



Source: Rutgers University Community Repository

connect Boundary Lane and Delsea Drive in 1922, Edgewater Avenue was extended over the ravine between Twedell Avenue and Snyder Avenue in 1928, and Edgewater Avenue was reconstructed in 1986. In addition, Deadline Drive was named in 1987. Sidewalks and curbs were also installed throughout the Borough over the years.

In terms of environmentally related developments, the Borough of Westville approved the budget to construct 9.5 miles of sewer in 1922, a Shade Tree Committee was formed in 1924, the Works Progress Administration (WPA) constructed a pond building and tennis court at the Thomas West Park in 1940, New Jersey state worked to reduce flooding along Broadway in 1971, and the Environmental Commission was created in 1987. In 1990, the Woodbine Avenue Sewer Project was started as a result of flooding that occured at Willow and High Streets in 1989.

In the past few decades, the Borough of Westville has experienced additional changes. A few churches have closed and in some cases new ones took their place, holiday boat parades with the boats festooned in colorful lights became a tradition, the first liquor licenses were granted in the 1980s, and in more recent years, the impacts of the Covid-19 pandemic were felt throughout the community.

Figure 3: 1931 Aerial Photo of Westville Area

Source: Karl Anderson

Notable Residents of the Borough of Westville

Notable Westville residents include Milton Ross Plum, an American football quarterback who played in the 1950s and 1960s, attorney and New Jersey State Senator Harold “Jake” Hannold, and television and media personality Sally Starr.

Commodore Stephen Decatur and his good friend Captain James Lawrence (“Don’t give up the ship”) attended Woodbury Academy (the first naval academy in the Unitied States) and were early heroes of the War of 1812.

Of notorious repute were brothers William Henry Starr and James Samuel Starr (formerly of Chestnut Street), Communist spies and kidnappers, who fled to Europe and secured political asylum in the former Soviet Union.

Ice Skaters in Thomas West Park, Date Unknown (Mid Twentieth Century)

Source: Fritz Sims

Borough of Westville

Figure 4: Basemap

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Philadelphia

PA

NJ

Delaware River

Gloucester City

Brooklawn

Camden County

Bellmawr

Big Timber Creek

Lake Martha

West Deptford

Gloucester County

Deptford

130

45

47

295

Broadway

Crown Point Rd

Gateway Blvd

Delsea Dr

Almonesson Rd

E Olive St

0 Miles 0.25 Miles 0.5 Miles

North

Source: DVRPC (2022)

CHAPTER 4:

Land Use and Land Cover

Land cover is a description of the landscape on the earth's surface, such as pavement, forest, or grasslands. Land use is a description of society's use of the land, such as commercial or residential. The New Jersey Department of Environmental Protection (NJDEP) and the Delaware Valley Regional Planning Commission (DVRPC) have analyzed the land use and land cover of the state and region based on aerial photography. DVRPC produced aerial maps of its nine-county region as recently as 2022 and Figure 5 on page 13 is a leaf-on aerial map of the Borough of Westville from this most recent flyover. However, the most recent land use/land cover analysis was created in 2015 by NJDEP and is shown in Figure 6 on page 14.

Looking Southwest along Delaware View Avenue (to Highland Ave)

Looking Southeast along Highland Avenue (to Rt 130)

Borough of Westville

Figure 5: Aerial Imagery

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Borough of Westville

Figure 6: NJDEP Land Use/Land Cover

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Philadelphia

PA

NJ

Delaware River

Gloucester City

Brooklawn

Camden County

Bellmawr

Lake Martha

West Deptford

Gloucester County

Deptford

Big Timber Creek

Broadway

Gateway Blvd

Crown Point Rd

Delsea Dr

Almonesson Rd

E Olive St

130

45

47

295

Undeveloped

Forest

Urban

Water

Wetlands

0 Miles 0.25 Miles 0.5 Miles

North

Source: NJDEP (2015)

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 or endorsed.

NJDEP Land Use

As an established borough, Westville is mostly developed or urbanized, exept for the areas of the borough occupied by waterways and wetlands. As shown in Tables 1 and 2 below, the borough includes 33 distinct land uses/land cover types in 5 major categories. Since Westville is predominantly urbanized, the largest of these major categories is urban area comprising 62% of the total land use/land cover. Residential land, particularly single-unit homes of medium density, makes up the majority of the urbanized space, at 26% of the borough's total land use/land cover. High density residential makes up close to 8% of the total land use/land cover, commercial land is around 6%, and major roadways and industrial land both comprise slightly less than 5% each

Table 1: NJDEP General Land Use/Land Cover

Land Use	Area (Acres)	Percentage
Barren Land	1.46	0.17%
Forest	44.32	5.09%
Urban	544.33	62.46%
Water	239.46	27.48%
Wetlands	41.93	4.81%
Total	**871.50**	**100.00**

Source: NJDEP, 2015

Water is the next most common land use category, making up around 27.5% of the borough's area. Of this, by far the largest category is tidal rivers, inland bays, and other tidal waters, which is 26% of the total land use/land cover in the borough.

Wetlands and forests both make up approximately 5% of the total land use/land cover. Although these features represent only a small amount of area, they both contain a variety of sub categories such as deciduous brush/shrubland, mixed forest, freshwater tidal marshes, and managed wetland in built-up maintained rec area.

The final major category is barren land which makes up just 0.17% of the total land use/land cover.

Table 2: NJDEP Detailed Land Use/Land Cover

General Land Use/Land Cover Type	Detailed Land Use/Land Cover Label	Area (Acres)	Percentage
Barren Land			
	Altered Lands	0.00017	0.00002%
	Transitional Areas	1.45	0.17
Forest			
	Coniferous (>50% Crown Closure)	1.60	0.18%
	Deciduous Bush/ Shrubland	6.03	0.69%
	Decidous Forest (>50% Crown Closure)	16.4	1.88%
	Decidous Forest (10-50% Crown Closure)	12.08	1.39%
	Mixed Forest (>50% Decidous with 10-50% Crown Closure)	3.38	0.39%
	Old Field (<25% Brush Covered)	4.42	0.51%
	Phragmites Dominate Old Field	0.41	0.05%
Urban			
	Commercial/Services	52.8	6.14%
	Industrial	53.5	4.73%
	Major Roadway	41.26	4.73%
	Mixed Urban or Built-up Land	6.98	0.80%
	Other Urban or Built-up Land	15.14	1.74%
	Railroads	7.76	0.89%
	Recreational Land	52.63	6.04%
	Residential, High Density or Multiple Dwelling	69.01	7.92%
	Residential, Rural, Single Unit	3.23	0.37%
	Residential, Single Unit, Low Density	7.89	0.92%
	Residential, Single Unit, Medium Density	229.45	26.33%

NJDEP Detailed Land Use/Land Cover (continued)

General Land Use/Land Cover Type	Detailed Land Use/Land Cover Label	Area (Acres)	Percentage
Ubran (continued)			
	Transportation/ Communication/Utilities	4.06	0.47%
	Upland Rights-of-Way Developed	0.6	0.07%
Water			
	Artificial Lakes	1.78	0.20%
	Bridge Over Water	0.65	0.007%
	Streams and Canals	0.22	0.02%
	Tidal Mud Flat	10.96	1.26%
	Tidal Rivers, Inland Bays,and Other Tidal Waters	225.85	25.92%
Wetlands			
	Decidous Scrub/Shrub Wetlands	12.37	1.42%
	Decidous Wooded Wetlands	20.81	2.39%
	Freshwater Tidal Marshes	5.0	0.57%
	Managed Wetland in Built-up Maintained Rec Area	3.20	0.37%
	Phragmites Dominate Coastal Wetlands	0.23	0.03%
	Phragmites Dominate Interior Wetlands	0.32	0.04%

Source: NJDEP, 2015

DVRPC Land Use

DVRPC's assessment of the land use in the Borough of Westville uses different labels than NJDEP and is shown in Figure 7 on page 19. According to DVRPC, 31% of the Borough is residential, 27.1% is water, and 12.2% is transportation. Referring to Table 3, the rest is a combination of commercial, industrial, recreational, and undeveloped lands.

Table 3: DVRPC Land Use

Land Use	Area (Acres)	Percentage
Commercial	31.99	3.67%
Industrial	49.31	5.66%
Institutional	14.57	1.67%
Military	0.24	0.03%
Recreation	45.51	5.23%
Residential	270.22	31.03%
Transportation	105.93	12.16%
Undeveloped	24.90	2.86%
Utility	5.86	0.67%
Water	236.12	27.11%
Wooded	86.25	9.90

Source: DVRPC

Birch Avenue

Borough of Westville

Figure 7: DVRPC Land Use

dvrpc

Philadelphia

PA

NJ

Delaware River

Gloucester City

Brooklawn

Camden County

Bellmawr

Lake Martha

Big Timber Creek

West Deptford

Gloucester County

Deptford

130

45

47

295

Broadway

Crown Point Rd

Gateway Blvd

Delsea Dr

Almonesson Rd

E Olive St

- Commercial
- Industrial
- Institutional
- Military
- Recreation
- Residential
- Transportation
- Undeveloped
- Utility
- Water
- Wooded

0 Miles 0.25 Miles 0.5 Miles North

Source: DVRPC (2015)

CHAPTER 5:

Climate

Climate is a measure of long-term weather patterns and takes into account temperature, precipitation, humidity, atmospheric pressure, wind, and other meteorological variables. Geographically situated midway between the North Pole and the Equator, New Jersey's climate is extremely variable. The state's temperate, continental climate is influenced by both hot and cold, and dry and humid airstreams. From May through September, New Jersey is dominated by moist, tropical air that originates in the Gulf of Mexico and is swept in by prevailing winds from the southwest. In winter, winds generally prevail from the northwest, bringing cold, polar air masses from subarctic Canada.

The climate in New Jersey varies greatly depending on the part of the State you are in. The southern portion tends to be more temperate than the north. The dominant feature of the atmospheric circulation over North America, including New Jersey, is the broad, undulating flow from west to east across the middle latitudes of the continent. This pattern exerts a major influence on the weather throughout the State. New Jersey has five distinct climatic regions. These are: Northern, Central, Pine Barrens, Southwest, and Coastal.

Southwest Climate Zone

The Borough of Westville lies within the Southwest Climate Zone. The Southwest Zone lies between sea level and approximately 100 feet above sea level. The close proximity to the Delaware Bay adds a maritime influence to the climate of this region. The Southwest 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.

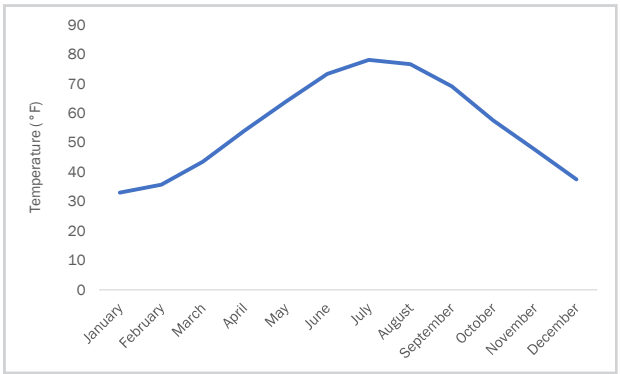
This region receives less precipitation than the Northern and Central regions and it is also far enough inland to be away from the heavier rains of some coastal storms, thus it receives less precipitation than the Coastal Zone. Prevailing winds are from the southwest, except in winter when west to northwest winds dominate. High humidity and moderate temperatures prevail when winds flow from the south or east. The moderating effect of the water also allows for a longer growing season. 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

A number of weather and climate observation stations are located near Westville. The National Centers for Environmental Information (NCEI), formerly the National Climate Data Center (NCDC), of the National Oceanic and Atmospheric Administration publishes climate data from the approximately 10 to 15 stations in and adjacent to Gloucester County on the NCEI website. The station at Philadelphia International Airport across the Delaware River has the most consistent weather records in the region.

Temperature

Based on data recorded at the Philadelphia International Airport weather station from 1981 to 2010, the mean annual temperature is 55.8°F. Shown in Figure 8: Monthly Temperatures (1981-2010) below, the coldest month is January with an average mean temperature of 33°F and the warmest month is July with an average of 78.1°F.

Figure 8: Monthly Temperatures (1981-2010)

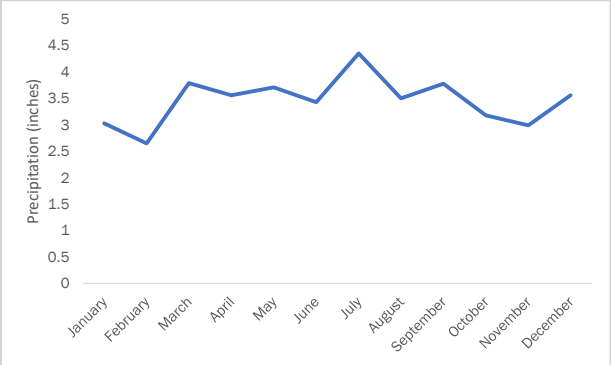


Source: NCEI, 2022

Precipitation

The Borough of Westville received around 41.53 inches of precipitation every year from 1981 to 2010. Shown in Monthly Precipitation (1981-2010), the least amount of precipitation occurred in February with 2.65 inches and the most occurred in July with 4.35 inches of precipitation.

Figure 9: Monthly Precipitation (1981-2010)



Source: NCEI, 2022

Snowfall

Snowfall generally occurs in the Borough of Westville from December through March, with November and April seeing less than a half-inch on average. From 1981-2010, the heaviest snowfall occurred in January and February, which average 6.5 inches and 8.8 inches respectively.

CHAPTER 6:

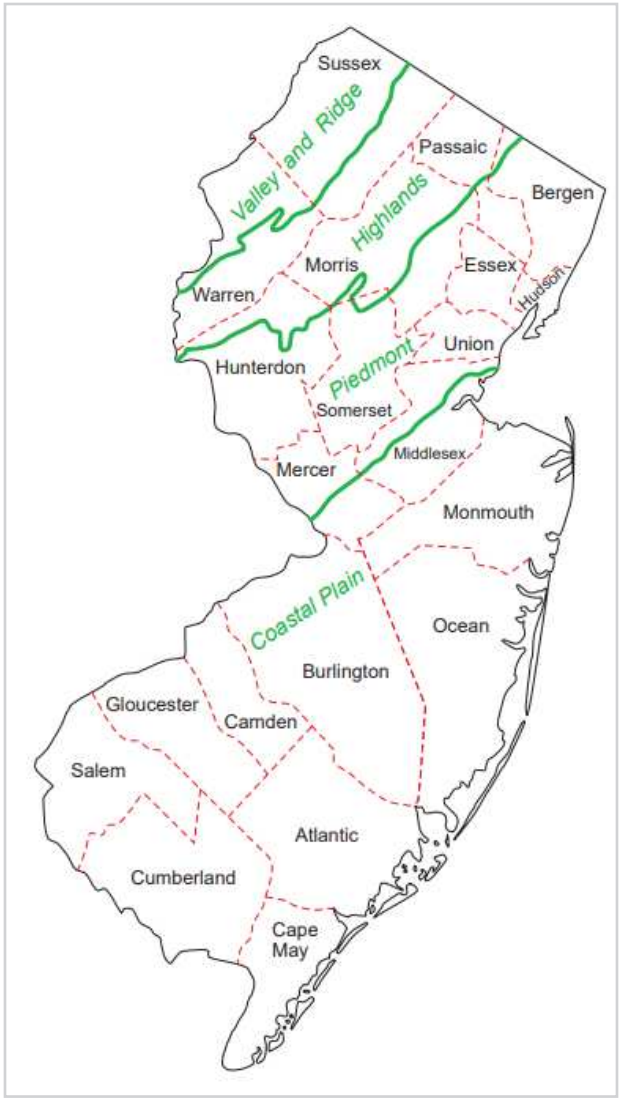
Phsyiography and Geology

Geography and geology, along with soils and water resources, are physical resources: the nonliving features on which residents of the Borough of Westville rely on for a stable built environment and sustenance.

Physiography is the study of a location in relation to its underlying geology. New Jersey is characterized by four physiographic provinces. Shown in Figure 10, these provinces include the Valley and Ridge Province, the Highlands Province, the Piedmont Plateau Province, and the Coastal Plain Province. The Coastal Plain Province is often further subdivided into the Inner Coastal Plain and the Outer Coastal Plain. The terrain of the four provinces is very diverse, with the rocky terrain of the northern provinces at one extreme and the sands of the coast at the other.

The Borough of Westville is located in the Inner Coastal Plain. 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. The deposits 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, and the topography of the area is mostly flat and low lying.

Figure 10: Generalized Landform Regions of New Jersey



Source: New Jersey Geological Survey, 2003

Geologic Formations

Westville contains five underlying geologic formations that run roughly southeast to northwest and extend beyond the borders of the borough. They are visible in Figure 11 below and Figure 12 on page 25. Figure 11 is a cross-section of the formations within the Woodbury Quadrangle, an area demarcated by the U.S. Geological Survey (USGS) within Gloucester County, which includes the Borough of Westville. The section illustrated in Figure 11 is not "cut" directly through the Borough of Westville, but the formations and the way in which they are layered would be similar underneath the borough.

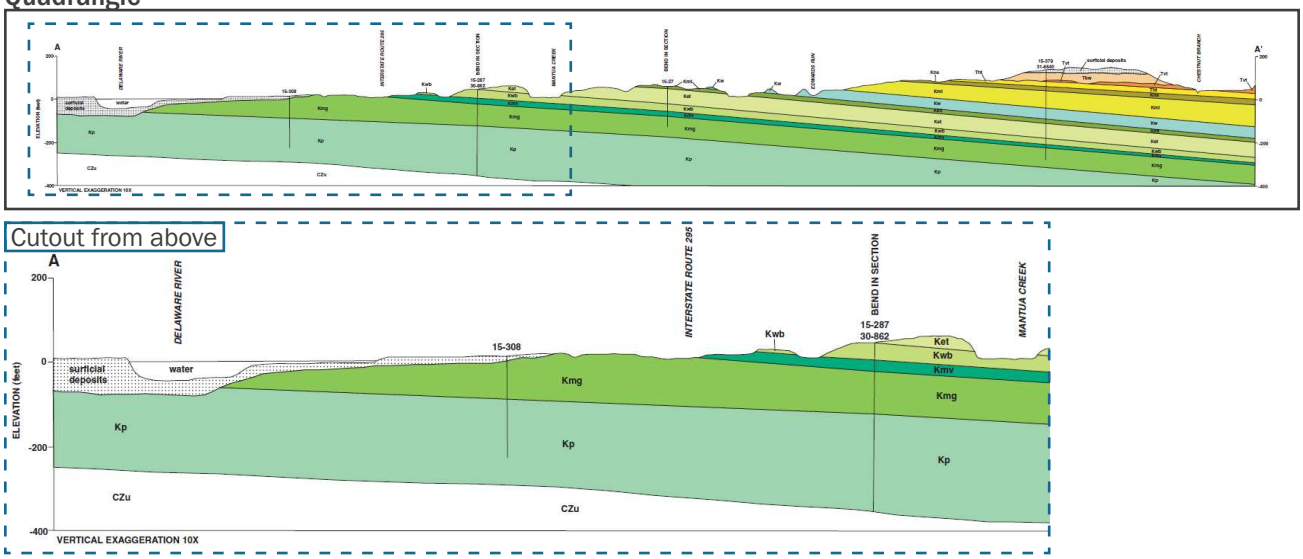
The geology underneath the borough is also described in Table 4, where the geologic formations are organized from the most recently formed (top of table) to the oldest (bottom of table). Aquifers containing groundwater that supports the region's industries, businesses, and residents are located between and within these geological formations and are discussed in the Groundwater section.

Table 4: Geologic Formations in the Borough of Westville

Geologic Name	Abbreviation	Lithology	Geologic Age
Englishtown Formation	Ket	Quartz sand, fine- to coarse-grained, locally interbedded with thin to thick beds of clay	Late Cretaceous, Campanian
Woodbury Formation	Kwb	Clay-silt	Late Cretaceous, Campanian
Merchantville Formation	Kmv	Glauconite sand to quartz-glauconite sand, clayey, silty	Late Cretaceous, Campanian
Magothy Formation	Kmg	Quartz sand, fine- to coarse-grained, interbedded with thin-bedded clay or clay-silt	Late Cretacous, Santonian
Potomac Formation	Kp	Sand, fine- to coarse- grained, interbedded with white, red, or yellow clay	Late Cretaceous, Cenomanian

Source: NJDEP, 2003

Figure 11: Crosssection of the Woodbury Quadrangle



Source: NJDEP, 2003

Borough of Westville

Figure 12: Geology

dvrpc

Philadelphia

PA

NJ

Delaware River

Gloucester City

Brooklawn

Camden County

Bellmawr

Lake Martha

West Deptford

Gloucester County

Deptford

Big Timber Creek

Broadway

Crown Point Rd

Gateway Blvd

Delsea Dr

Almonesson Rd

E Olive St

130

45

47

295

- Englishtown Formation
- Magothy Formation
- Merchantville Formation
- Potomac Formation
- Woodbury Formation

0 Miles 0.25 Miles 0.5 Miles

North

Source: NJDEP (2022)

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 or endorsed.

CHAPTER 7:

Soils

Soil is the foundation for all land uses. Soil types vary in their physical, chemical, and biological properties, influencing the vegetation and development potential of a region. Soil properties also affect the location of wells and septic facilities, often determining development potential in certain areas. Soil is a natural resource that cannot be replenished on the human time scale.

Data on soil types derives from surveys conducted by the U.S. Department of Agriculture (USDA) Natural Resources Conservation Service (NRCS). The Soil Testing Laboratory at the Rutgers New Jersey Agricultural Experiment Station tests soil properties for residents throughout New Jersey. The Cooperative Extension of Gloucester County sells soil testing kits.

Septic Suitability

Soil type is a major determining factor in planning for the location of septic systems. A variety of negative community impacts can occur if a septic system is constructed in soils with low infiltration rates, steep slopes, high water tables, or in areas that flood. These impacts may include contamination of groundwater, potentially leading to contamination of drinking water and pollution of nearby surface water; foul odors from unfiltered effluent; toilet and septic system failure; and high costs to property owners from installing and maintaining home disposal systems. It is not known from readily accessible data what percentage of the borough possesses soils unsuitable for septic systems. Further site level investigation is needed in this regard.

Agricultural Soils

The Borough of Westville is almost entirely urbanized with only about 5.6 percent of the soil area suitable for farming and only 1.5 percent considered Prime Farmland.

Soils defined as Prime Farmland have the best combination of physical and chemical characteristics for producing high yields of crops. They do not substantially erode, are not saturated with water for long periods of time, and do not flood frequently. This land is mostly contained in the Almonesson Little League fields in the southwest corner of the Borough.

Approximately 4.1 percent of Westville's soils fit under the category of Farmland of Unique Importance. While these soil types do not share the conventional characteristics of prime soil, they have some combination of temperature, humidity, drainage, elevation, aspect, or locational characteristics that allow for successful growth and sale of a specialty crop, such as blueberries or cranberries. In the Borough of Westville, these soils are mostly adjacent to Big Timber Creek.

The remaining 94.3 percent of soils in Westville are classified as Other Soils and are not considered suitable for farming. They are typically highly saturated, have steep slopes, have been urbanized or otherwise disturbed, or do not have a chemical makeup that would facilitate the growth of crops. The distribution of agricultural soils in the Borough of Westville is listed in Table 5 and mapped in Figure 13.

Table 5: Agricultural Soils

Soil Classification	Acres	Percentage
Prime Farmland	13.4	1.5%
Farmland of Statewide Importance	0	0%
Farmland of Statewide Importance, if drained	0	0%
Farmland of Unique Importance	35.8	4.1%
Other Soils	822.2	94.3%

Source: NJDEP, 2022

Almonesson Fields

Soil Types

The Borough of Westville has sandy and loamy soil series, including Downer, Fallsington, Freehold, Manahawk, Mannington, and Udorthents. The borough also has disturbed urban soils that do not function according to their original structure. The soil names and classifications are shown in Table 6 on page 30 and mapped in Figure 14 on page 34.

The Land Capability Classification system was developed by the United States Department of Agriculture (USDA) to determine the best agricultural use of lands by classifying and mapping erosion rates and potential in relation to both physical characteristics and agricultural capacity. The number represents the capability class which tells you how limited the soil is for agricultural purposes, and the letter tells you the subclass designation which tells you what kind of limitation is the main problem.

Tables 7 and 8 on page 31 provide an explanation of the numbers and letters associated with the Land Capability Class and Development Capability definitions

Four soil series, sometimes in complexes containing urban land, make up 56.6 percent of the borough's land area: Downer, Fallsington, Mannington, and Udorthents. These soil series are described in more detail below.

Downer Series

Downer soils are well drained, coarse-loamy soils that are derived from loamy fluviomarine deposits. They can be found in areas with slopes of up to 30 percent and are acidic but can (when found on gentler slopes) be used for growing field crops, vegetables, flowers, and some fruit trees.

Fallsington Series

Fallsington soils are poorly drained fine loams, with slow to moderate permeability. They occur in flats and depressions with slopes of less than 5 percent and are formed from loamy marine and old alluvial sediments. This hydric soil of Statewide Importance is often used for cultivating truck crops and small grains. Native vegetation growing in them includes wetland forest species, such as oaks, maples, sweetgum, and pond pine. These soils possess serious constraints to development because of their high water table.

Mannington Series

Mannington soils were previously mapped as tidal marsh or fresh water marsh miscellaneous land types. They are a mucky silt loam on a smooth zero percent slope in an estuarine tidal marsh. The soil is moderately acid to neutral throughout the profile and has silt loam, mucky silt loam or silty clay loam texture. These soils are very poorly drained and are mostly used as wetland wildlife habitats.

Udorthent Series

The Udorthent series is typically present in areas of human activity and consists of somewhat poorly drained to very poorly drained soils that have been altered mainly by filling and compaction. Large variation may occur within this series as a result of different land management practices, land use, vegetation types, and the presence of impervious surfaces. For this reason, onsite investigation is needed to determine the suitability of this soil for a particular use.

Table 6: Soils

Soil Code	Soil Name	Acres	Land Capability Class	Development Capability		
				Building without Basement	Building with Basement	Small Commercial
FauB	Fallsington-Urban land complex, 0 to 5 percent slopes	99.8	3w	Very Limited	Very Limited	Very Limited
FrfB	Freehold loamy sand, 0 to 5 percent slopes	13.4	2s	Not Limited	Not Limited	Not Limited
FrrB	Freehold-Urban land complex, 0 to 5 percent slopes	17.0	2s	Not Limited	Not Limited	Not Limited
MakAt	Manahawkin muck, 0 to 2 percent slopes, frequently flooded	3.3	7w	Very Limited	Very Limited	Very Limited
MamuAv	Mannington-Nanticoke-Udorthents complex, 0 to 1 percent slopes, very frequently flooded	28.4	8w	Very Limited	Very Limited	Very Limited
UddcB	Udorthents, dredged coarse materials, 0 to 8 percent slopes	54.5	3w	Not Limited	Not Limited	Not Limited
UR	Urban land	77.2	8s	N/A	N/A	N/A
USDOWB	Urban land-Downer complex, 0 to 5 percent slopes	289.7	8s	N/A	N/A	N/A
USFREB	Urban land-Freehold complex, 0 to 5 percent slopes	49.0	8s	N/A	N/A	N/A
WATER	Water	226.0	N/A	N/A	N/A	N/A

Source: NRCS, 2010

Table 7: Explanation of Land Capability Class

Capability Class	
1	soils have slight limitations that restrict their use
2	soils have moderate limitations that reduce the choice of plants or require moderate conservation practices
3	soils have severe limitations that reduce the choice of plants or require special conservation practices, or both
4	soils have very severe limitations that restrict the choice of plants or require very careful management, or both
5	soils have little or no hazard of erosion but have other limitations, impractical to remove, that limit their use mainly to pasture, range, forestland, or wildlife food and cover
6	soils have severe limitations that make them generally unsuited to cultivation and that limit their use mainly to pasture, range, forestland, or wildlife food and cover
7	soils have very severe limitations that make them unsuited to cultivation and that restrict their use mainly to grazing, forestland, or wildlife
8	soils and miscellaneous areas have limitations that preclude their use for commercial plant production and limit their use to recreation, wildlife, or water supply or for esthetic purposes

Source: NRCS, 2022

Table 8: Explanation of Land Capability Subclass

Land Capability Subclass	
e	is made up of soils for which the susceptibility to erosion is the dominant problem or hazard affecting their use. Erosion susceptibility and past erosion damage are the major soil factors that affect soils in this subclass.
w	is made up of soils for which excess water is the dominant hazard or limitation affecting their use. Poor soil drainage, wetness, a high water table, and overflow are the factors that affect soils in this subclass
s	is made up of soils that have soil limitations within the rooting zone, such as shallowness of the rooting zone, stones, low moisture-holding capacity, low fertility that is difficult to correct, and salinity or sodium content
c	is made up of soils for which the climate (the temperature or lack of moisture) is the major hazard or limitation affecting their use.

Source: NRCS, 2022

Soil Erosion

Soil erosion is one of the most important environmental problems facing developing and agricultural communities alike. Geologic, or "background," erosion occurs at approximately the same rate as soil formation, leading to neither a net loss nor 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, eroded rock material mixes with decomposed vegetation and creates more nutrient-rich soil.

Conversely, erosion caused by human activity has greatly increased the volume and rate of soils lost. In the United States, the most significant effects are the loss of prime agricultural soils, increased flooding, and pollution of streams and rivers. The Borough of Westville has soil erosion and sediment control requirements as part of its Stormwater Control Regulations, which are intended to reduce erosion by utilizing best management practices to manage stormwater runoff and maximize natural water infiltration.

Borough of Westville

Figure 13: Agricultural Soils

dvrpc

Philadelphia

PA

NJ

Delaware River

Gloucester City

Prime Farmland

Farmland of Statewide Importance

Farmland of Statewide Importance, if drained

Farmland of Unique Importance

Brooklawn

Lake Martha

Camden County

Bellmawr

Big Timber Creek

130

West Deptford

45

Broadway

47

Crown Point Rd

Gateway Blvd

Delsea Dr

Almonesson Rd

E Olive St

Gloucester County

295

Deptford

0 Miles

0.25 Miles

0.5 Miles

North

Source: NJDEP (2022)

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 or endorsed.

Borough of Westville

Figure 14: Soils

dvrpc

Philadelphia

PA

NJ

Delaware River

Gloucester City

Brooklawn

Camden County

Bellmawr

Lake Martha

West Deptford

Gloucester County

Deptford

Big Timber Creek

130

45

47

295

Broadway

Crown Point Rd

Gateway Blvd

Delsea Dr

Almonesson Rd

E Olive St

FauB
FrfB
FrrB
MakAt
MamuAv
UR
USDOWB
USFREB
UddcB
Water

0 Miles 0.25 Miles 0.5 Miles

North

Source: NRCS (2010)

CHAPTER 8:

Topography

Topography relates to the surface terrain and features of an area. The Borough of Westville has a relatively flat topography that slightly increases in elevation as one proceeds inland from the banks of the Delaware River and Big Timber Creek. Its areas of highest elevation are around where I-295 intersects with Delsea Drive and in the triangle created by I-295, Gateway Boulevard, and Crown Point Road. The lowest elevations are located in the center of the Borough at Thomas West Park and in-between Thomas West Park and Lake Martha. The highest elevation in the borough is approximately 46 feet. The lowest elevation in the Borough is at the water's edge, which is 10 feet above sea level, and in the middle of the borough where historic and current stream beds enter and exit Westville Lake. More details of Westville's topography are visible in Figure 15: Elevation on page 37.

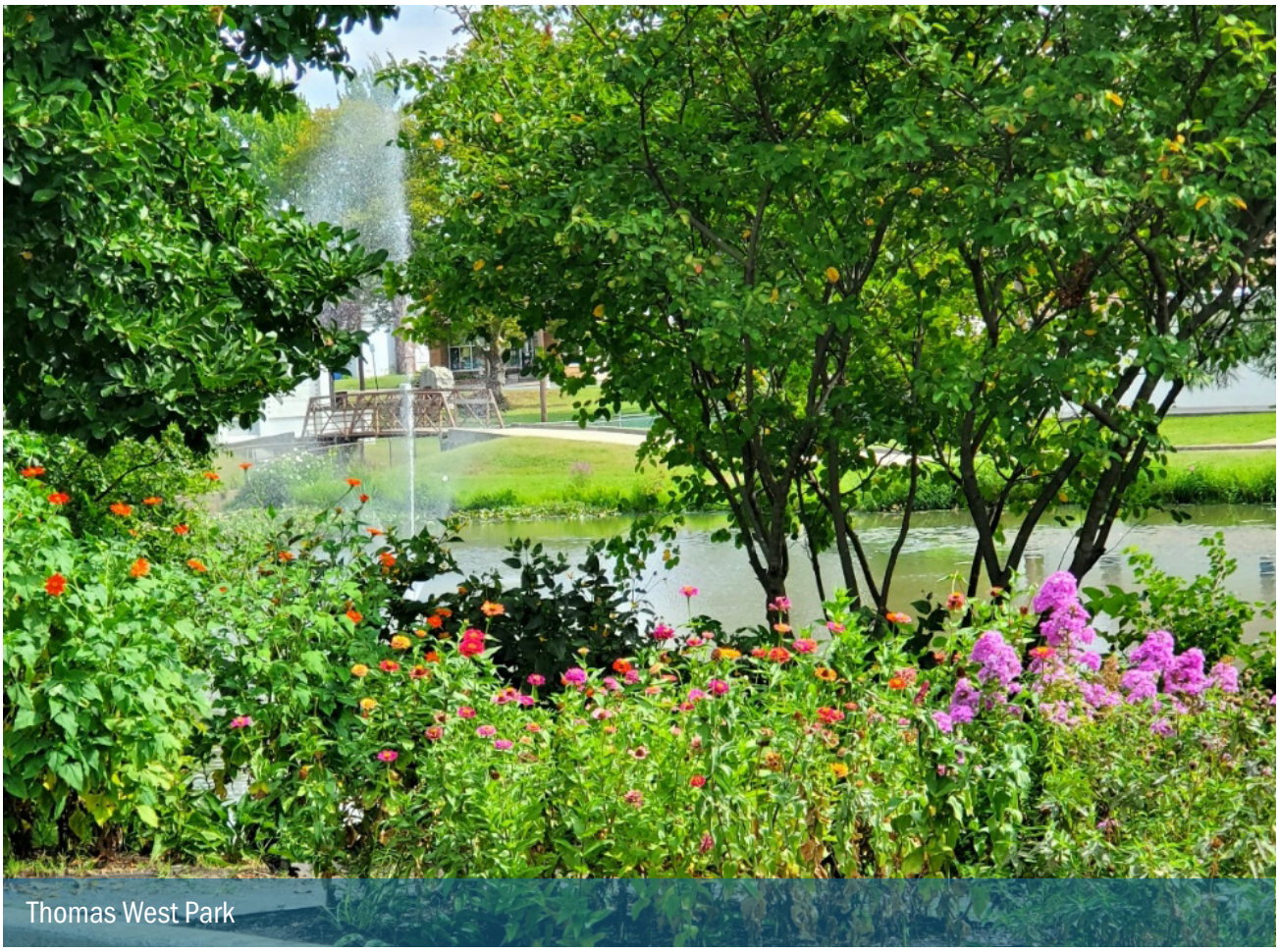
Steep Slopes

Steep slopes are fragile environmental features, and development of steep slope areas is inadvisable because it can result in soil instability, erosion, increased stormwater runoff, flooding, and sedimentation of the stream below. These effects in turn result in degradation of water quality, habitat destruction, and potential damage to property.

Slope is calculated by dividing the vertical rise by the horizontal difference and multiplying by 100 in order for it to be expressed as a percentage. Generally, slopes under 10 percent are not subject to any development constraints.

According to Figure 16 on Page 38, the majority of land within Westville is less than 5 percent in slope. Slopes of 5 to 10 percent are present along waterways, where the water has eroded soil over time, and through human intervention, for example along built-up highways. Generally, slopes under 15 percent are not considered to be "steep". Some of the steepest areas in Westville are along Big Timber Creek and highway interchanges from Interstate-295.

Although it has no areas with slopes above 10 percent, Westville's municipal code labels these as Environmentally Critical Areas and requires developers of major developments to provide topographic base maps indicating where steep slopes and other environmentally sensitive features are located. Using that information, developers must also provide an environmental site analysis that includes a discussion of any steep slopes on the site and the potential constraints that these slopes might have on the development of the site.



Thomas West Park

Source: Judith White

Borough of Westville

Figure 15: Elevation

dvrpc

10 Feet 20 Feet 40 Feet 60 Feet

Philadelphia

PA

NJ

Delaware River

Gloucester City

Brooklawn

Camden County

Bellmawr

Lake Martha

Big Timber Creek

West Deptford

130

45

47

Broadway

Crown Point Rd

Gateway Blvd

Delsea Dr

Almonesson Rd

E Olive St

295

Gloucester County

Deptford

0 Miles 0.25 Miles 0.5 Miles North

Source: DVRPC (2015)

Borough of Westville

Figure 16: Steep Slopes

dvrpc

0 percent to 4.99 percent

5 percent to 9.99 percent

Philadelphia

PA

NJ

Delaware River

Gloucester City

Brooklawn

Camden County

Bellmawr

Big Timber Creek

Lake Martha

West Deptford

Gloucester County

Deptford

130

45

47

295

Broadway

Crown Point Rd

Gateway Blvd

Delsea Dr

Almonesson Rd

E Olive St

0 Miles 0.25 Miles 0.5 Miles

North

Source: USGS (2022)

CHAPTER 9:

Hydrology and Water Resources

The Borough of Westville has a close relationship with its water bodies, which form three borders of the borough. The most significant body of water that borders the borough is the Delaware River which runs along the Northwestern border. Forming the Northeastern border of the Borough of Westville is Big Timber Creek and along part of the Southwestern border is Lake Martha.

Surface Water

Watersheds

A watershed is an area of land that resembles a basin in shape, surrounded by ridge-like areas of higher elevation. Any watershed drains all of its surface water bodies, groundwater, and rainfall to a common outlet, such as the outflow of a reservoir, the mouth of a bay, or the point where a tributary discharges into a larger stream. Larger watersheds can contain many smaller watersheds, or "subwatersheds." For example, the Delaware River watershed contains all of the streams that drain into the Delaware River and then into the Delaware River Bay and Atlantic Ocean, but these individual streams also have their own watershed, where the common outlet is the point where that stream meets the Delaware River. Watersheds are natural ecological units and have distinct biotic and abiotic characteristics.

Each watershed has its own Hydrologic Unit Code, or HUC, which is a series of numbers determined by the USGS that defines that watershed. The fewer the number of digits in the HUC, the larger the size of the watershed: HUC-2 watersheds have two-digit codes and have areas of tens of thousands of square miles, while HUC-12 watersheds, with 12-digit codes, are often less than 50 square miles. Smaller watersheds are naturally nested within larger watersheds.

NJDEP monitors HUC-11 and HUC-14 watersheds in the state. New Jersey has 152 HUC-11 watersheds and over 900 HUC-14 subwatersheds. The HUC-11 watersheds in New Jersey average about 60 square miles. HUC-14 watersheds are about nine square miles on average, so approximately six or seven HUC-14 watersheds would typically be nested within a single HUC-11 watershed.

As shown in Figure 17 on the page 41, the Borough of Westville is located almost entirely within one HUC-14 subwatershed, the Big Timber Creek subwatershed. It is approximately 10.3 square miles in size and stretches on the west from close to the border of the Borough of Westville, on the east to the confluence of the North Branch and South Branch of Big Timber Creek, and on the north to the Borough of Lawnside in Camden County. A very small sliver of the far northwestern part of the borough is classified as part of the Woodbury HUC-14 subwatershed. Both the Big Timber Creek and Woodbury subwatersheds are located within the Woodbury/Big Timber/Newton Creeks HUC-11 watershed.

Woodbury/Big Timber/Newtown Creeks Watershed

NJDEP combined the Woodbury, Big Timber, and Newton Creeks into one HUC-11 watershed. Together, these creeks drain 98.9 square miles of land in Gloucester and Camden counties into the Delaware River. The entirety of the Borough of Westville is located within this watershed.

Watershed Management Area 18

NJDEP uses watersheds as a unit of area for managing natural resources. The agency has divided the state into 20 Watershed Management Areas. The Borough of Westville is within Watershed Management Area 18, known as the Lower Delaware Region, which includes 68 municipalities in 391 square miles of southwestern New Jersey. The main watersheds of this Watershed Management Area include Oldmans Creek, Raccoon Creek, Repaupo Creek, Mantua Creek, Big Timber Creek, Cooper River, Pennsauken Creek, and Pompeston Creek, all of which drain into the Delaware River. The land in this Watershed Management Area ranges from highly urbanized along the Delaware River to forested and agricultural inland and to the south.

Streams

The Borough of Westville contains or is adjacent to one named stream: Big Timber Creek. This stream is freshwater and tidal.

The Delaware River and Big Timber Creek are monitored for biological life, nutrients, chemicals, and other parameters. More information on water quality in these water bodies is located in the Surface Water

Big Timber Creek

Lakes and Ponds

Westville contains 1.78 acres of artificial lakes and water impoundments. This is contained in a single pond in Thomas West Park in the center of the Borough.

Lake Martha, located directly to the Southwest of the borough, is a tidally influenced stream and marsh area which is largely located within the Wheelabrator Wildlife Refuge and Butterfly Garden.

Wetlands

Wetlands have numerous definitions and classifications because of their diversity and the regulation of their uses. However, a basic definition of a wetland is an area that has enough water at some time during the year to stress plants and animals that are not adapted to life in water or saturated soils.

Wetland soils, which are also known as hydric soils, are areas where the land is saturated for at least seven consecutive days during the growing season. While wetlands almost always require the presence of hydric soils, hydric soils are not always wetlands. For land to be considered a natural wetland, it must have vegetation unique to wetlands and hydric soils.

Total wetland acreage in the borough, based on NJDEP's land use/land cover data, is 41.93 acres, of which 38.18 acres feature natural wetlands vegetation: wetlands that have experienced less human alteration and are more likely to contain typical or indigenous plants and animals that are native to that wetland type. Of the Borough of Westville's naturally vegetated wetlands, 20.81 acres are classified as forested wetlands, 12.37 acres are scrub/shrub wetlands, and 5 acres are freshwater tidal marshes. All of the Borough of Westville's wetlands are freshwater and the majority are assembled along Big Timber Creek. More information on the Borough of Westville's naturally vegetated wetland areas is found in the Natural Vegetation: Wetlands section (page 83).

Westville also contains 3.75 acres of modified or managed wetlands, which no longer support the typical natural wetlands vegetation found in analogous unaltered natural areas but do show signs of soil saturation and exist in areas shown to have hydric soils on U.S. Soil Conservation Service soil surveys. Westville's modified wetlands include 3.2 acres of wetlands found in maintained recreational areas, 0.32 acres of phragmites dominated interior wetlands, and 0.23 acres of phragmites dominated coastal wetlands. (see Table 2: NJDEP Detailed Land Use/Land Cover)

New Jersey protects freshwater (interior) wetlands under the New Jersey Freshwater Wetlands Protection Act Rules: N.J.A.C. 7:7A. This law also protects transitional areas, or "buffers," around freshwater wetlands. The standard width of the transition area that is protected is 150 feet around a freshwater wetland of "exceptional resource value," which is defined as one that either discharges into trout-supporting waters or has been documented as habitat for a threatened or endangered species. The standard extent of transitional area that is protected around a freshwater wetland of "intermediate resource value" (one that is not of "exceptional resource value" or "ordinary") is 50 feet.

Borough of Westville

Figure 17: Watersheds

dvrpc

Big Timber Creek
Woodbury Creek

Philadelphia
PA
NJ
Delaware River
Gloucester City
Brooklawn
Camden County
Bellmawr
Lake Martha
West Deptford
Gloucester County
Deptford
Big Timber Creek
130
45
47
295
Broadway
Crown Point Rd
Gateway Blvd
Delsea Dr
Almonesson Rd
E Olive St

0 Miles 0.25 Miles 0.5 Miles North

Source: NJDEP (2022)

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 or endorsed.

NJDEP's published freshwater wetland maps provide guidance on where wetlands are found in New Jersey, but they are not the final word on location. Only an official determination from NJDEP, called a "letter of interpretation" (LOI), can formally designate the presence of freshwater wetlands on a property. An LOI verifies the presence, absence, or boundaries of freshwater wetlands and transition areas on a site. The activities that are permitted to occur within wetlands are very limited, and permits are required for most of them. Violations of the wetland regulations will result in penalties determined by NJDEP. Additional information on wetlands rules and permits is available through the NJDEP Division of Land Use Regulation and on its website under "Freshwater Wetlands."

The NJDEP Landscape Project maps wetland habitat for threatened and endangered species. Both natural and modified wetlands are included in the Landscape Project. See Chapter 13: Landscape Project Priority Habitats for more information on this project.

Agricultural Wetlands

Agricultural wetlands are modified former wetland areas currently under cultivation. The Borough of Westville has no agricultural wetland sites.

Surface Water Quality

The Borough of Westville's Stream Designations

Surface water quality standards are established by federal and state governments to ensure that water is suitable for its intended use. The Federal Clean Water Act (P.L. 95-217) requires that, wherever possible, water quality standards provide water suitable for fish, shellfish, and wildlife to thrive and reproduce, and for people to swim and boat.

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). Freshwater bodies (FW1 and FW2) are further broken down into trout-producing (TP), trout-maintaining (TM), or nontrout waters (NT). The water quality for each of these groups must be able to support designated uses that are assigned to each water body classification in Surface Water Quality Standards N.J.A.C 7:9B-1.12.

Big Timber Creek

Big Timber Creek is classified as FW2-NT, indicating that it is a freshwater, nontrout-producing, nontrout-maintaining water body.

Delaware River

The Delaware River is governed by the Delaware River Basin Commission (DRBC) Water Quality Regulations, which is a separate set of water quality regulations. The segment of the Delaware River that runs past the Borough of Westville for approximately 900 feet is within Zone 4 along the Delaware River, which extends from River Mile (RM) 95.0 to RM 78.8 (Shown in Figure 18: Delaware Estuary Water Quality Monitoring Program Locations and DRBC Water Quality Zones on page 48) . This zone proceeds north from the state boundary line between Pennsylvania and Delaware, and also includes tributaries along that segment. The quality of Zone 4 waters is required to be maintained for industrial water supplies after reasonable treatment, maintenance of resident fish and other aquatic life, wildlife, passage of anadromous fish, recreation with secondary contact (which includes fishing, canoeing, rowing, and powerboating) above RM 81.8, and navigation.

The determination of whether or not water quality is sufficient to meet a water body's designated use(s) is based on whether the water body is within established limits for certain surface water quality parameters. Some examples of surface water quality parameters include fecal coliform, dissolved oxygen (the amount of oxygen in a body of water), potential of hydrogen (pH), phosphorous, and toxic substances. NJDEP also evaluates water quality by examining the health of aquatic life in a stream.

Surface Water Quality Protection Categories

In addition to the classifications above, NJDEP has three tiers of surface water quality protection: Outstanding National Resource Waters, Category 1 Waters, and Category 2 Waters.

The Borough of Westville's waterways fit in the Category 2 tier. Category 2 includes all waterways that do not match the more specific criteria required for the first two categories, which identify waterways of exceptional significance. Most waterways in the state are Category 2. The water quality, aesthetic value, and ecological integrity of Category 2 waters should be protected and maintained, but unlike in Outstanding National Resource Waters or Category 1 Waters, some amount of reduction in water quality is authorized to accommodate necessary and important social and economic development. For example, Category 2 waterways require a 50-foot development buffer around them rather than the 300-foot buffer required for Category 1 waterways.

New Jersey's Integrated Water Quality Monitoring and Assessment Report

The Federal Clean Water Act mandates that states submit biennial reports to the U.S. Environmental Protection Agency (EPA) describing the quality of their waters. States must submit two reports: the Water Quality Inventory Report, or "305(b) Report," documenting the status of principal waters in terms of overall water quality and support of designated uses; and a list of water bodies that are not attaining water quality standards, or the "303(d) List."

States must also prioritize 303(d)-listed water bodies for Total Maximum Daily Load (TMDL) analyses. The TMDL quantifies the amount of a pollutant a water body can assimilate (its loading capacity) without violating water quality standards. The TMDL analysis identifies those high-priority water bodies for which states anticipate establishing TMDLs in the next two years.

NJDEP integrates the 303(d) List and the 305(b) Report into a single report according to EPA's guidance. The most recent Draft 2022 Integrated Water Quality Monitoring and Assessment Report categorizes water quality assessment into three statuses: Fully Supporting, Not Supporting, and Insufficient Data. These statuses are then placed into sublists for the Integrated Report and to help clarify the response strategy for impairments. Sublists 1 and 2 contain waters that are Fully Supporting designated uses and no uses are threatened. Sublist 3 contains waters for which there is insufficient data to determine their status. Sublist 4 contains waters that do not attain water quality standards, but that 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 contains waters that do not attain their designated use and for which a TMDL is required. Sublist 5 is equivalent to the 303(d) List. Table 10: Integrated Water Quality Report Key includes more details about the assessment statuses.

NJDEP bases the assessment of entire HUC-14 watersheds (which serve as "assessment units") on the results of one or more monitoring sites within the watershed. The results from monitoring sites located within each HUC-14 subwatershed are extrapolated to represent all of the water bodies within the entire HUC boundary. In practice, the HUC-14 approach provides a more conservative assessment since any impairment of any water body in a given HUC-14 watershed will result in that entire watershed being listed as impaired for that use or parameter. In addition, where a HUC-14 watershed contains waters of different classification, the more stringent classification is used to assess impairment, and that impairment is then applied to the entire watershed. Because of the degree of extrapolation required for this approach, NJDEP performs more detailed testing to determine the actual cause, source, and extent of impairment in the HUC-14 watershed before developing a TMDL or taking other regulatory action to address the impairment.

NJDEP identifies the designated uses applicable to each HUC-14 watershed and determines whether each water quality monitoring station located in certain water bodies in that watershed indicates that the water meets the water quality standards that correspond with designated uses. Not all designated uses are applicable for all HUC-14 watersheds.

The assessment unit (the HUC-14 watershed) is then placed on the appropriate sublist (Sublists 1–5) for each use. Table 9 shows each of the sublists for the Big Timber Creek Assessment Unit and Table 10 gives the description for the sublists . As shown in Table 9, an assessment unit may be listed on one or more sublists (i.e., on Sublist 2 for drinking water, Sublist 3 for aquatic life, etc.).

Table 9: Integrated Water Quality Monitoring and Assessment Report

Assessment Unit (HUC-14 Watershed)	HUC - ID	Aquatic Life	Fish Consumption	Water Supply	Recreation
Big Timber Creek (below Northbound/ Southbound confluence)	02040202120080	3	5	1	3

Source: NJDEP, 2022

Table 10: Integrated Water Quality Report Key

Sublist	Status	Description
1	Fully Supporting	An assessment unit is fully supporting designated uses and no uses are threatened, and all other designated uses in the assessment area have been assessed and attained.
2	Fully Supporting	An assessment unit is fully supporting designated uses and no uses are threatened, but one or more designated uses in the assessment unit have not attained water quality standards, and/or there is insufficient data to make a determination.
3	Insufficient Data	Insufficient data and information are available to determine if the designated use is fully supported.
4	Not Supported	One or more designated uses are not supported or are threatened but TMDL development is not required because of one of the following reasons.
4A	Not Supported	A TMDL has been completed for the parameter causing designated use nonsupport.
4B	Not Supported	Other enforceable pollutant control measures are reasonably expected to result in fully supporting the designated use in the near future.
4C	Not Supported	Non-support of the designated use is caused by something other than a pollutant.
5	Not Supported	One or more designated uses are not supported or are threatened by a pollutant(s), that requires development of a TMDL.

Source: NJDEP, 2022

Table 11: 303(d) List of Impaired Water for Fish Consumption with Priority Ranking

Assessment Unit (HUC-14 Watershed)	Parameter	Ranking
Big Timber Creek (below Northbound/ Southbound confluence)	PCBs in Fish Tissue	Low

Source: NJDEP, 2022

However, an assessment unit can only be placed on Sublist 1 if all uses for that assessment unit are attained. In order to determine whether or not an assessment unit supports a designated use, NJDEP identifies a suite of parameters that serve as the minimum dataset associated with each designated use. If one or more designated uses are assessed as "nonattainment" (Sublist 5), the pollutant(s) or impairment causing the nonattainment status is identified on the "303(d) List of Impaired Waters with Priority Ranking." When the pollutant causing nonattainment is unknown, the pollutant is listed as "pollutant unknown" or "toxic unknown." The ranking (Low, Medium, High) refers to the priority given a specific assessment unit when determining the schedule for a TMDL.

Table 11 lists the only designated use for which the Big Timber Creek watershed in Westville is non-attaining (Fish Consumption) and the pollutant causing the impairment.

The Lower Delaware has the most fish tissue sampling in the state and the majority of fish tissue data continues to show fish consumption use impairments throughout the area. PCBs are the predominant toxin found in fish tissue in the Lower Delaware. There are signs that fish tissue improvements are occurring as recent sampling for mercury, DDT and its metabolites, and chlordane are fully supporting in a limited number of waterbodies. In the Borough of Westville, Big Timber Creek is non-attaining for PCB and fully attaining for mercury.

PCBs were used as coolants and lubricants in electrical equipment from the 1940s until 1977, when their manufacture was stopped due to evidence of their harmful effect on the environment. PCBs do not break down quickly in the environment and accumulate in water, soil, air, and animal life. Exposure to PCBs can cause skin conditions and impair the liver and immune system in humans.

In addition to recognizing the presence of contaminatns for fish consumption as listed in the Integrated Water Quality Monitoring Report for Westville, all those who catch fish in Westville (or any New Jersey) waters for consumption should abide by the Fish Consumption Advisories posted online by NJDEP. These advisories provide information on the types and amounts of locally caught fish that are safe to eat.

Water Quality Monitoring Networks

The determination of whether or not water quality is sufficient to meet an assessment unit's (HUC-14 watershed's) designated uses is based on testing results from various water quality monitoring networks.

NJDEP's Monitoring Networks

Across the state. NJDEP primarily relies on two water quality monitoring networks: the Ambient Surface Water Quality Monitoring Network (ASWQMN) and the Ambient Biomonitoring Network (AMNET).
NJDEP runs the ASWQMN in cooperation with the USGS. This network contains 126 stations, 76 are located in fixed locations and 50 are in periodic sites that are randomly selected, that monitor priority regions, basins, and watersheds for nutrients (i.e., phosphorous and nitrogen), bacteria, metals,

sediments, dissolved oxygen, pH, or other parameters. The closest ASWQMN stations to the Borough of Westville are located on the Mantua Creek at Pitman Borough, the Cooper River at the Borough of Haddonfield, and the Delaware River at Penn's Landing in Philadelphia.

AMNET, which is administered solely by NJDEP, evaluates the health of aquatic life as a biological indicator of water quality. The network includes over 820 monitoring sites located throughout the state.

Each station is sampled once every five years. The closest AMNET stations to the Borough of Westville are located in Harrison Township, Glassboro Borough, Mantua Township, Bellmawr Borough, and Washington Township.

Each site is tested only for the diversity of aquatic life. In testing this water quality parameter, NJDEP samples streams for benthic (bottom-dwelling) macroinvertebrates, which include such insects as dragonfly and caddisfly larvae, clams, mussels, snails, worms, and crustaceans that are large enough to be seen by the naked eye. Macroinvertebrates are studied because they are a good indicator species: if pollution harms a stream, their populations are adversely affected and require a significant amount of time to recover. While chemical tests measure water quality on a given day, the presence or absence of macroinvertebrates represents water quality changes over a longer period preceding the testing day. Water bodies are rated on the number of different species of organisms present, as well as the number of individuals within those populations.

Delaware River Basin Comission (DRBC): Delaware Estuary Boat Run

The Delaware River and its tributaries are also assessed by the DRBC. The Commission describes its Delaware Estuary monitoring program, the Delaware Estuary Boat Run, as one of the longest-running monitoring programs in the world. Once per month from April to October, the Commission collects samples at 22 stations along the tidal Delaware River in order to provide accurate, precise and defensible estimates of the surface water quality of the Delaware Estuary and allow assessment of water quality criteria compliance. The Commission conducts sampling of bacteria, nutrients, dissolved oxygen, heavy metals, chlorophylla, dissolved silica, and volatile organics.

As shown in Figure 18 the closest Boat Run monitoring station to the Borough of Westville is across the Delaware River in the Philadelphia Navy Yard.

Total Maximum Daily Loads (TMDLs)

For impaired waters (waters on Sublist 5), the state is required by the EPA to establish a TMDL. As mentioned previously in the section on New Jersey's Integrated Water Quality Monitoring and Assessment Report, a TMDL quantifies the amount of a pollutant 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 the sources of pollutants and the percentage reductions of each pollutant that must be achieved to attain water quality standards. These sources can be point sources, coming from a single "point," such as a sewage treatment plant; or nonpoint sources, which come from a collection of sources, such as runoff from various types of residential, commercial, or agricultural lands.

Listed in Table 11 on page 46, there is one HUC-14 watershed in the Borough of Westville that is listed on Sublist 5. The Borough of Westville has no TMDLs that specifically reference the Borough, but according to the 2022 New Jersey Integrated Water Quality Assessment Report, the Borough is included in the TMDL for Polychlorinated Biphenyls (PCBs) for Zones 2 - 5 of the Tidal Delaware River (which is the area along the Delaware River from Trenton to just south of Hope Creek Generating Station).

In general, implementation of a TMDL relies on actions mandated by NJDEP's Stormwater Management Rules, including the ordinances required to be adopted by municipalities under those rules (see the Nonpoint Sources subsection on page 50 for details about the stormwater rules and their basic requirements). It also depends on private landowners making voluntary improvements to their land.

Figure 18: Delaware Estuary Water Quality Monitoriong Program Locations and DRBC Water Quality Zones

Source: DRBC, 2022

Potential Causes of Water Quality Impairments

Point Sources

Point sources of discharge, 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 waterbodies. 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 the Nonpoint Sources section on the following page).

NJDEP, through the Division of Water Quality and the Bureau of Surface Water and Pretreatment Permitting, administers the NJPDES program (N.J.A.C. 7:14A). Under NJPDES, any facility discharging domestic or industrial wastewater directly into surface water or groundwater (usually through a septic system) must apply for and obtain a permit for discharging. Rather than creating individually tailored permits for 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 NJPDES permits by visiting discharging facilities and requiring facilities to periodically conduct water quality, biological and toxicological analyses, and thermal impact and cooling water assessments.

As of May 2022, six active NJPDES permits for point source discharges were issued for activities in the Borough of Westville. One is a 5G3 general permit for construction activities, one is a 5G2 general permit for basic industrial stormwater, and four are for different

Table 12: NJPDES Active Permit List for Westville

NJPDES Permit Number	Program Interest (PI) Number	Facility Name	Facility Address	Expiration Date	Discharge Category Description
NJ0005401	46223	Energy Transfer Marketing and Terminals LP	1240 Crown Point Road	3/31/24	Individual Stormwater (IP) (RF)
NJ0005401	46223	Energy Transfer Marketing and Terminals LP	1240 Crown Point Road	3/31/24	Industrial Wastewater (IP) (B)
NJG0149543	168149	Westville Boro	1035 Broadway	12/31/22	MS4 - Tier A Municipal Stormwater (GP) (R9)
NJG0162507	281092	Mars Graphics INC	1012 Edgewater Avenue	1/31/23	Basic Industrial Stormwater (GP) (5G2)
NJG0241326	685973	Rail Expansion Project - PH E	Crown Point Road and Park Avenue	2/28/27	Construction Activity Stormwater (GP) (5G3)
NJG0271888	46223	Energy Transfer Marketing and Terminals LP	1240 Crown Point Road	12/31/26	Sludge Quality Categories 6 - 9 (GP) (SQIG)

Source: NJDEP, 2022

categories. They are shown in Table 12. Note, Energy Transfer Marketing and Terminals uses a Westville mailing address, but the facilities themselves reside in West Deptford.

More information on each facility's permit is available at NJDEP's DataMiner data portal. Although the NJPDES program has made progress in regulating point source discharges, NJDEP has allowed many minor discharges without regard to their cumulative impact on surface water quality

Nonpoint Sources

Nonpoint source pollution, which comes from a wide variety of sources rather than from a single point, such as a discharge pipe, has a detrimental effect on the water quality and ecology of streams in most municipalities, including the Borough of Westville. These sources are also the most difficult to identify and remediate because they are diffuse, widespread, and cumulative in their effect.

Nonpoint source pollution in the Borough of Westville is derived from stormwater drainage off paved surfaces, such as streets and parking lots, commercial/industrial areas, residential sites (with and without detention basins), lawns, and from agricultural fields that lack adequate vegetative buffers. Some of this runoff comes to the waterways from similar sources in upstream towns, and some of it derives from the Borough of Westville's land uses.

Some examples of nonpoint source pollutants contained in stormwater runoff include the following: excess fertilizers, herbicides, and insecticides from residential lawn areas; oil, grease, rubber, and toxic chemicals from automobiles and improper disposal of household wastes; acid rain and mercury from fossil fuel-fired energy production; sediment from improperly managed construction sites and forest lands, and eroding streambanks; salt from streets treated during winter precipitation events; nutrients from yard waste left to decompose on the street; and bacteria and nutrients from geese, pet wastes, and faulty septic systems.

In February of 2004, NJDEP issued a new Stormwater Management Rule, as required by EPA's Phase II Stormwater Management Program for Municipal Separate Stormwater Sewer Systems (MS4). NJDEP updated the rule in 2020 and amended it in 2023. The rule lays out guidance and requirements for management of and education about stormwater at the local level. It applies to all towns in New Jersey, all county road departments, and all public institutional facilities on large sites (such as hospitals and colleges) that contain stormwater sewer systems that are separated from regular sewer systems. Each entity with this type of sewer system is required to obtain an MS4 general permit for the stormwater system.

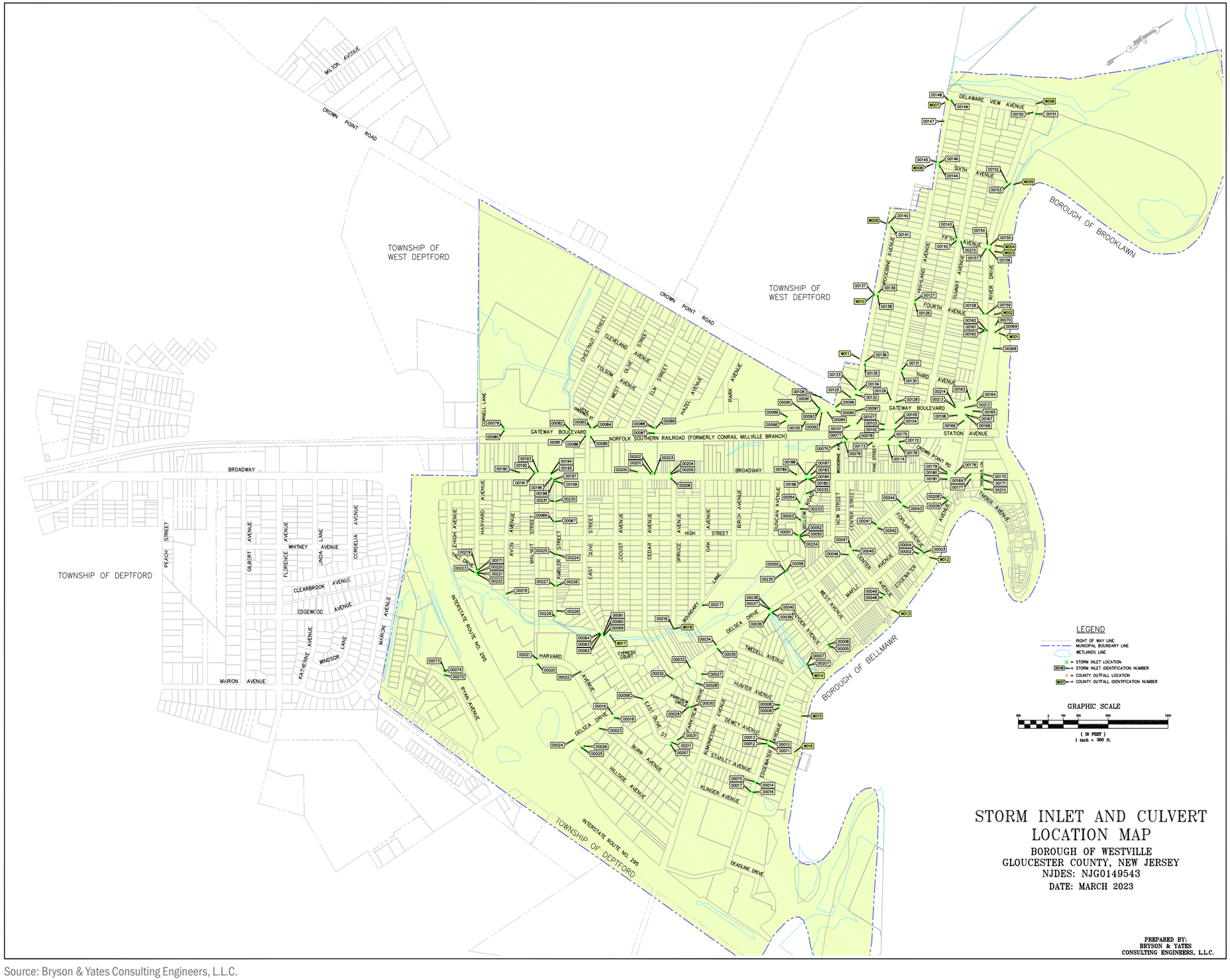
Under this permit, a town must meet certain specific requirements in planning, ordinance adoption, education, and management of municipal facilities and investigation of parts of the stormwater system. Municipalities are classified as either Tier A or Tier B under the stormwater rules. The Borough of Westville is listed among the Tier A municipalities, which have higher population levels and densities, as well as more stringent requirements than Tier B municipalities.

The Borough of Westville has addressed these requirements with multiple ordinances including a Stormwater Management Ordinance passed in 2005 and revised in 2021 and a Stormwater Pollution Prevention Plan first adopted in 2004 and most recently updated in 2020.

In order to maintain their MS4 permit, the 2023 amendments to the rules require municipalities to map all publicly and privately owned strormwater infrastructure by 2026 (see Figure 19), outline potential water quality improvement projects and the funding necessary for these projects by 2027, and submit final project locations for water quality improvment projects by 2028.

Municipalities may adopt more restrictive stormwater requirements than those required by New Jersey, which sets minimum requirements. All development, regardless of its size or how it is regulated, should have its effect on stormwater considered.

Figure 19: Westville Stormwater Inlet and Outfall Map



Source: Bryson & Yates Consulting Engineers, L.L.C.

Stormwater Management Plan Requirements

The general goals and requirements for stormwater management planning for the State of New Jersey as laid out in the New Jersey Administrative Code (NJAC) 7:8 Subchapter 2 are shown below.

Stormwater Management Goals

All stormwater management plans, and stormwater control ordinances shall be designed to:

1. Reduce flood damage, including damage to life and property;

2. Minimize, to the extent practical, any increase in stormwater runoff from any new development;

3. Reduce soil erosion from any development or construction project;

4. Assure the adequacy of existing and proposed culverts and bridges, and other instream structures;

5. Maintain groundwater recharge;

6. Prevent, to the greatest extent feasible, an increase in nonpoint pollution;

7. Maintain the integrity of stream channels for their biological functions, as well as for drainage;

8. Minimize pollutants in stormwater runoff from new and existing development in order to restore, enhance and maintain the chemical, physical, and biological integrity of the waters of the State, to protect public health, to safeguard fish and aquatic life and scenic and ecological values, and to enhance the domestic, municipal, recreational, industrial and other uses of water; and

9. Protect public safety through the proper design and operation of stormwater management basins.

Stormwater Management Plan Requirements

(a) A stormwater management plan shall include stormwater management measures, including green infrastructure, and nonstructural stormwater management strategies necessary to meet the stormwater management goals of this chapter.

(b) A regional stormwater management plan shall comply with the requirements of this subchapter and N.J.A.C. 7:8-3.

(c) A municipal stormwater management plan shall comply with the requirements of this subchapter and N.J.A.C. 7:8-4.

(d) A stormwater management plan shall incorporate the safety standards for stormwater management basins at N.J.A.C. 7:8-6.

(e) In developing a stormwater management plan and identifying appropriate stormwater management measures thereunder, each stormwater management planning agency shall consider the physical characteristics and ecological resources of the stormwater management planning area.

(f) A stormwater management plan and any stormwater management ordinance shall be coordinated with any other stormwater management plans related to the same river basin or drainage area.

(g) For stormwater management plans developed pursuant to N.J.A.C. 7:8-3 and 4, "nonstructural stormwater management strategies" may include one or more of the following practices that:

1. Protect areas that provide water quality benefits or areas particularly susceptible to erosion and sediment loss;

2. Minimize impervious surfaces and break up or disconnect the flow of runoff over impervious surfaces;

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

4. Minimize the decrease in the "time of concentration" from pre-construction to postconstruction. "Time of concentration" is defined as the time it takes for runoff to travel from the hydraulically most distant point of the drainage area to the point of interest within a watershed;

5. Minimize land disturbance, including clearing and grading;

6. Minimize soil compaction;

7. Provide low-maintenance landscaping that encourages retention and planting of native vegetation and minimizes the use of lawns, fertilizers, and pesticides;

8. Provide vegetated open-channel conveyance systems discharging into and through stable vegetated areas; and

9. Provide other source controls to prevent or minimize the use or exposure of pollutants from development sites in order to prevent or minimize the release of those pollutants into stormwater runoff.

Floodplains

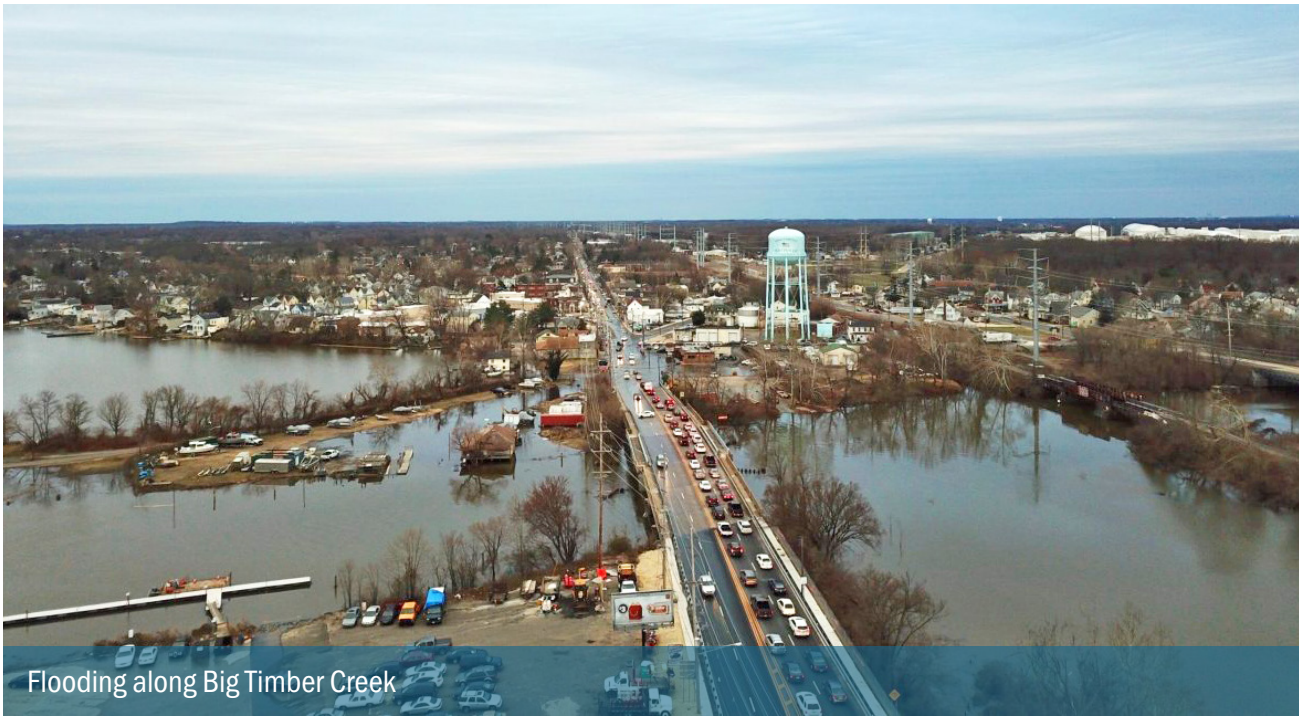
Areas susceptible to being inundated by floodwaters from any source are called floodplains. Floodplains encompass a floodway, which is the portion of a floodplain subject to high velocities of moving water, and the adjacent flood fringe, which includes lands outside the floodway that hold excess water during overlow of the normal stream channel. The floodway is the most dangerous part of the floodplain.

The 1-percent floodplain, also known as the 100-year floodplain, is defined as the land area that will be inundated by the overflow of water that hasa 1 percent chance of occurring in any given year (the 100-year flood). The probability of flooding is computed based on historical river flows and flood events. At least 10 years of data is required to calculate flood probabilities. This number represents a moving average and can be periodically recalculated to account for changes in flood trends in an area.

The Federal Emergency Management Agency maps the floodplain on maps known as the Flood Insurance Rate Map (FIRM). FEMA categorizes floodplains on the FIRM into zones which are geographic areas defined according to the level of flood risk. In the Borough of Westville, the flood zones mapped on the FIRM include A, AE, and X. Zones A and AE both designate areas that have a 1-percent chance of flooding in any given year (the 100-year floodplain) This floodplain is also referred to in the Flood Insurance Rate Map as the Special Flood Hazard Area (SFHA). Zone AE includes areas that have undergone detailed analysis in order to calculate the base flood elevation. Base Flood Elevation (BFE) is the elevation of water resulting from a flood that has a 1 percent chance of equaling or exceeding that level in any given year. Base flood elevations have not been calculated for Zone A.

Zone X designates areas that have a 0.2 percent chance of flooding in any given year, also known as the 500-year floodplain or as the Moderate Flood Hazard Area.

The extent of these flood zones is shown in Figure 20 on page 57 and the total land area of each zone is listed in Table 13 on page 56.



Flooding along Big Timber Creek

Source: South Jersey Observer, 2022

Table 13: Floodplain Area

Floodplain	Area (Acres)	Percentage
A	24	2.7
AE	71	8.2
X	43.9	5.0
Total	138.9	15.9

Source: FEMA, 2016

Floodplains require protection in order to prevent loss of or damage to property constructed on them. Equally important is the preservation of the aquatic communities that exist in floodplains. As food for many other species, these aquatic communities support the aquatic ecosystem as a whole. In addition, floodplains remove and mitigate various pollutants dissolved in stormwater, particularly fertilizer, when vegetation located within them absorbs the pollutants through their roots. The vegetation can also physically trap nutrients and sediments and prevent them from traveling farther downstream. All efforts to keep development out of floodplains will help to preserve the flood-carrying capacity of streams and their water quality.

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. NJDEP adopted a Flood Hazard Control Act in 2007, which was most recently amended in 2016. Full text of the revised Flood Hazard Area Control rules and other additional information on floodplain activities is available from NJDEP Division of Land Use Regulation and from its website under “Land Use.”

The Borough of Westville manages development in its floodplains through its Flood Damage Prevention Ordinance in its municipal code. All development that is subject to review under the New Jersey Municipal Land Use Law (N.J.S.A. 40:55D-1 et seq.) or the New Jersey Uniform Construction Code (NJAC 5:23) must comply with the Flood Damage Prevention Ordinance.

Sea Level Rise

New Jersey’s climate is changing, and these changes are predicted to affect many communities, particularly those along the Delaware River. Increasing temperatures are predicted to cause sea level to rise acoss the globe, primarily due to the increase in sea water from melting glaciers, ice caps, and ice sheets; and thermal expansion (the process of sea water growing in volume as it warms). In addition, along the mid-Atlantic coast of the United States, sea level rise will be exacerbated due to land subsidence. Land subsidence in the mid-Atlantic is primarily caused by the settling of sediments deposited over many millenia, glacial isostatic adjustment and by the excessive use of groundwater which drains underground aquifers.

In the Greater Philadelphia region, the projected average amount of sea level rise by 2050 is between 1.0 feet and 1.8 feet with a middle value of 1.4 feet. As the sea level rises, low-lying areas will also experience an increase in tidal flooding. In Westville, high tide, or Mean High High Water (MHHW) is currently about 4 feet above sea level. These areas flood on an almost daily basis. However, occasionally, higher tides occur. Areas that currently flood at least 26 times or more at high tide are considered to be “chronically inunudated.” These chronically inundated areas currently encompass all lands within 1.1 feet of MHHW. Therefore in 2050, we can expect that areas below 6.5 feet above sea level (4 for MHHW plus 1.4 feet of sea level rise plus 1.1 feet for chronic inundation) will be chronically inundated. These areas are shown in Figure 21 on page 58 and include the edges of Big Timber Creek and Lake Martha and potentially along Willow Drive between Broadway and High Street.

Borough of Westville

Figure 20: Floodplains

dvrpc

AE: 1% Annual Chance Flood Area with BFE

A: 1% Annual Chance Flood Area without BFE

X: 0.2% Annual Chance Flood Area

Philadelphia

PA

NJ

Delaware River

Gloucester City

Brooklawn

Camden County

Bellmawr

Big Timber Creek

Lake Martha

West Deptford

Gloucester County

Deptford

130

45

47

295

Broadway

Crown Point Rd

Gateway Blvd

Delsea Dr

Almonesson Rd

E Olive St

0 Miles 0.25 Miles 0.5 Miles North

Source: FEMA (2022)

Borough of Westville

Figure 21: 2050 Sea Level Rise

dvrpc

Projected Sea Level Rise

Current Water Body

Philadelphia

PA

NJ

Delaware River

Gloucester City

Brooklawn

Camden County

Bellmawr

Lake Martha

Big Timber Creek

West Deptford

130

45

47

Broadway

Crown Point Rd

Gateway Blvd

Delsea Dr

Almonesson Rd

E Olive St

295

Gloucester County

Deptford

0 Miles

0.25 Miles

0.5 Miles

North

Source: Kopp (2014)

Borough of Westville

Figure 22: Impervious Surfaces

dvrpc

Philadelphia

PA

NJ

Delaware River

Gloucester City

Building

Road

Other

Brooklawn

Lake Martha

Camden County

Bellmawr

Big Timber Creek

West Deptford

130

45

47

Crown Point Rd

Gateway Blvd

Delsea Dr

E Drive St

Gloucester County

295

Deptford

0 Miles

0.25 Miles

0.5 Miles

North

Source: DVRPC (2015)

After 2050, the projections for sea level rise vary tremendously based on the amount of greenhouse gases emitted worldwide. In the Philadelphia region, the estimated range of sea level rise by 2100 is between 1.7 feet as the lowest level possible if greenhouse gas emissions are aggresively curtailed and 4.5 feet as the upper limit possible if greenhouse gases continue to be emitted at current rates. As sea level continues to rise, the areas impacted by storm surges will also increase in size and scope.

Impervious Coverage

Impervious surfaces are ground surfaces through which water is unable to filtrate into the ground. The amount of impervious surfaces in an area has a measurable impact on a range of environmental issues from stormwater to flooding to urban heat island. In general, scientists have found that levels of impervious cover of 10 percent or more in an urban area 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 percent to 30 percent within a subwatershed, streams can become severely degraded. The Borough of Westville contains 312 acres of impervious surfaces which is 53% of the dry land portion of the borough (as in land not classified as water or wetlands).

Flooding Blocking Access to High Street

Source: Emma Lee, WHYY

River Drive looking Southeast (to Rt 130)

Stream Buffers and Greenways

Vegetated stream buffers are one strategy for reducing the effects of stormwater runoff. The stream buffer is an area comprising a stream channel and the land immediately inland of the channel. Stream buffers are quite effective at filtering substances that would otherwise be carried into streams by floods or stormwater; they can limit the entrance of sediment, pollutants, and nutrients into the stream itself. The vegetation located within the buffer area traps sediment and it can absorb some of the nutrients in fertilizer that flows to the stream from lawns and farms.

When a stream buffer contains enough trees and large shrubs to create a strong root system and shade, this vegetation can stabilize the stream banks and control the stream's water temperature. The buffer can also serve as a green corridor or "greenway" that gives wildlife greater mobility between larger forested habitat areas, enabling animals to find food, shelter, or other resources. People can also use greenways for recreation. Their linear nature makes them well suited for jogging, walking, and biking. They can also be used for fishing or boat launching if they contain access points to the water. Enhanced access to the Borough of Westville's waterways, if created with minimal impact to the environment, allows visitors to experience them directly, and through their enjoyment, become more determined stewards and advocates for these waterways.

In aesthetic terms, stream buffers can also help preserve the pre-industrial or pre-suburban character of a community, providing a sense of "visual relief." Overall, stream buffers can enhance a community's quality of life, improve water quality, increase property values, provide tourism and recreation opportunities, and bolster the economic value of a community.

The importance of a healthy, intact stream buffer zone has been well documented scientifically over the past 50 years, especially for headwater streams. In general, the wider the stream buffer, the more likely it will provide the borough with the benefits described in the previous three paragraphs. In addition to the floodplain regulations discussed in the floodplains subsection (page 55), New Jersey state law requires a 50-foot buffer around most streams, although municipalities can establish wider buffers.

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. An example of this cross-section is depicted in Figure 11 on Page 24. Because of this tilting, each aquifer emerges on the land surface in a sequential manner. The deepest and oldest strata emerge on the surface near the Delaware River. Where each individual layer emerges is called its "outcrop" area. The Potomac-Raritan-Magothy formation, the deepest and most abundant aquifer, is a major water source for Inner Coastal Plain communities.

Other smaller aquifers on top of the Potomac-Raritan-Magothy formation are the Englishtown and the Mount Laurel-Wenonah. These aquifers are separated by two confining units, the Merchantville-Woodbury and the Marshalltown-Wenonah (see Figure 12: Geology).

Flooding on Willow St. near High St.

Source: Tim Hawk, NJ Advance Media

Aquifers and Confining Units

The Potomac-Raritan-Magothy aquifer is a principal geological formation underlying the Borough of Westville and is the primary source of drinking water for the Borough of Westville's public wells. It has an outcrop area that matches the route of the Delaware River, and so it outcrops along the Borough of Westville's western border.

The Potomac-Raritan-Magothy 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 indistinguishable from one another over large areas of the Coastal Plain as 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 (60 to 150 million years ago).

In the Delaware Valley, three aquifers designated as lower, middle, and upper have been distinguished within the Potomac-Raritan-Magothy system. The Borough of Westville draws from all three aquifer layers for its water. These aquifers are divided by two confining units. The aquifers are largely made up of sands and gravels, locally interbedded with silt and clay. The lower aquifer sits on the bedrock surface. The confining units are composed primarily of very fine-grained silt and clay sediments that 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.

Flooding on High St. - King tide and rain event on June 19, 2019

Source: Emma Lee, WHYY

Low tide along Big Timber Creek

Borough of Westville

Figure 23: Groundwater Recharge Areas

dvrpc

Philadelphia

PA

NJ

Delaware River

Gloucester City

Brooklawn

Camden County

Bellmawr

Lake Martha

West Deptford

Gloucester County

Deptford

Big Timber Creek

Broadway

Crown Point Rd

Gateway Blvd

Delsea Dr

Almonesson Rd

E Olive St

130

45

47

295

0 inches per year

1 to 7 inches per year

8 to 10 inches per year

11 to 15 inches per year

Hydric Soil - no recharge calculated

Wetlands, Open Water - no recharge calculated

0 Miles 0.25 Miles 0.5 Miles

North

Source: NJDEP (2022)

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 or endorsed.

The Potomac-Raritan-Magothy is the primary source of drinking water to New Jersey residents from Burlington to Salem counties, as well as to communities in Delaware. Because of this high usage, the levels of water in this aquifer declined to such low levels that NJDEP established the region as a water supply critical area (Critical Area Number 2) three decades ago. All water supply companies and authorities within this area have annual limits on water withdrawals from the Potomac-Raritan-Magothy aquifer. The entirety of the Borough of Westville is within the boundary of the Critical Area.

Groundwater Recharge

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

The New Jersey Geological Survey (NJGS) has developed a methodology for evaluating land areas for their ability to transmit water to the subsurface, using precipitation records, soil surveys, and land use/land cover data. NJDEP has used this methodology to map the groundwater recharge potential of land areas throughout the state. Recharge is equivalent to the amount of precipitation per year that could reach the water table in an area with a particular combination of soil and land use. It is expressed as inches per year.

It should be noted that the NJGS methodology is limited. The NJGS has stated that this method only evaluates groundwater recharge potential, not aquifer recharge, and should be considered accordingly. Groundwater recharge potential is not the same as aquifer recharge, which the NJGS has defined as the recharge rate for those geological formations that yield economically significant quantities of water to wells.

The Borough of Westville has generally good recharge potential with 46 percent of the borough at moderate recharge rates of between 8 to 10 inches per year.

A quarter of the borough is classified as having no recharge potential, 14 percent recharges 1 to 7 inches per year, 5 percent is 0 inches per year, and 4 percent at 11 to 15 inches per year. The remaining is open water with no recharge calculated. This is shown in Figure 23 on page 65.

Further conversion of pervious land into impervious land would likely decrease the already moderate groundwater recharge potential of the borough, especially if it occurred in the borough's high-recharge areas.

In general, on high recharge lands, large amounts of paving and high impervious cover will have the most detrimental impact, although they are also usually the places that are most suitable for building because they are on well-drained soils. While the surest way to protect groundwater recharge is to leave land undeveloped, there are ways in which urbanized areas can preserve ground and stormwater standards.

Best Management Practices (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. Also referred to as "green stormwater infrastructure," these techniques are used in more developed communities to manage stormwater and protect drinking water supplies

The Borough of Westville Water Tower

CHAPTER 10:

Drinking Water

The Borough of Westville receives its drinking water from the Westville Water Department. The Westville Water Department relies on three wells which draw water from over 300 feet deep in the Potomac-Raritan-Magothy Aquifer. The borough also has the capacity to purchase water from the Woodbury City Water Department and the Deptford Water Department.

In addition, the borough has a five year renewable Shared Service Agreement with the Borough of Brooklawn for 15 million gallons of water from their PRM withdrawal allocation at a cost of $15,000 per year for a total of $75,000.

As required by state and federal regulations, most notably the 1974 Federal Safe Drinking Water Act, the drinking water quality of all utilities is regularly monitored for a variety of chemical and biological contaminants. Monitored chemical contaminants include inorganic compounds, radionuclides (i.e., radioactive compounds), and synthetic organic chemicals. The synthetic organic chemicals that are monitored include volatile organic chemicals (i.e., organic chemicals that readily become gases), pesticides, herbicides, and disinfection by-products. Biological contaminants that are monitored include coliform and Legionella bacteria, as well as parasites such as Giardia and Cryptosporidium. Turbidity (or cloudiness) is also tested. Lead and copper are also tested at a sample number of household taps.

Drinking water supplies are rated by the New Jersey Department of Environmental Protection for their susceptibility to contamination by different parameters, a rating that reflects the potential for contamination rather than its existence. These Contaminant Susceptibility Ratings, shown in Table 14, are reported in the Source Water Assessment Report and Summary for the Borough of Westville. For each of the potential contaminants, the report shows the number of wells which are shown to have High (H), Medium (M), or Low (L) susceptibility to that contaminant.

The Westville Water Department is also required to publish Annual Drinking Water Quality reports which inform residents about the results of their water quality tests. This report is shown in Table 15 on page 70 and with acronyms explained in Table 16 on page 72. Some of the data is more than a year old as the state does not require annual testing of contaminants which do not change frequently.

Westville failed the 2023 Cumulative Quarterly PFNA Water Quality Test and is required by NJDEP to upgrade its Municipal Water Filtration System. This entails finding a vendor to design and manufacture a new filter for PFOS removal that specifically fits its current system. The cost estimate is 1 -2 million dollars. Completion is expected by mid 2025 depending on available grant funding.

The Borough of Westville contains no private wells tested under Private Well Testing Act.

See Figure 25 on page 76 for a map of Westville's water mains.

Table 14: Contaminant Susceptibility Ratings

	Pathogens			Nutrients			Pesticides			Volatile Organic Compounds			Inorganics			Radionuclides			Radon			Disinfection Byproduct Precursors		
	H	M	L	H	M	L	H	M	L	H	M	L	H	M	L	H	M	L	H	M	L	H	M	L
Wells (3)		3			3				3	3			1	2		3					3	2	1	

Source: NJ DEP, 2022

Table 15: Westville Water Department 2021 Annual Report Test Results

Contaminant Category	Specific Contaminant	Date Reported	Violation (Y/N)	Level Detected	Units of Measurement	MCLG	MCL	Likely Source of Contamination
Microbiological Contaminants								
	Coliform Bacteria	2020	No	0/100 ml	P/A	N/A	0	Naturally present in the environment
Radioactive Contaminants								
	Gross Alpha	9/20/16	No	3.05	pCi/l		15	Erosion of natural deposits
	Radium - 228 & 226	9/20/16	No	3.05	pCi/l	0	5	Erosion of natural deposits
Inorganic Contaminants								
	Barium	4/9/18	No	0.088	ppm	2	2	Discharge of drilling wastes; discharge from metal refineries; Erosion of natural deposits
	Copper	2020	No	0.938	ppm	1.3	AL - 1.3	Corrosion of household plumbing systems; Erosion of natural deposits
	Flouride	4/9/18	No	1.5	ppm	4	4	Erosion of natural deposits; water additive which promotes strong teeth; Discharge from fertilizer and aluminum factories

Westville Water Department 2021 Annual Report Test Results Continued

Contaminant Category	Specific Contaminant	Date Reported	Violation (Y/N)	Level Detected	Units of Measurement	MCLG	MCL	Likely Source of Contamination
Inorganic Contaminants (Continued)								
	Lead	4/9/18	No	0	ppb	0	AL - 15	Corrosion of household plumbing systems; Erosion of natural deposits
	Nitrate (as Nitrogen)	2020	No	1.946	ppm	10	10	Runoff from fertilizer use; Leaching from septic tanks and sewage; Erosion of natural deposits
	Total Trihalomethane	8/12/20	No	Range 50.5 - 58.0, Highest detect - 58	ppb	N/A	80	By-product of drinking water disinfection
	Haloacetic Acids	8/29/19	No	Range ND - 9.8, Highest detect - 9.8	ppb	N/A	60	By-product of drinking water disinfection
Regulated Disinfectants								
	Chlorine	2020	N/A	0.11 average; Range 0.1-0.2; Highest detect 0.2	ppm	4.0	4.0	Water additive used to control microbes
Synthetic Organic Compounds								
	PFNA		No	Range 8.82-13.6; Highest detect - 13.6	Ppt	N/A	13	Discharge from industrial chemical factories

Source: Westville Water Department, 2021

Table 16: Glossary of Terms

Acronym	Defintion
ND	Non-Detect - Laboratory analysis indicates that the constituent is not present
ppm	Parts per million
ppb	Parts per billion
pCi/l	Picocuries per liter - A measure of the radioactivity in water
AL	Action Level - the concentration of a contaminant which, if exceeded, triggers treatment or other requirements which a water system must follow
IT	Treatment Technique - A treatment technique is a required process intended to reduce the level of a contaminant in drinking water
MCL	Maximum Contaminant Level - The “Maximum Allowed” is the highest level of a contaminant that is allowed in drinking water. MCLs are set as close to the MCLGs as feasible using the best available drinking technology.
MCLG	Maximum Contaminant Level Goal - The “Goal” is the level of a contaminant in drinking water below which there is no known or expected risk to health. MCLGs allow for a margin of safety.
MRDL	Maximum Residual Disinfectant Level - The highest level of a disinfectant allowed in drinking water.
MRDLG	Maximum Residual Disinfectant Level Goal - The level of drinking water disinfectant, below whih there is no known or expected risk to health. MRDLGs do not reflect the benefits of the use of disinfectants to control microbial contamination.

Source: NJ DEP

CHAPTER 11:

Sewer

As shown in Figure 24 on page 75, almost all areas in the Borough of Westville are approved for sewer service. The areas that are not approved are at the Northeastern end of Timber Avenue next to Big Timber Creek.

The Westville Water Department maintains the sewer pipes for the Borough of Westville. These pipes transport sewage to the Gloucester County Utilities Authority (GCUA) based in West Deptford Township. GCUA is a regional wastewater collection system that serves 16 municipalities with 71 miles of pipes and treats over 6.3 billion gallons of wastewater annually. Wastewater is treated at GCUA's facility and then discharged into the Delaware River. The biosolids removed as part of the treatment process are incinerated on site.

Floodwater drainage gate (see the Stormwater and Flooding sections on pages 49 - 56)

Borough of Westville

Figure 24: Sewer Service Area

dvrpc

Sewer Service Area

Philadelphia

PA

NJ

Delaware River

Gloucester City

Brooklawn

Camden County

Bellmawr

Big Timber Creek

Lake Martha

West Deptford

Gloucester County

Deptford

130

45

47

295

Broadway

Crown Point Rd

Gateway Blvd

Delsea Dr

Almonesson Rd

E Olive St

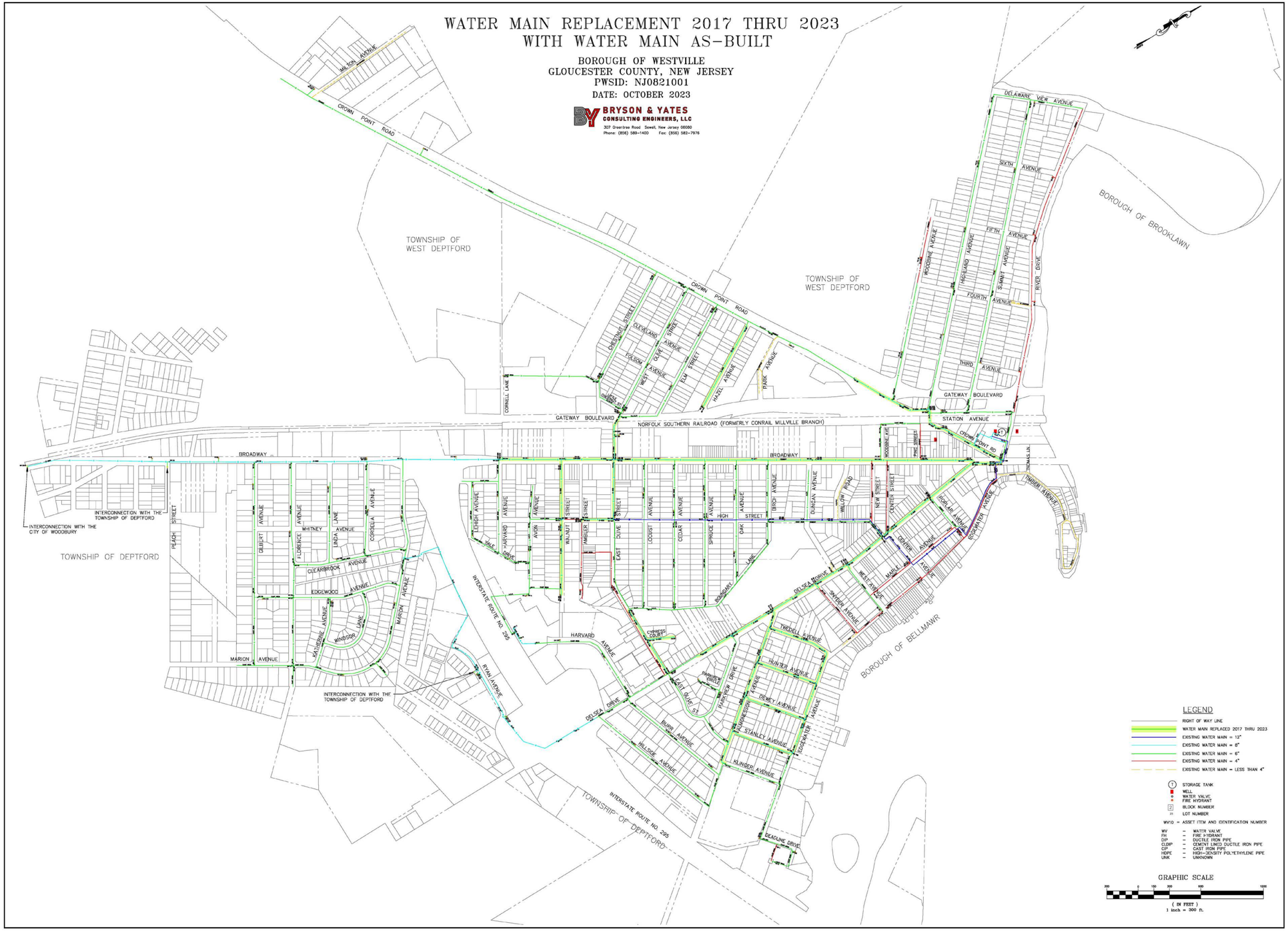
0 Miles 0.25 Miles 0.5 Miles

North

Source: NJDEP (2022)

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 or endorsed.

Figure 25: Westville Water Main As-Built Map



Source: Bryson & Yates Consulting Engineers, LLC

CHAPTER 12:

The Value of Biological Resources

When a community protects wildlife and habitat, it is also protecting biodiversity, which encompasses the variety of genetic material within a particular species population, the variety of species (plants, animals, microorganisms) within a community, and the variety of natural communities within a given region. Biodiversity allows species to adapt and evolve as their environments change, improving their chances for survival, as well as that of the biological communities of which they are a part. A diversity of plant and animal species is also necessary to maintain healthy human environments, agricultural productivity, and ecosystem health. Other types of organisms, including fungi and bacteriav — many of which are not well known — contribute to nutrient cycling, decomposition of organic matter, soil rehabilitation, pest and disease regulation, pollination, and water filtering. Once biodiversity declines, it is extremely hard for an ecosystem to recover or replace species.

Scientists have discovered and named somewhere between 1.5 and 1.8 million plant and animal species, and there is an estimated 10 to 20 times that number unknown to science. Alarmingly, this great diversity of species is now diminishing at an unprecedented rate. Researchers generally agree that the extinction rate is now catastrophically high, somewhere between one thousand and ten thousand times the rate before human beings began to exert significant pressure on the environment. Given these trends, and barring significant increases in conservation efforts, approximately one-half of the world's species will be gone by the end of this century.

While the decline of biodiversity is indeed a global problem, conservation needs to occur on both global and local levels if it is to succeed. The Borough of Westville contains numerous types of natural habitats, all of which are important for maintaining biodiversity; the most common are deciduous forest, deciduous wooded wetland, and tidal mud flats, but several others are represented in the borough. The following sections will identify and describe in more detail the plant and animal communities that inhabit these habitats within the borough.

Thomas West Park

CHAPTER 13:

Natural Vegetation

A region's vegetation is dependent on many factors, the most important of which are climate and soils. The Borough of Westville's climate is temperate and rainfall averages almost 48 inches per year. The Borough of Westville contains soils that are well drained and support a large diversity of trees and brushs as well as poorly drained soils which sustain wetland plants.

The Borough of Westville's natural vegetation types, along with human-influenced types of land cover, have been tabulated and mapped most recently by NJDEP's 2015 land use/land cover analysis, which is shown in Table 17 below and Figure 26 on page 81. Each land cover type, including vegetation, is based on definitions provided by the Anderson Land Use Classification System, which was created by the USGS.

Table 17: 2015 Natural Vegetation

Land Cover Category	Land Cover Type	Acres	Percentage of Total Land
Forest			
	Coniferous Forest (>50% Crown Closure)	1.60	0.18%
	Deciduous Forest (>50% Crown Closure)	16.40	1.88%
	Deciduous Forest (10-50% Crown Closure)	12.08	1.48%
	Mixed Forest (>50% Deciduous with 10-50% Crown Closure)	3.38	0.39%
	Forest Total	**33.46**	**3.84%**
Grasslands			
	Deciduous Brush/Shrubland	6.03	0.69%
	Old Field (>25% Brush Covered)	4.42	0.51%
	Phragmites Dominate Old Field	0.41	0.05%
	Grassland Total	**10.86**	**1.25%**
Wetlands			
	Deciduous Scrub/Shrub Wetlands	12.37	1.42%
	Deciduous Wooded Wetlands	20.81	2.40%
	Freshwater Tidal Marshes	5.00	0.57%
	Managed Wetland in Built-up Maintained Rec Area	3.20	0.37%
	Phragmites Dominate Coastal Wetlands	0.23	0.03%
	Phragmites Dominate Interior Wetlands	0.32	0.04%
	Wetlands Total	**41.93**	**4.81%**

Source: NJ DEP, 2015

Borough of Westville

Figure 26: Natural Vegetation Areas

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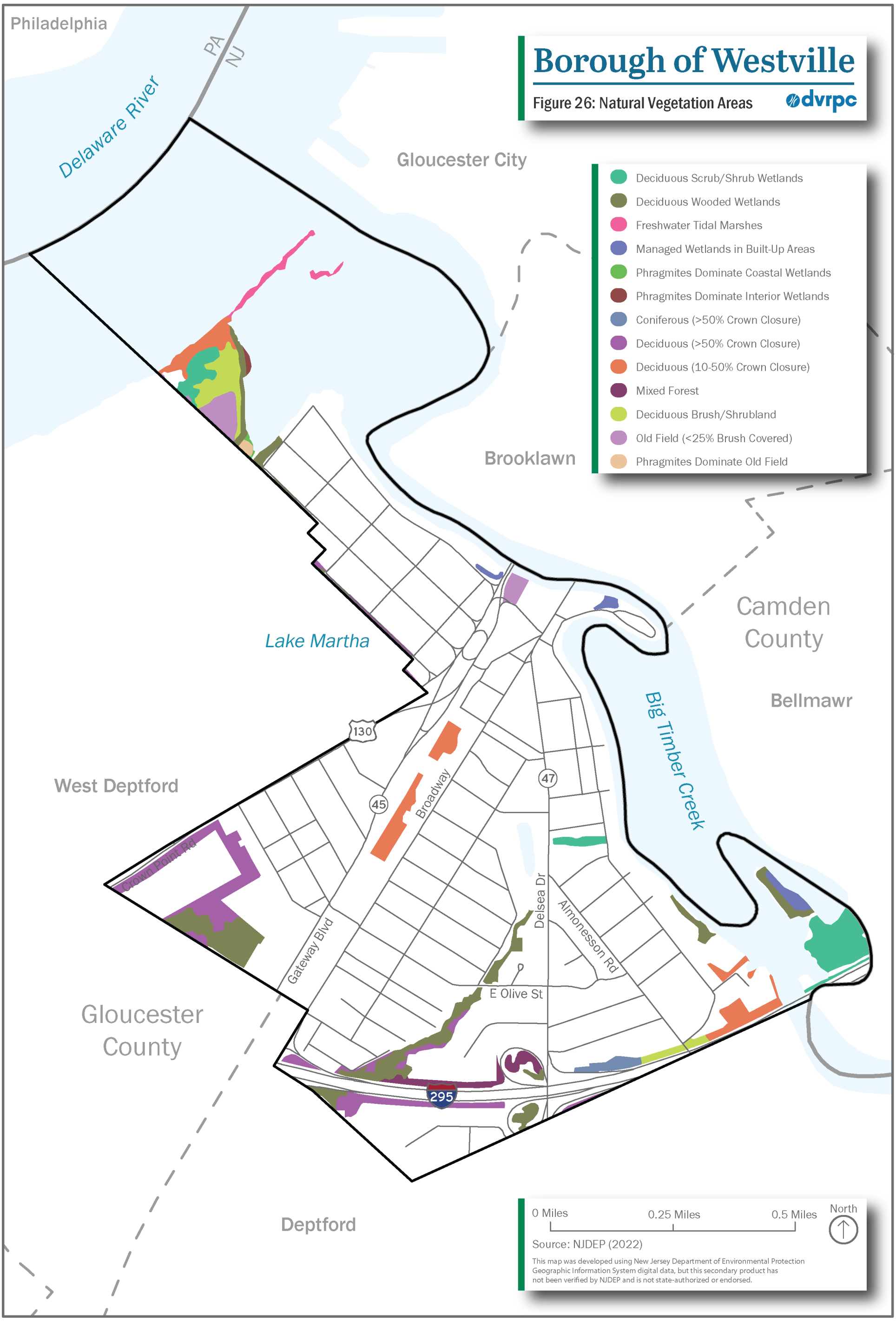


Source: NJDEP (2022)

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 or endorsed.

Borough of Westville

Figure 27: Wetlands

dvrpc

Wetlands

Wetlands

As was discussed in the wetlands section, a wetland in basic terms is an area that has enough water at some time during the year to stress plants and animals that are not adapted to life in water or saturated soils. The Borough of Westville primarily contains tidal wetlands that are associated with tidal portions of the Delaware River system, as well as a few acres of interior wetlands. None of the borough's marshes are saline.

According to NJDEP, wetlands compose 41.93 acres, or 4.81 percent, of the Borough of Westville's total land use/land cover. The Borough of Westville contains freshwater tidal marshes, scrub/shrub wetlands, and wooded wetlands. The borough also contains phragmites dominate wetlands, which support an aggressive non-native plant, Phragmites.

Wooded Wetlands

Wooded wetlands are dominated by deciduous trees. There are 20.81 acres of forested wetland land cover in the Borough of Westville. The predominant forested wetland canopy species may include red maple (Acer rubrum), tupelo (Nyssa sylvatica), green ash/ red ash (Fraxinus pennsylvanica), black willow (Salix nigra), swamp white oak (Quercus bicolor), willow oak (Quercus phellos), southern red oak (Quercus falcata), American sweetgum (Liquidambar styraciflua), and American sycamore (Platanus occidentalis). These species combine to form a series of mixed hardwood lowland habitats throughout New Jersey. In the Borough of Westville, this habitat type is found along the western edge of the borough and south of Thomas West park.

Freshwater Tidal Wetlands

Freshwater tidal wetlands, which are present on 5 acres of the borough's land cover, are co-dominated by annual and perennial herbaceous plant species that grow in tidal waters with salinities of less than one part per thousand. Freshwater marsh species in western New Jersey often include yellow water lily (Nuphar lutea), green arrow arum (Peltandra virginica), pickerel weed (Pontederia cordata), annual wild rice (Zizania aquatica), dotted smartweed (Polygonum punctatum), smooth beggartick (Bidens laevis), and broadleaf cattail (Typha latifolia). Marshes with this type of vegetation are most often found on the tidal Delaware River and its tributaries.

Phragmites Dominate Interior Wetlands

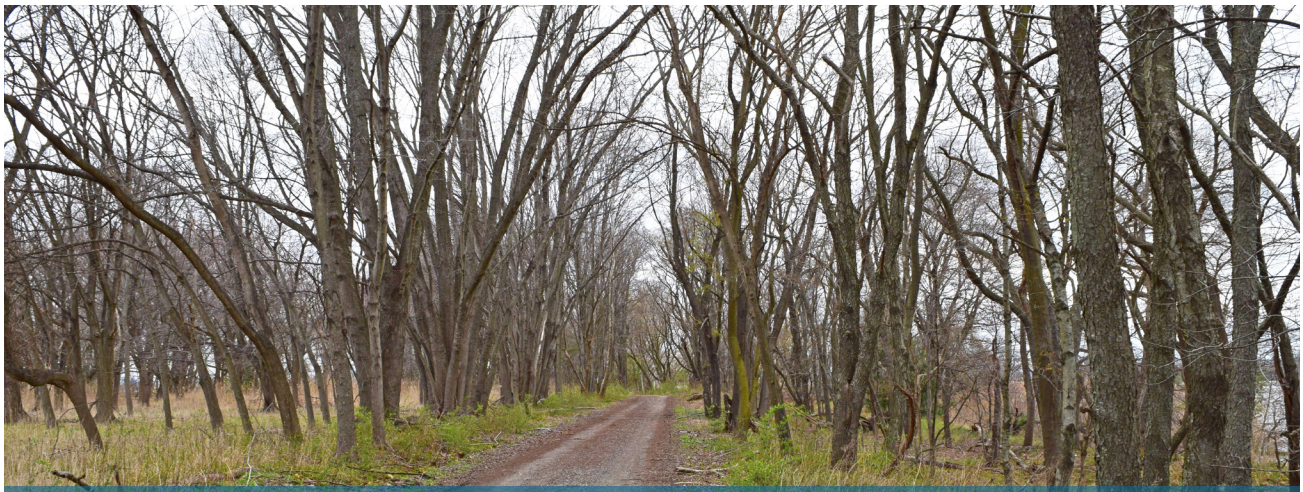
Phragmites dominate wetlands are a type of wetland that contains herbaceous vegetation dominated by Phragmites. Phragmites is an invasive grass species that is six feet or more in height, and grows rapidly and in large stands, choking out native species in the process. It moves into wetland areas from adjoining drier land, growing through underground shoots that are difficult to eradicate. As it spreads, Phragmites often traps silt and thus gradually raises the land level, converting the habitat to one that is drier. This wetland classification makes up 0.55 acres in the borough.

Scrub/Shrub Wetlands

Scrub/shrub wetlands are closely associated with deciduous wooded wetlands, and often make up transitional areas between deciduous wetland and other land cover types. They are located on 12.37 acres of the Borough of Westville's land. Typical native species in scrub/shrub wetlands in New Jersey include sweet pepperbush (Clethra alnifolia), buttonbush (Cephalanthus occidentalis), swamp rose (Rosa palustris), elderberry (Sambucus species), arrowwood viburnum (Viburnum dentatum), winterberry (Ilex verticillata), and silky dogwood (Cornus amomum). In the Borough of Westville, these wetlands exist along Big Timber Creek and the Delaware River with a few acres in the middle of the Borough of Westville south of Thomas West Park.

Joseph Arsenault Wetland Report

Environmental consultant Joseph Arsenault created a Wetland Mapping Project for the Borough of Westville in February of 2022. His mapping, shown in Figure 27 on page 82, mapped 77.41 acres of wetlands including 14.931 acres of freshwater wetlands, 60.524 acres of tide marsh/tide influenced wetlands, and 1.955 of non-tidal open water. The full report can be found in Appendix E.



Wheelabrator Wildlife Refuge

Forests

Forests are the second-most abundant natural vegetation type in the Borough of Westville after wetlands. Upland forests are dominated by tree cover and do not have water at or near the soil surface. The majority of the Borough of Westville was covered with upland deciduous forest before human settlement, at which time residents began clearing forests for lumber and farmland. Most upland areas have been converted to development. As indicated in Table 17: 2015 Natural Vegetation, 33.46 acres (3.84 percent) of the Borough of Westville's land use/land cover is now composed of upland forests. Today's upland forests are second or third growth. They are found throughout the borough, although they tend to be located near stream corridors or as a buffer between residential areas and transportation or industrial land uses.

Deciduous Forest

Deciduous forest of various types comprises the majority of upland forest in the Borough of Westville at 28.48 acres. Some of the most recognizable trees in local deciduous forests are black oak (Quercus velutina), white oak (Quercus alba), mockernut hickory (Carya tomentosa), American sweetgum (Liquidambar styraciflua), American beech (Fagus grandifolia), and flowering dogwood (Cornus florida). The composition of the Borough of Westville's upland deciduous forests is largely one of mixed oaks— black, red, and white oaks (Quercus velutina, Q. rubra, and Q. alba)—joined by other hardwoods such as birch (betula species), sycamore (Platanus occidentalis), beech (Fagus grandifolia), hickory (carya species), eastern black walnut (Juglans nigra), and locust (black locust, Robinia pseudoacacia; and honey locust, Gleditsia triancanthos). The understory is dominated by flowering dogwood, black cherry (Prunus serotina), and sassafras (Sassafras albidum). Vines, such as wild grapes (vitis species), Virginia creeper (Parthenocissus quinquefolia), and poison ivy (Toxicodendron radicans), are common. Spicebush (Lindera benzoin), arrowwood viburnum (Viburnum dentatum), and black haw (Viburnum prunifolium) are common shrubs in moister locations.

Coniferous Forest

Coniferous forest land is located on 1.6 acres in the Borough of Westville just to the east of intersection of I-295 and Highway 47. Coniferous forests are typically composed of successional plant species and may include red cedar (Juniperus virginiana), Virginia pine (Pinus virginiana), and pitch pine (Pinus rigida). They will most likely be overgrown over time by dominant deciduous trees, such as ash (fraxinus species), birch, oak, and hickory.

Mixed Forest

An additional 3.38 acres of forest consist of mixed deciduous and coniferous trees, and represent an intermediate stage in forest succession.

Grasslands

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 provide habitat for specialized species, such as grassland birds and shade-intolerant herbaceous plants that cannot live elsewhere. 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 field that was cleared or disturbed at one time and then abandoned. Following abandonment, old field land cover is overgrown by perennial herbs and grasses. These pioneer plants remain the dominant species for three to 20 years. Later, woody plants take over in the process of habitat succession.

Grassland is often encountered along wood edges or roadsides, and in landscapes where mowing is infrequent and where woody plants are not yet the dominant vegetation. To be sustained, grasslands must be mowed every one or two years. Grasslands are also highly susceptible to invasive species.

The Borough of Westville contains 10.86 acres of fields including 6.03 acres of deciduous brush/shrubland, 4.41 acres with less than 25% brush cover located along Big Timber Creek directly adjacent to the Southeast side of the Route 130 bridge, and 0.42 acres of old fields dominated by phragmites.

Rare Plant Species

According to the Natural Heritage Database, NJDEP's maintained list of documented sightings of threatened and endangered species, three rare plant species have been observed in the Borough of Westville. As seen in Table 18, these plant species do not have recorded observations in recent years.

Marsh Water-starwort

Marsh Water-starwort prefers still or slow-moving waters in lakes or ponds, the shores of rivers and lakes, and swamps. The flowers are able to be pollinated by wind when exposed and by water when floating or fully submerged.

Awl-leaf Arrowhead

Awl-leaf Arrowhead is an aquatice plant which lives in brackish salt marshes, floodplains, fresh tidal marshes, or the shores of rivers and lakes. It can form small mats in the water and is found from Mississippi to Connecticut.

Smooth Hedge-nettle

Smooth Hedge-nettle is a flowering herb in the mint family. It prefers partial sun and moist conditions and blooms during the summer for about 1 - 2 months.

Table 18: Rare Plant Species

Scientific Name	Common Name	State Rank	Date Last Observed
Callitriche palustris	Marsh Water-starwort	S2	1975-06-28
Sagittaria subulata	Awl-leaf Arrowhead	S3	1923-08-08
Stachys tenuifolia	Smooth Hedge-nettle	S3	1923-08-08

Source: Natural Heritage Database, 2022

CHAPTER 14:

Landscape Project Priority Habitats

The Landscape Project, developed by the Endangered and Nongame Species Program of the NJDEP Division of Fish and Wildlife, is an interactive ecosystem-based mapping tool which categorizes wildlife habitats into one of five groups according to their importance, with Rank 5 being the highest. Ranks 3–5 include habitats that possess two exceptional conditions: (1) a documented occurrence of one or more species on 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." Ranks 1 and 2 include habitats that either have a documented occurrence of a Species of Special Concern 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."

The Landscape Project identifies both critical and suitable habitat in the Borough of Westville, which is described in Table 19 and shown in Figure 28 on the page 89. Preserving these habitats will help maintain the diversity of species that still exist in the borough and improve the likelihood of survival for endangered and threatened species. Landscape Project areas in the Borough of Westville provide habitat for 7 rare species, which are described in the following sections on animals found in the Borough of Westville.

Table 19: Threatened and Endangered Species Habitat

Rank	Rank Description	Acres
1	Habitat Specific Requirements	190.09
2	Special Concern	14.59
3	State Threatened	0.93
4	State Endangered	114.37
5	Federal Listed	336.86
Total		656.84

Source: NJ DEP, 2017

Borough of Westville

Figure 28: Landscape Project Habitats

dvrpc

Rank 1: Habitat Specific Requirements
Rank 2: Special Concern
Rank 3: State Threatened
Rank 4: State Endangered
Rank 5: Federal Listed

Philadelphia
PA
NJ
Delaware River
Gloucester City
Brooklawn
Camden County
Bellmawr
Lake Martha
West Deptford
Gloucester County
Deptford
Crown Point Rd
Broadway
Gateway Blvd
Delsea Dr
Almonesson Rd
E Olive St
Big Timber Creek
130
45
47
295

0 Miles 0.25 Miles 0.5 Miles North

Source: NJDEP (2022)

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 or endorsed.

Borough of Westville

Figure 29: Important Bird Areas

dvrpc

Important Bird Areas

Philadelphia
PA
NJ
Delaware River
Gloucester City
Brooklawn
Camden County
Bellmawr
Big Timber Creek
Lake Martha
West Deptford
Gloucester County
Deptford
130
45
47
295
Broadway
Crown Point Rd
Gateway Blvd
Delsea Dr
Almonesson Rd
E Olive St

0 Miles 0.25 Miles 0.5 Miles North

Source: National Audubon Society (2022)

CHAPTER 15:

Animal Communities

Although no comprehensive inventory of the different animal species within the Borough of Westville exists, there are a variety of different types of records that can be pieced together. Using federal, state, scientific, and nonprofit sources, it is possible to identify and describe known and possible animals in the Borough of Westville and surrounding areas. A compilation of animals that may be found in the Borough of Westville is included in the Appendices.

Rare, threatened, and endangered species are ranked on the level of their scarcity at both the global and United States state level. This system was developed by The Nature Conservancy and is now maintained by NatureServe. The state level rankings are shown in Table 20.

Table 20: State Level Rare Species Ranking

Rank	Rank Description
1	Critically imperiled because of extreme rarity or because it is somehow especially vulnerable to extinction or extirpation, typically with 5 or fewer occurences
2	Imperiled because of rarity or because other factors demonstably make it very vulnerable to extinction or extirpation, typically 6-20 occurences
3	Rare, uncommon or threatened, but not immediately imperiled, typically with 21-100 occurences
4	Not rare and apparently secure, but with cause for long-term concern, usually with more than 100 occurences
5	Demonstrably widespread, abundant, and secure
H	Historical occurance, formerly part of the native biota with the implied expectation that it may be rediscovered
X	Presumed extirpated or extinct
U	Unknown rank
?	Not yet ranked or assigned rank is uncertain

Source: NJ DEP, 2022

Invertebrates

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

Macroinvertebrates are invertebrates that are visible to the naked eye but are smaller than 50 millimeters. 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 long period of time. NJDEP's AMNET program surveys streams for macroinvertebrate communities, which indicate water quality levels.

There are 10 invertebrate species listed as endangered in New Jersey: four butterfly species, three mussel species, two beetle species, and one dragonfly species. There are also 14 invertebrate species listed as threatened: six dragonfly species, five mussel species, and three butterfly species. Before New Jersey communities were as heavily developed as they are today, freshwater mussels were abundant in the state's streams and were a major food source for the region. Because of the destruction of suitable aquatic habitats by dams and pollution, the native mussel population has sharply declined.

Rare Invertebrates

According to the Natural Heritage Database, three rare invertebrate species have been recorded in the Borough of Westville, see Table 21. All three are moths and include the Pink Streak and two moths of the Noctuid family. The Pink Streak is found in the eastern United States from Kansas to Texas and is listed as endangered in Massachusetts and Connecticut. The two Noctuid moths are Macrochilo Louisiana and Macrochilo Santerivalis.

Table 21: Rare Invertebrates

Scientific Name	Common Name	Rank
Dargida rubripennis	Pink Streak	S3
Macrochilo louisiana	A Noctuid Moth	S2, S3
Macrochilo santerivalis	A Noctuid Moth	S1, S3

Source: NJ DEP, 2022

Vertebrates

Vertebrates are less numerous than invertebrates, but their larger size makes them much more visible and thus better studied and recorded. Fish, amphibians, reptiles, birds, and mammals are fairly well documented.

Fish

The Borough of Westville's water bodies and wetlands provide habitat and food to freshwater fish. Like mussels, fish were once abundant along the Delaware River and its tributaries. Water quality degradation from urban development and agricultural practices has caused most fish populations to decline.

Nevertheless, a variety of fish species have been observed in the Borough of Westville's environs. No known list of fish species exists that is focused only on the Borough of Westville, but several groups are tracking them in the borough. See Appendix B for a list of freshwater fish species encountered near the Borough of Westville.

The NJDEP Division of Fish and Wildlife counts fish in the Lower Delaware River, which is the section of the Delaware River that the Borough of Westville borders, through its annual Delaware River Seine Survey. Native, nonnative, and invasive fish are included in this inventory. This program has lasted for over three decades. Its most recent available records (2019) lists 43 species, with bay anchovy (Anchoa mitchilli), white perch (Morone americana), banded killifish (Fundulus diaphanus), spottail shiner (Notropis hudsonius), and blueback herring (Alosa aestivalis) being the most common.

The New Jersey Conservation Foundation records a variety of species of fish in the Big Timber/Mantua Creek watershed and farther inland. Species mentioned in this watershed include atlantic shad (Alosa sapidissima), largemouth bass (Micropterus salmoides), striped bass (Morone saxatilis), yellow perch (Perca flavescens), American eel (Anguilla rostrata), chain pickerel (Esox niger), and channel catfish (Ictalurus punctatus).

The Natural Heritage Database includes two federally listed endangered species of fish, the Atlantic sturgeon (Acipenser oxyrinchu) and the shortnose sturgeon (Acipenser brevirostrum), which have been observed in the Borough of Westville, see Table 22. The Delaware River is a migration corridor for these species.

Table 22: Endangered Species of Fish

Scientific Name	Common Name	Rank
Acipenser oxyrinchus	Atlantic Sturgeon	S1
Acipenser brevirostrum	Shortnose Sturgeon	S1

Source: NJ DEP, 2022

Atlantic Sturgeon

The Atlantic sturgeon (Aceipenser oxyrhynchus) lives in coastal waters from Canada to Florida. Hatching in the freshwater of coastal rivers, the Atlantic sturgeon travels to the sea as a sub-adult and returns to freshwater as an adult to spawn. Atlantic sturgeon are larger than Shortnose sturgeon and have been recorded to reach up to 14 feet in length and 60 years of age. They were once found in large numbers, but their populations have declined due to overfishing

and habitat loss. The primary threats facing Atlantic sturgeon today are entanglement in fishing gear, habitat degradation, habitat impediments such as dams, and vessel strikes.

Shortnose Sturgeon

The shortnose sturgeon (Acipenser brevirostrum) is the smallest of three sturgeon species that occur in eastern North America. Sturgeon are sometimes called "living fossils" since they are among the oldest bony fishes, and have retained many primitive characteristics. This species migrates between freshwater and saltwater during its life (making it "diadromous") and is found in large estuaries and near-shore waters along the Atlantic Coast from Canada to Florida. A significant portion of New Jersey's shortnose sturgeon population occurs in the upper tidal Delaware River. This species is listed as state and federally endangered. Once heavily fished for their meat and eggs, sturgeon are now threatened more by river dredging and water quality degradation from contaminants like endocrine-disrupting chemicals. Other threats include boat strikes, bycatch, and poaching.

Amphibians and Reptiles

New Jersey contains 71 species of amphibians and reptiles. This list includes 16 salamanders, 16 frogs and toads, 13 turtles, three lizards, and 23 snakes. Amphibians of some types, such as bullfrogs (Rana catesbeiana), are abundant. Other species are rare, in part because they depend on vernal ponds, which typically form on a seasonal basis. Amphibians may also be rare because they also depend on high-quality waterways. There are three state-listed endangered species in New Jersey (two salamander species and one tree frog species) and three state-listed threatened species (two salamander species and one tree frog species). No species in these categories is known to reside in the Westville.

Reptiles can also be quite elusive when surveys attempt to find and record them. No reptile species of special concern are known to reside in Westville. There are eight state-listed endangered reptile species in New Jersey (three snake species and five turtle species) and three state-listed threatened species (one snake species and two turtle species). As with amphibians, no species in these categories is known to reside in Westville.

No known list exists of amphibians or reptiles that is focused only on the Borough of Westville. However, many of the species recorded by the NJDEP Division of Fish and Wildlife may be found in the Borough of Westville. See Appendix C for a list of amphibians and reptiles found in New Jersey.

Birds

There are between 350 and 500 species of birds in New Jersey, 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 the New Jersey Atlantic coast and the Delaware Bay are major parts of the Atlantic, or Eastern, Flyway, an established migratory air route in North America shown in Figure 30.

Reflecting the Borough of Westville's location as a developed waterfront community, common birds found in the area include waterfowl, gulls, herons/egrets, doves, sparrows, wrens, finches, and some owls.

One bird species of conservation concern is known to exist in the Borough of Westville: the State Endangered bald eagle (Haliaeetus leucocephalus); and one species of special concern: the great blue heron (Ardea Herodias). Both are listed in Table 23.

Table 23: Bird Species of Concern

Scientific Name	Common Name	Rank
Haliaeetus leucocophalus	Bald Eagle	S1, S2
Ardea herodias	Great Blue Heron	S3, S4

Source: NJ DEP, 2022

Bald Eagle

Bald eagles (Haliaeetus leucocephalus) can be found throughout the state year-round. They nest close to water, enabling them to hunt and eat fish and other aquatic species. According to the Conserve Wildlife Foundation of New Jersey, there are now 150 nesting

pairs of eagles in the state after they were driven to the brink of extirpation (local extinction) in 1970 from the effects of the pesticide DDT. Eagles are very sensitive to human disturbance and will abandon their nest sites if people encroach on the area during the nesting season. They also continue to be affected by chemicals and heavy metals in their environment.

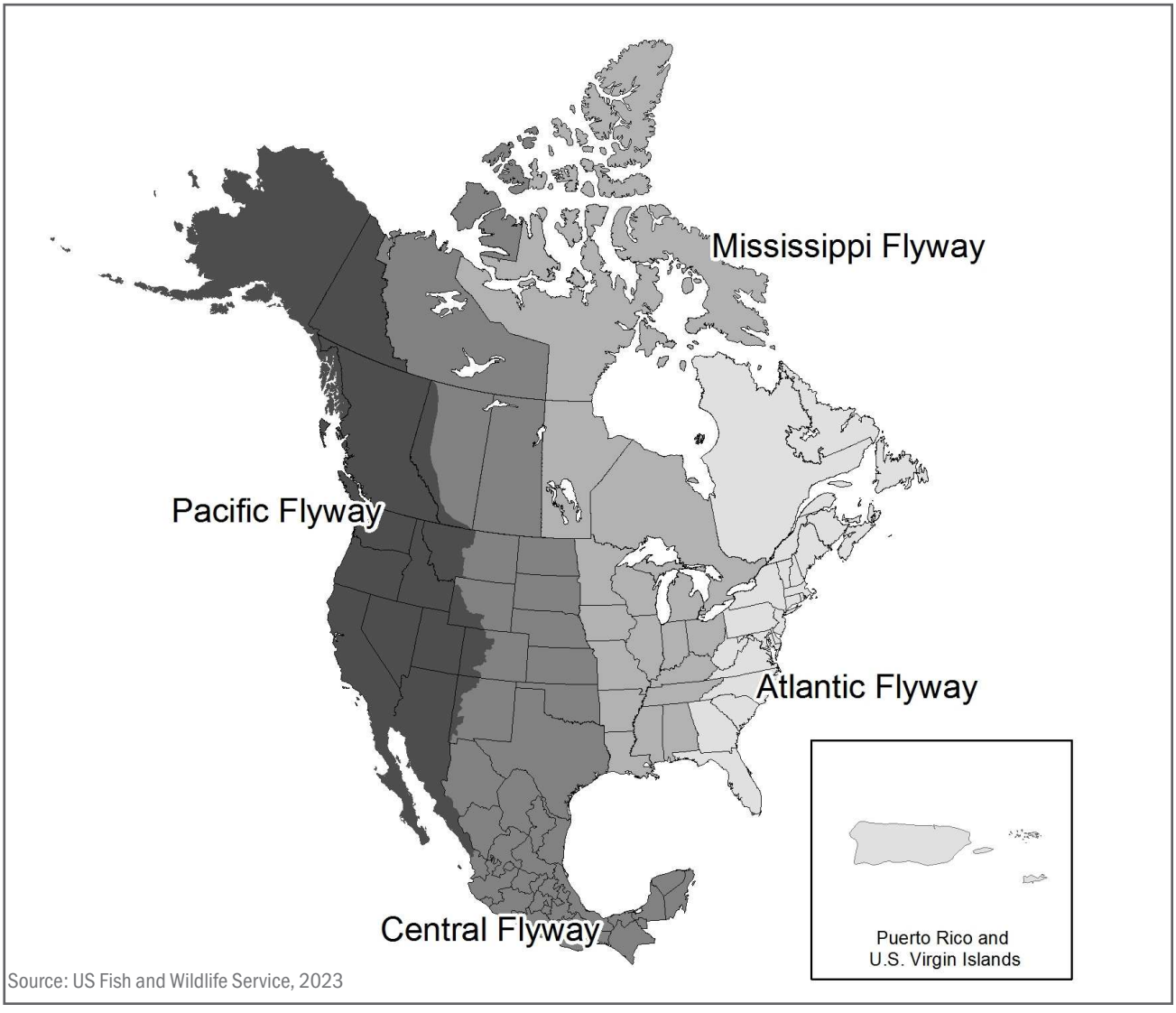
Great Blue Heron

The great blue heron (Ardea herodias), at 46 inches in length and with a wingspan of 72 inches, is the largest heron found in North America. This wading bird is found in a wide variety of aquatic habitats, including freshwater and saltwater marshes, lake edges, streams and shorelines. The great blue heron feeds on aquatic reptiles, amphibians, and small fish. It nests in adjacent woodlands, in colonies of up to five hundred breeding pairs. While the non-breeding population is stable in New Jersey, breeding pairs have been identified as a species of special concern.

Mammals

Mammals are more easily documented than other species because they tend to be larger and live in habitats also ideal for human development. There are over 90 mammal species in New Jersey, including nearly 30 types of whales and dolphins. Nine species of mammals are listed by the state as endangered including six species of whales, the Indiana Bat, the White-footed Mouse, and the River Otter. Of these three land-based species, the White-footed mouse hasbeen reported to exist within Westville. Some other

Figure 30: Migratory Bird Flyways



Source: US Fish and Wildlife Service, 2023

common mammals documented in Westville include American Beavers, Eastern chimpmunks, cottontail rabbits, gray squirrels, groundhogs, house mice, muskrats, raccoons, opossums, skunks, white tailed deer, meadow voles, and moles.

Important Bird Areas

The Important Bird Area is a global effort by the National Audubon Society to identify, promote, and conserve areas that are vital to birds and other species. Important Bird Areas are not regulated but are instead designated by Audubon chapters as high priority areas for conservation within their jurisdiction. The New Jersey Audubon Society has an expanded initiative called the Important Bird and Birding Area (IBBA) Program that identifies areas that provide essential habitat for sustaining bird populations as well as areas that provide exceptional opportunities for bird watching. The New Jersey IBBA program has identified 122 sites within the state.

One of these areas, the Mantua, Woodbury, and Big Timber Creeks IBBA is partially within the Borough of Westville as shown in Figure 29 on page 90

The Mantua, Woodbury, and Big Timber Creeks IBBA is 7,340 acres with approximately 90 acres within the Borough of Westville. It includes the main channels of each creek listed in the IBBA's name from the Delaware River inland. It is a state level priority area and contains diverse habitats such as tidal wetlands, interior wetlands, and upland forest. It is one of New Jersey's most urbanized IBBAs, surrounded on all sides by suburban development. This area provides breeding and wintering habitat for the State Endangered red-shouldered hawk (Buteo lineatus) and is home to an exceptional single-species concentration of the migratory waterfowl, northern pintail (Anas acuta). It is a major wintering site for waterfowl, such as mallards (Anas platyrhynchos) and American black ducks (Anas rubripes).

Canada Geese

The State of New Jersey now has a resident Canada goose population of birds that no longer migrate along the Atlantic Flyway. In 2018 this population was approximately 63,000 while the migratory population was between 70,000 to 80,000. Although geese can provide enjoyable wildlife viewing opportunities, they can also cause property and environmental damage. Goose droppings that wash into lakes during storms can elevate coliform bacteria to unhealthy levels, polluting surface waters and closing lakes to swimming. Also, because geese can be quite aggressive during the nesting season, they can potentially injure humans. However, 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. Like all waterfowl, Canada geese are protected by the Migratory Bird Treaty Act. Therefore, a management program may require the USDA's approval. Management techniques include planting shrubby vegetation around streams, lakes, and ponds to block waterfowl access; discouraging humans from feeding geese; and using fertility reduction techniques, such as egg addling or removal.

Just wanted a donut: Beaver outside of Pisker's Bakery in spring 2023

Source: Bill Whinna, Westville Police Cheif

World War II, Korea, and Vietnam War Memorial in Thomas West Park

Source: Bob Peyre-Ferry

CHAPTER 16:

The Built Environment

Important Structures

Early Schools

Newbold School

Constructed in 1885 along Crown Point Road just south of the intersection with Woodbine Avenue, the Newbold school is considered the oldest school in Westville. It played an important role in the development of the community of the Borough of Westville and was in use until 1964. It was torn down in 1966.

School #1

Westville Public School, or School #1, was constructed prior to 1909 on New Street a few lots east of where New Street intersects with High Street. This school was torn down and rebuilt in 1912 closer to the intersection with High Street where it stayed in use until the middle of the century.

School #3

School #3 was built in 1926 to accomodate the increase in population after World War 1.

Current Schools

Parkview Elementary School

Parkview Elementary School is located in the center of the Borough of Westville directly adjacent to Thomas West Park. It educates students from Pre-Kindergarten to the 6th Grade.

Gateway Regional High School

The Gateway Regional School District in Woodbury Heights was formed in 1964 to accomodate students from the Borough of Westville and surrounding municipalities. Before Gateway was formed, students attended either Woodbury or Gloucester City High School until 1940 and just Woodbury High School from 1940 to 1964. To accommodate the increased enrollment, Gateway Regional High School constructed a new addition in 1966 and acquired adjacent land in 1976.

Library

Located at 1035 Broadway, the Westville Free Public Library, shown below, is a member of the Libraries of Gloucester/Salem Information Network (LOGIN).

Police Department

The Westville Police Department was established in 1914 and is located at the Municipal Office Building in Downtown Westville.

The Borough of Westville Free Public Library

Westville Fire Department

Fire Department

Firefighting in the Borough of Westville began formally in 1898 when the Union Fire Company was formed. This Company was headquartered in several locations before purchasing Prosperity Hall at Broadway and Pine Street in 1921. In 1922, the Independent Fire Company formed as the second fire company in the Borough of Westville and was based at Broadway and West Olive Street. In the face of limited volunteers and budgets, these two companies merged in 1988 to form the Westville Fire Department. The stations were also impacted by this merger with the Station at Broadway and Pine Street turning into the administrative headquarters and the Station on West Olive Street containing all the apparatus. There are currently over 130 members in the Department

Historic Sites

Thomas West House

Built in 1746 by Thomas West, the founder and namesake for The Borough of Westville, the Thomas West House is located at the intersection of 6th Avenue and River Drive. Major additions were added to the house in 1819 and the early 1900s, but the original structure remains to this day. The house is also rumored to be a stop on the underground railroad and originally contained a tunnel that led to the shore of Big Timber Creek.

Fort Nassau

As the first European colonizers in the region, the Dutch constructed Fort Nassau in 1624 at the mouth of Big Timber Creek. This was the first permanent European structure in New Jersey. It was partially dismantled in 1651. The exact location of this fort is unknown and was potentially located in Gloucester City, Brooklawn, or the Borough of Westville.

Ladd's Castle

John Ladd was a surveyor from England who helped William Penn lay out the city of Philadelphia. Offered a city block as payment, Ladd instead requested to be paid in silver which he used to purchase land in New Jersey in 1688. He constructed a house, originally known as "Candor Hall," on this land in 1690 which remains to this day in the city of Woodbury.

CHAPTER 17:

Contamination and Known Contaminated Sites

Known Contaminated Sites

The New Jersey Known Contaminated Sites List 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. The most dangerous sites from a human health standpoint are those on the National Priorities List, commonly known as Superfund sites. Information on Superfund sites can be retrieved using the Comprehensive Environmental Response, Compensation, and Liability Information System. Most other contaminated sites are handled by the state—specifically, NJDEP. However, NJDEP may not have knowledge of all contamination present in a given municipality, as some contaminants from a previous use of a property may continue to be undetected (e.g., contaminants may be buried underground on a site that has not been disturbed since that time), or the contamination may be unreported by the site owners.

As of February 2022, there were 7 active known contaminated sites within the Borough of Westville and they are listed in Table 24. Detailed information on each Remedial Level classification is located in Table 25 on page 100.

Active sites, shown on Figure 31 on page 101, have confirmed contamination of the soil, groundwater, and/or surface water, and have one or more active cases, potentially alongside additional pending and closed cases.

Among the known contaminated sites in the Borough of Westville are manufacturing facilities, an auto service center, and a municipal maintenance facility.

The Known Contaminated Site List for New Jersey is automatically updated daily so the list may change at any time as sites are identified or mitigated. The list of contaminated sites may include sites where remediation is either currently under way, required but not yet initiated or has been completed and addressed via an Institutional Control.

Table 24: Known Contaminated Sites

Name	Address	Site ID	Program interest Number	Remedial Level
American Service Center	11 Delsea Drive	7723	000039	C1
Macedonia Baptist Church	351 High Street	374608	615580	
Mars Graphic Services Inc	1012 Edgewater Avenue	24460	285302	C2
S L Waber Inc	300 Harvard Avenue	29448	026076	C2
Westville Boro DPW	114 Crown Point Road	7716	004272	C2
800 Delsea Drive	800 Delsea Drive	54682	031857	C2
919 Broadway	919 Broadway	225800	294711	C2

Source: NJ DEP, 2022

Many contaminated sites have multiple names that may refer to past or present owners or uses. The site ID and PI numbers are the most reliable means of getting updates on the status of a contaminated site. There are several reasons why NJDEP may not assign a remedial level to a site. If the site is determined to be contaminated because of the presence of an unregulated heating oil tank, the case is transferred to a separate program under NJDEP: the Unregulated Heating Oil Tank program. This type of contaminant source is not managed under NJDEP's Site Remediation program, which is the program that assigns remedial levels. Another reason is if the source of the contamination is a relatively small petroleum spill of less than 100 gallons that does not flow into surface waters ("waters of the state") and is remediated within 90 days. Sites that meet these criteria are managed by local health departments, not the NJDEP Site Remediation Program. A third reason why a site may not have a listed remedial level is because it has been transferred to another remediating party during the process of remediation, including but not limited to an entity managing the site under the Industrial Site Recovery Act.

Table 25: Remedial Level Definitions

Name	
A	Emergency Action—Stabilization
B	A single-phase remedial action with a single contaminant affecting only the soil.
C1	Remediation does not require a formal design. The source of the contamination is known or has been identified. There is a potential for groundwater contamination.
C2	Remediation requires a formal design. The source of the contamination is known, or the release has caused groundwater contamination.
C3	A multi-phased remediation action where the source of the contamination is either unknown or there is an uncontrolled discharge to soil and/or groundwater.
D	A multi-phased remediation with multiple sources/releases to multiple media, including groundwater.
S	Should have a Remedial Level but this field was either Blank or designated as "N/A" in Pre-NJEMS data.

Source: NJ DEP, 2022

Borough of Westville

Figure 31: Known Contaminated Sites

dvrpc

1. American Service Center
2. Macedonia Baptist Church
3. Mars Graphic Services Inc.
4. S L Waber Inc.
5. Westville Borough DPW
6. 800 Delsea Drive
7. 919 Broadway Street

Philadelphia
PA
NJ
Delaware River
Gloucester City
Brooklawn
Camden County
Bellmawr
Lake Martha
Big Timber Creek
West Deptford
Gloucester County
Deptford
130
45
47
295
Broadway
Crown Point Rd
Gateway Blvd
Delsea Dr
Almonesson Rd
E Olive St

0 Miles 0.25 Miles 0.5 Miles North

Source: NJDEP (2022)

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 or endorsed.

Borough of Westville

Figure 32: Groundwater Contamination

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Contaminated Area

1 Coastal Eagle Point Oil Company

2 Mars Graphic Services Inc.

3 S L Waber Inc.

4 Westville Municipal Garage

Philadelphia

PA

NJ

Delaware River

Gloucester City

Brooklawn

Lake Martha

Camden County

Bellmawr

Big Timber Creek

West Deptford

Gloucester County

Deptford

130

45

47

295

Broadway

Crown Point Rd

Gateway Blvd

Delsea Dr

Almonesson Rd

E Olive St

0 Miles 0.25 Miles 0.5 Miles

North

Source: NJDEP, NJDOT (2022)

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 or endorsed.

Groundwater Contamination

There are three sites within the Borough of Westville that have evidence of groundwater contamination from various sources (see Figure 32 on page 102 and Table 26 below). Note, Coastal Eagle Point Oil Company uses a Westville mailing address, but the physical facilities themselves reside in West Deptford. These sites are restricted by a Classification Exception Area (CEA) designation, which is a geographically defined area within which the local groundwater resources are known to be contaminated (i.e., the water quality does not meet drinking water and groundwater quality standards for specific contaminants). A CEA can be established for a contaminated site's aquifer if state drinking water quality standards are not met because of: (1) natural groundwater quality, (2) discharges from an NJPDES permitted site, or (3) pollution caused by human activity.

A CEA designation suspends aquifer use in the affected areas until state drinking water standards are met. It is not a groundwater remedy but rather an institutional control established in conjunction with an approved remedy. NJDEP may revise or establish a CEA at any time to more accurately reflect the groundwater conditions using revised data.

Before a CEA expires, the remediation party collects at least two rounds of groundwater samples in a way that accounts for seasonal fluctuations in the groundwater table and represents the entire horizontal and vertical extent of the groundwater CEA. If the samples indicate that contaminant concentrations have decreased below the target groundwater quality standard, the permittee can request removal of the CEA from NJDEP. When NJDEP approves the removal, the permit is terminated. If the samples indicate that the contaminant concentration is not going to be reduced below the standard by the expiration of the CEA, the licensed site remediation professional will have to undertake active remediation and apply to NJDEP to extend the CEA.

Table 26: Groundwater Contamination Classification Exception Areas (CEAs)

Name	Address	CEA Name	Description
Coastal Eagle Point Oil Company	Route 130 and Interstate 295	Texaco Eagle Point (Deep UPM)	Plume includes all of site and extends off site to the southeast 445 feet from UPRM-34 and 645 feet from UPRM-18.
Mars Graphic Services Inc	1012 Edgewater Avenue	Harte Hanks Print Inc	The CEA is for shallow groundwater with historic fill onsite. CEA property boundaries Indeterminate
S L Waber Inc	300 Harvard Avenue	S L Waber Inc	Plume encompasses 4.45 acres at and under the north and west of the site's two main buildings.
Westville Municipal Garage	114 Crown Point Road	Westville Municipal Garage	The CEA extends 240 ft west and 360 ft east (downgradient), and is 150 ft wide.

Source: NJ DEP, 2022

Underground Storage Tanks

Property owners in the Borough of Westville may use storage tanks to store fuel oil, or in the case of service stations, gasoline or diesel fuel. Older storage tanks are increasingly likely to have outdated leak control and corrosion prevention measures and must be monitored for emissions. Corrosion and leakage of underground storage tanks can become a serious threat to the groundwater and soil surrounding it.

Sites with underground storage tanks are monitored under an NJDEP program called the Bureau of Underground Storage Tanks. Sites are registered, receive permits, and are monitored for leaks at regular intervals. As of the publication of this ERI, the tank at 300 Harvard Avenue was the only actively registered and compliant tank in the Borough of Westville. Some homeowners in the Borough of Westville may also have underground storage tanks, which on residential properties are used primarily to hold home heating oil. Those private residences are not publicly listed by NJDEP unless they pose a health hazard.

Historic and Current Landfills

As of 2014, when NJDEP most recently updated its landfill records, the Borough of Westville contained no historic or current landfill sites. The Coastal Eagle Point Landfill operated by Sunoco lies just outside the borough to the west along I-295. This landfill was part of the larger refinery complex and other contaminants on the site included gasoline storage tanks, underground product line leaks, and four unlined trenches that received petroleum residues. The United States Environmental Protection Agency and NJDEP imposed cleanup requirements on the site in 1992 and as of June 2009 the site has been controlled for human exposure.

Landfills pose a number of potential environmental problems, including groundwater contamination and harmful air emissions. Current EPA landfill regulations mandate that the owner or operator of the landfill conduct at least 30 years of postclosure care and monitoring to ensure that the landfill's leachate (i.e., water that has passed through a landfill) is properly removed and treated, so that it does not leak into its surroundings and contaminate the surrounding soil and groundwater. While current landfill regulations have greatly decreased the probability of landfill failure within the 30-year postclosure window, it is likely that these systems will remain in danger of leaking and contaminating the outside environment well into the future, beyond the mandated postclosure period.

Radon

Radon is a radioactive gas that comes from the natural decay of uranium found in nearly all soils. It moves up through the ground to the air above, and into homes through cracks and other holes in foundations. A buildup of radon-contaminated air within a home can pose a long-term health hazard to residents, potentially causing lung cancer. The only method of detection is to conduct a test for alpha particles in 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.

As of 2019, the most recent date listed on the NJDEP website, the Borough of Westville was listed as a Tier 2 municipality; that is, a municipality with moderate potential of having high radon levels in homes. Municipalities are designated as Tier 2 when 5 to 24 percent of homes have radon concentrations greater than or equal to 4.0 picocuries per liter in the air (among a minimum of 25 tested homes). A 4.0 picocurie measurement is the level at which homeowners should take immediate action to remove the radon in their homes.

CHAPTER 18:

Energy Use in the Borough of Westville

Every five years, DVRPC updates its greenhouse gas inventory for the nine-county Greater Philadelphia region for which it develops plans. DVRPC estimates energy use in the entire region, as well as in each county and each municipality within this region, including the Borough of Westville.

In its most recent estimation for Westville, which was published in 2018 with data from 2015, DVRPC calculated that Westville consumed 5,572 Billion British Thermal Units (BBtus) of energy in a year. A British Thermal Unit (Btu) is the amount of energy needed to cool or heat one pound of water by one degree Fahrenheit. A gallon of gasoline contains about 116,000 BTUs, so Westville's total energy use in 2015 was equivalent to about 48 million gallons of gasoline. The Borough of Westville performed below average in comparison with other municipalities in terms of energy use per person/job (see Figure 33 on page 106). The total cost of Westville's energy use was estimated to be $51.6 million. The combustion of fuels for this consumed energy, in combination with several non-energy sources of greenhouse gases, resulted in the release of approximately 315,000 metric tons of carbon dioxide equivalent gases.

Energy use is calculated by tabulating energy consumption across the commercial, industrial, and residential sectors, along with mobile (i.e., vehicle) energy consumption. Of the sectors for which data was available and able to be allocated to the municipal level, the commercial and industrial sector consumed the most energy in Westville. Their total was about 5,199 BBtus of energy, or about 93 percent of the total energy consumed in the borough (see Table 27 on page 106). The other sectors consumed far less energy with residential and mobile energy each both consuming approximately 3 percent of the total energy in the borough.

The energy expenditures were highest for the commercial and industrial sector as well at $44 million, or approximately 85% of the total energy expenditures. Natural gas was the dominant source of energy with 99% of the BBTU's supplied.

For more information on where Westville's energy use fits into the region's consumption, DVRPC published a webmap in July 2018 (Figure 33 on page 106), a summary report (November 2018) and accompanying methods and sources document (November 2018). There is also an interactive webmap on the DVRPC website which can generate individual reports for each municipality.

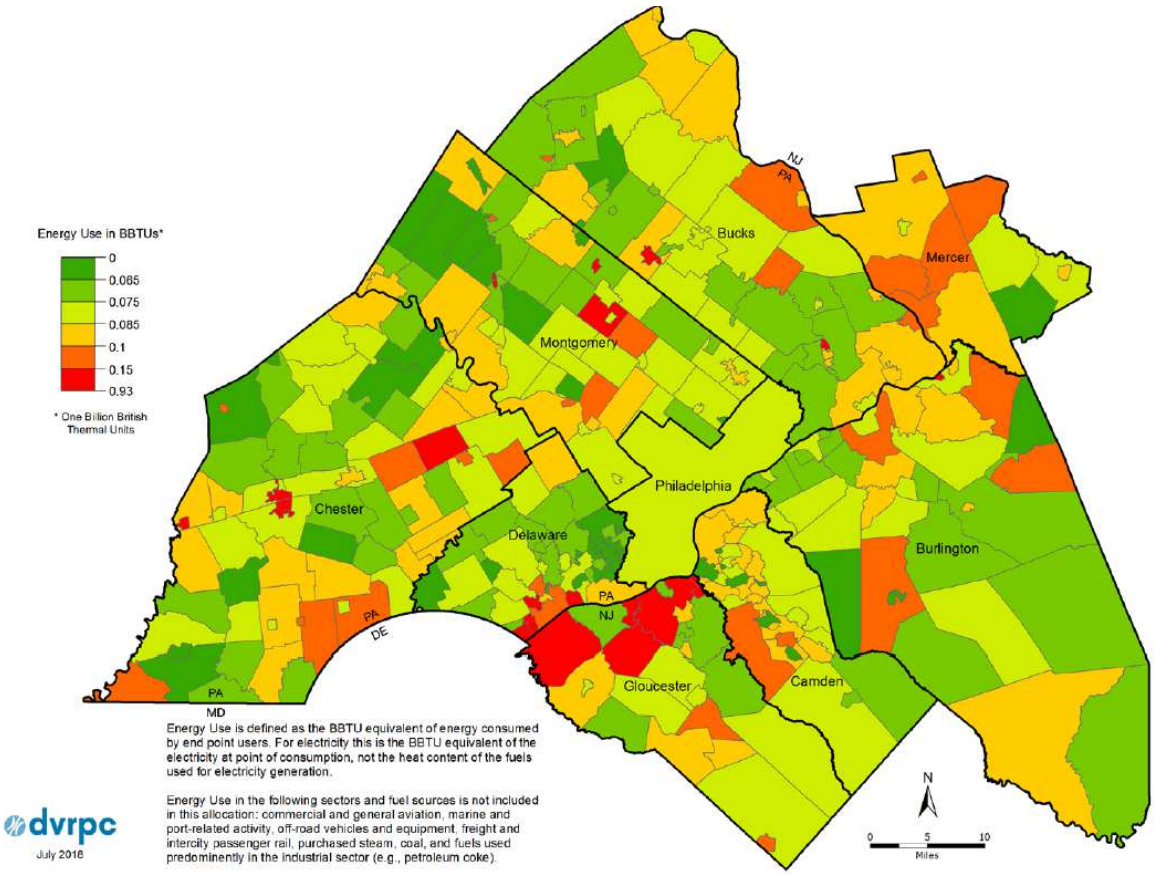
Electric Vehicle Charging Location

Table 27: Energy Use, Cost, and Greenhouse Gas Emissions

Sector	Energy Use (BBTU)	Percentage of Total Energy Use	Energy Expenditures (Dollars)	Percentage of Total Energy Expenditures	Greenhouse Gas Emissions by Sector ($MTCO_2e$)	Percentage of Total Greenhouse Gas Emissions
Residential	179	3%	3,510,249	7%	12,741	4%
Industrial and Commercial	5,199	93%	44.050,127	85%	278,422	89%
Mobile - Highway	193	3%	4,041,941	8%	14,840	5%
Mobile - Transit	1	<1%	N/A	0%	68	<1%
Non-Energy Greenhouse Gas					8,470	3%
Total	5,572	100%	$51,602,317	100%	314,543	100%

Source: DVRPC, 2018

Figure 33: Energy Use per Person/Job by Municipality (BBTUs)



Source: DVRPC, 2018

CHAPTER 19:

Open Space

At present, the borough contains 163 acres of open space land within 8 parcels that have been deed restricted (permanently preserved) for use by borough residents.

Parks and Recreation

The Borough of Westville is home to a widespread park system that provides a variety of active and passive recreational opportunities for area residents. According to Table 28 on page 108, the borough contains over 47 acres of municipally owned recreation land. Amenities for active recreation in the borough's parks include soccer fields, baseball/ softball fields, tennis courts, basketball courts, and football fields. In addition to sports fields and courts, the Borough of Westville contains a number of playgrounds, picnic areas, and trails.

Passive recreation encompasses most other park activities, including walking, fishing, bird watching, bike riding, boating, and picnicking. Shown in Figure 34 on page 109, the borough's parks range in scale and scope. At 17.7 acres, the largest park in the Borough of Westville are the soccer fields on Chestnut Street which contain multiple soccer fields and open areas as well as restrooms and wooded areas. The borough also contains several medium to small sized parks with a variety of amenities. These include Thomas West Park in the middle of the borough with picnic areas, a pond, and a walking track, and River Drive Park (Michael K. Galbraith Park) along Big Timber Creek with a fishing pier and views of Philadelphia across the Delaware River.

The Borough of Westville also contains land that has been legally set aside for open space through deeds. This includes parkland as well as marshland areas and includes 8 parcels which total 163 acres. This protected land is shown in Table 29 on page 108.

Almonesson Field

Table 28: Municipal Parks

Park Name/Location	Acres	Amenities
Almonesson Sports Fields	8.62	baseball fields, concession stand, football fields, restrooms, parking, play area
Chestnut Street Soccer Fields	17.7	parking, restroom, soccer fields
Park Avenue Little League Field	5.99	baseball field
River Drive Park (Michael K. Galbraith Park)	4.85	benches, fishing pier, parking
Thomas West Park	9.44	benches, parking, pavilon, picnic areas, play area, basketball court, pickleball court, walking path
Woodbine Ave Playground/Park	.5	playground, tennis court, basketball court
Total	47.1	

Source: The Borough of Westville, 2023

Table 29: Deed-Restricted Open Space

Landowner/Easement Holder	Number of Parcels	Total Acres
Borough of Westville	8	163

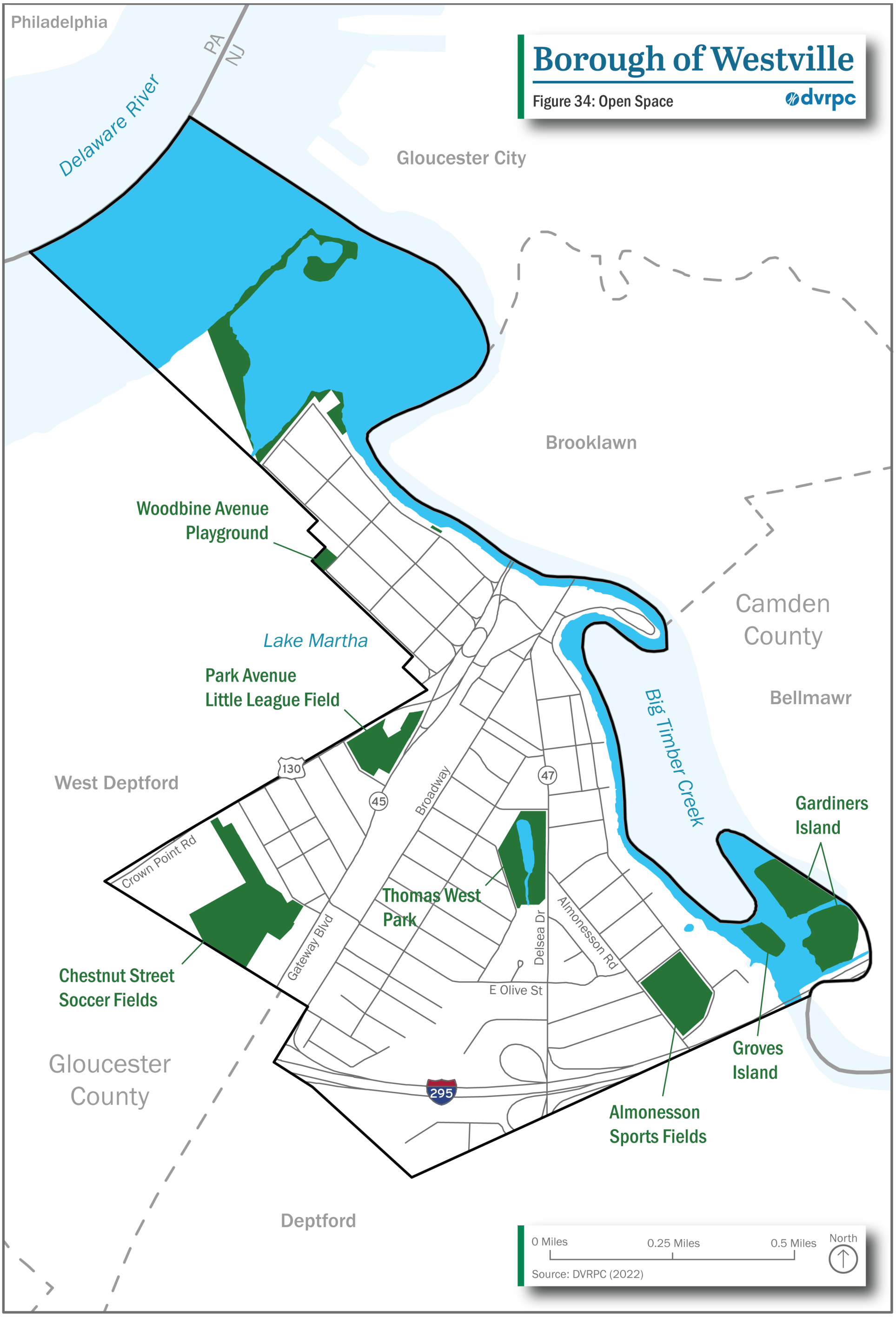
Source: DVRPC, 2021

Michael K. Galbraith Park

Borough of Westville

Figure 34: Open Space

dvrpc



Source: DVRPC (2022)

CHAPTER 20:

Land Types for Conservation

The Borough of Westville has limited open space remaining to protect. The borough's wetlands are afforded protections from development by the State of New Jersey's Freshwater Wetlands Protection Act Rules (N.J.A.C. 7:7A). Any remaining undeveloped open space within the borough could be considered for conservation, as well as any private, developed land intentionally set aside and modified for this purpose.

Lands with higher natural resource values that could be prioritized for conservation purposes, based on the maps provided in this report, are as follows. They are organized by degree of importance within each map category, unless otherwise noted:

Land Use/Natural Vegetation

- Forest land.
- Land along waterways
- Wetlands;
- Brush/shrubland;
- Barren land (with the goal of converting it into a natural use).

Slope

- Land with slopes of 20 degrees or more.
- Secondarily, land with slopes of between 10 and 20 degrees.

Soils

- Land with soil types that are poor for development (Development Capability of C)

Agricultural Soils

- Prime farmland.
- Farmland of statewide importance.
- Farmland of unique importance.

Floodplains

- Land within the 1 percent/100-year floodplain
- Land within the 0.2 percent/500-year floodplain.

Impervious Coverage

- Land with impervious surface of less than 5%.

Groundwater Recharge

- Land with a high groundwater recharge rate of 10 to 14 inches per year.
- Land with a moderate groundwater recharge rate of 6 to 9 inches per year.

Landscape Project Priority Habitat

- Rank 5 (federal listed species) lands.
- Rank 4 (state endangered species) lands.
- Rank 3 (state threatened species) lands.
- Rank 2 (special concern species) lands.
- Rank 1 (habitat-specific requirements) lands.

Michael K. Galbraith Park - River Drive between 3rd and 4th

Source: Bob Peyre-Ferry

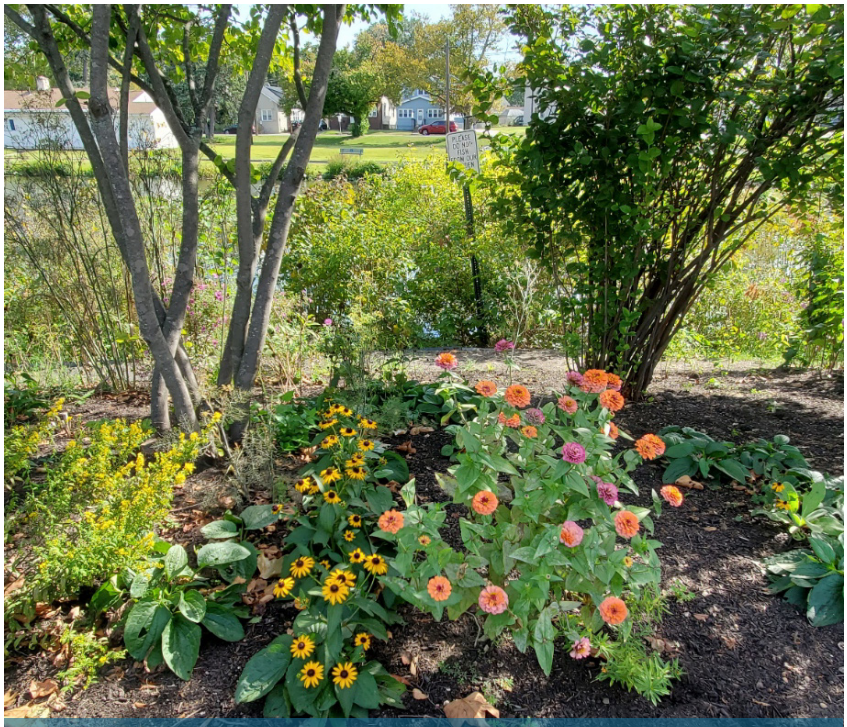
CHAPTER 21:

Development Constraints

The development of homes, commercial and industrial facilities, and infrastructure is limited by several types of environmental features, as well as from regulations governing certain environmental features. These restrictions are called “constraints” from a development perspective. Steep slopes, flood hazard areas, and wetlands or poorly draining soils all serve as functional constraints to development. These constraints are reinforced by state rules concerning the development of wetlands (Freshwater Wetlands Protection Act, N.J.A.C. 7:7A), flood hazard areas (Flood Hazard Area Control Act Rules, N.J.A.C. 7:13), habitat (New Jersey Endangered Species Conservation Act), and tidal shorelines (Coastal Zone Management Rules, N.J.A.C. 7:7); and federal laws concerning the development of federally-listed species habitat (as defined in the Endangered Species Act). The Borough of Westville’s zoning ordinance Chapter 330: Stormwater Control requires additional maps and plans for developments in environmentally critical areas to mitigate their impacts.

Sometimes, development is prohibited, as in the case of wetlands and extremely steep slopes. Other times, construction may occur, but it can be subject to long and costly permitting processes, reviews, and special design considerations. These rules are in place not to make development more costly, but rather to ensure that the ecosystem services for the community (beneficial floodplains, aesthetic value, or greenway access, for example) are protected, while avoiding environmental degradation such as the erosion or the sedimentation of streams.

Even if regulatory constraints did not exist, construction in floodplains, steep slopes, or poor soils may result in higher up-front costs to builders in order to construct sufficiently resilient buildings or infrastructure. If development does not adequately account for the physical constraints that exist on a parcel, it may cause damage to the property over time, particularly in the form of foundation or septic system failure.



Butterfly Garden at Thomas West Park | Source: Judith White

CHAPTER 22:

Conclusion

The history of the Borough of Westville reflects the history of the surrounding country. For thousands of years Lenni Lenape people lived in the forests, waterways, and fields of what is today southern New Jersey. Dutch, Swedish, and English colonists settled in the area throughout the 17th Century and established the Borough of Westville as an important transportation center and as a stable community full of residential and commercial development. Surrounded by water on two of three sides and as the historic and current gateway to South Jersey, the Borough of Westville has always been a meeting place, commercial center, and community hub and its environmental features reflect that status.

Today, the borough is criss-crossed by major regional and national highways and contains a diverse collection of residential, commercial, and industrial lands as well as a wide variety of plant and animal life in the marshlands, waterways, and open spaces around and throughout the borough. Issues such as pollution and flooding are present in the borough, as well as strong, active, and long-standing community organizations and a stable residential and commercial environment.

Thomas West Park

CHAPTER 23:

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Appendices

A: Plants in the Borough of Westville's Vicinity

B: Fish Counted in the Borough of Westville's Vicinity

C: Amphibians and Reptiles in New Jersey

D: Birds in the Borough of Westville's Vicinity

E: Westville Borough Mapping Project

DELAWARE VALLEY dvrpc REGIONAL PLANNING COMMISSION

APPENDIX A:

Plants in the Borough of Westville's Vicinity

Appendix A contains several lists of plants located within the Borough of Westville as well throughout Southern New Jersey. The first two lists were compiled by Karl Anderson: naturalist and past director of the Rancocas Nature Center. In a series of site visits throughout 2021, Mr. Anderson visited several locations in the Borough of Westville and recorded his observations and listed all the plant species found at the site. The observations are copied below and the combined list of all plant species observed in the Borough of Westville is included in Table A-1 on page A-3. Mr. Anderson also conducted a botanical inventory field trip on May 8, 2006 and the results of that survey are listed in Table A-2 on page A-11. A list of invasive plant species in Southern New Jersey compiled by the New Jersey Native Plant Society is contained in Table A-3 on page A-13.

Karl Anderson Site Visits Throughout 2021

Soccer Field Woods

This forest parcel is bounded by Cornell Avenue and its extension on the southwest, by a tank farm on the northwest, by commercial development on the southeast, and by soccer fields on the northeast. It can be divided into two unequal sections separated by an intermittent north-flowing stream that begins in a swamp at Cornell Avenue and eventually becomes the ditch dividing the soccer fields. This swamp and stream may become dry in late summer. The two sections are quite different. The larger northwestern section is dryer and is dominated by oaks. The southeastern section includes more of the wetlands along Cornell Avenue and has fewer oaks but more cherry, sweetgum, and black gum. A 1930 aerial photograph shows the northwestern section forested, but the southeastern section including the stream corridor cleared.

Soccer Field Woods Northwest (Between Stream Corridor and Tank Farm)

Visits: April 15, April 26, June 10, October 4

Classic oak woods with an understory of blueberry, mountain laurel, and other ericaceous plants. Becomes wet at the southern edge, with thickets of coastal sweet pepperbush mixed with black gum, red maple, and common reed. Black gum, red maple, and arrowwood are also along the stream corridor, with sensitive fern and stiltgrass. Except for the latter species there are only a few invasive plants, most of them near the field edge. The herb layer is relatively sparse. In some places, bracken fern and seedlings of chestnut oak, white oak, and sassafras make a ground cover. This is a very high-quality, relatively pristine forest, one that is unusual in the area.

Soccer Field Woods Southeast

Visits: April 15, April 26, April 30, June 10, October 4

Mixed forest, with fewer and younger oaks and more cherry and sweet gum than the Northeast Section, and fewer ericaceous plants. Includes wooded swamp along the steam and along Cornell Avenue. This swamp shows as a pond (?) on the 1930 aerial photograph. In the upland portion of the site there is a dense ground cover, particularly along the eastern edge (approaching the neighboring car dealership), with a mixture of Japanese honeysuckle, poison ivy, Virginia creeper, greenbrier, and mostly-small seedlings of willow, pin, and white oaks, and black cherry, interspersed with Canada goldenrod and white snakeroot. Native herbs are otherwise sparse. The swamp has the expected coastal sweet pepperbush mixed with black gum, red maple, and common reed. Invasive species are mostly along the field edge except for the Japanese honeysuckle in the forest understory.

Bird Sanctuary Woods on Delaware View Avenue

Visits: May 2, June 17, July 30, October 20

This parcel is bordered on the north and west by reed marsh and tidal marsh, and by Delaware View Avenue on the south, and extends eastward beyond Summit Avenue. Remnants of native vegetation are still present here, including hackberry, black cherry, sassafras, black walnut, and silver maple, but they are overwhelmed by non-natives. Invasive species dominate, particularly Japanese wisteria and Amur honeysuckle. The site has a lot of cover for birds and

small mammals, and in season a lot of food for berry-eating birds. The plant species mix is very diverse for a small area but includes many species that have been planted. Woodlands in West Deptford on the opposite shore of the adjacent wetlands and the thickets along the west side of Highlands Avenue are known to be attractive to bird life, especially in winter.

Along Delaware View Avenue and River Drive, South to Michael K. Galbraith Park

Visits: May 2, June 17, October 20

Mostly mowed lawn with specimen trees. Vegetation on the riprap along the river shore is dominated by false indigo with occasional saplings of white mulberry, silver maple, American black elderberry, American elm, sycamore, and box elder, with forbs including rose mallow and purple loosestrife. List includes recently planted/ornamental trees.

Small Woodlot South of Michael K. Galbraith Park

Visits: May 2, June 17

This small parcel is bordered by River Drive, Timber Creek, and Gateway Boulevard. It is dominated by non-native plant species, including one very large multi-stemmed white mulberry. The shrub layer is dominated by Amur honeysuckle. There are a few small specimens of native trees including hackberry, green ash, box elder, and sycamore. Near the street is a small grove (possibly planted) of black walnut. Poison ivy grows in profusion along the adjacent sidewalk.

Thomas West Park on Delsea Drive

Visits: May 8, June 19, August 30

Park surrounds a roughly two-acre pond. Habitat is mostly mowed grass, with some planted trees. A well-designed butterfly garden (exempted from this survey) is on the west shore of the pond. Except at the butterfly garden the grass is mowed close to the pond edge, so there is relatively little pondside vegetation.

South Along the Stream to Olive Street

Visits: May 8, June 19, August 30

A narrow wooded steam corridor extends south from the pond. There are some remnant native trees but the understory is a mixture of native and non-native species, with very few native shrubs.

Stream Corridor From Olive Street South to Harvard Avenue

Visits: May 8, July 26

There are remnant native trees along this stretch of stream corridor, including sweet gum, silver maple, and red maple here, but usually growing with non-native Norway maple and catalpa. There are few native shrubs except for Arrowwood.

Along Yale Drive there is a fairly wide area of woods between the street and the stream, with some large, healthy native trees including red, white, black, southern red, and swamp white oaks. Understory here includes some garden escapes including mockorange, redbud, rose of Sharon, gooseberry, and daffodils in addition to the expected Amur honeysuckle, multiflora rose, arrowwood, and English ivy. A tangle of goldenrod, mugwort, hemp dogbane, and other forbs borders the street.

Playground Woods on Woodbine Avenue

Visits: May 10, July 26, October 20

Small area bordered by the line of 5th Avenue, a lawn, and the borough boundary. Adjacent to woods and wetlands in West Deptford. Has a good variety of trees but smothered in wisteria. There is some relatively open forest floor, once you break through dense thickets at the playground edge. Site is dominated by a huge tulip tree and there are some large Norway maples. Provides some food and shelter for birds and small mammals.

Tidal Marshland

The marshes that are partly exposed along Timber Creek and the Delaware River at low tide are typical of the freshwater or slightly brackish river marshes of the Middle Atlantic states. The soils are a mixture of water-deposited sand and silt. The dominant plant in the deeper water is Spatterdock, with emergent leaves and with yellow flowers at water level. Other species occur mostly in the intertidal zone along the shore.

Table A-1: Vegetation Found in the Borough of Westville

Category	Scientific Name	Common Name	K. Anderson Notes
Trees and Shrubs			
	Acer negundo	Box elder	
	Acer platanoides	Norway maple	non-native
	Acer pseudoplatanus	Sycamore maple	non-native
	Acer rubrum	Red maple	
	Acer saccharinum	Silver maple	
	Ailanthus altissima	Tree of Heaven	non-native, invasive
	Albizia julibrissin	Persian silk tree	non-native
	Amelanchier	Serviceberry	planted
	Amorpha fruticose	False indigo	non-native
	Aronia melanocarpa	Black chokeberry	
	Berberis thunbergii	Japanese barberry	non-native, invasive
	Betula nigra	River birch	planted
	Betula populifolia	Gray birch	
	Broussonetia papyrifera	Paper mulberry	non-native
	Buddleia davidii	Butterfly bush	non-native, presumably planted
	Catalpa bignonioides	Southern catalpa	non-native
	Catalpa	Catalpa	non-native
	Catalpa speciosa	Northern catalpa	non-native
	Carya glabra	Pignut	
	Carya tomentosa	Mockernut	
	Celtis occidentalis	Hackberry	
	Cercis canadensis	Redbud	presumably planted
	Clethra alnifolia	Coastal sweet pepperbush	
	Crataegus	Hawthorn	
	Cornus amomum	Silky dogwood	
	Cornus kousa	Kousa dogwood	non-native, planted
	Diospyros virginiana	Persimmon	
	Elaeagnus umbellata	Autumn olive	non-native, invasive

Table A-1: Vegetation Found in the Borough of Westville Continued

Category	Scientific Name	Common Name	K. Anderson Notes
Trees and Shrubs (continued)			
	Eubotrys racemosa	Fetterbush	
	Fagus grandifolia	American beech	
	Forsythia	Border forsythia	non-native, presumably planted
	Fraxinus pennsylvanica	Green ash	planted
	Gaylussacia baccata	Black huckleberry	
	Gaylussacia frondosa	Blue huckleberry	
	Ginkgo biloba	Gingko	non-native, planted
	Gleditsia triacanthos	Honey locust	non-native
	Hibiscus syriacus	Rose of Sharon	non-native, presumably planted
	Ilex opaca	American holly	
	Ilex verticillata	Winterberry	
	Juglans nigra	Black walnut	
	Juniperus virginiana	Red cedar	
	Kalmia latifolia	Mountain laurel	
	Koelreuteria paniculata	Golden rain tree	non-native, presumably planted
	Ligustrum	Privet	non-native, invasive
	Liquidambar styraciflua	Sweet gum	
	Liriodendron tulipifera	Tulip tree	
	Lonicera maackii	Amur honeysuckle	non-native, invasive
	Magnolia	Saucer magnolia	non-native, planted
	Magnolia virginica	Sweet bay	presumably planted
	Malus	Flowering crabapple	non-native, planted
	Malus toringo	Siebold crabapple	non-native, presumably planted
	Morus alba	White mulberry	non-native
	Nyssa sylvatica	Black gum	
	Phellodendron	Cork tree	non-native
	Philadelphus coronaria	Mockorange	non-native

Table A-1: Vegetation Found in the Borough of Westville Continued

Category	Scientific Name	Common Name	K. Anderson Notes
Trees and Shrubs (continued)			
	Phyllostachy	Bamboo	non-native, invasive
	Picea pungens	Blue spruce	non-native
	Pinus strobus	White pine	
	Pinus virginiana	Virginia pine	
	Platanus occidentalis	American sycamore	
	Populus grandidentata	Bigtooth aspen	
	Prunus serotina	Black cherry	
	Prunus	Flowering cherry	non-native, planted
	Prunus	Flowering plum	non-native, planted
	Pyrus calleriana	Bradford pear	non-native, invasive
	Quercus alba	White oak	
	Quercus bicolor	Swamp white oak	
	Quercus coccinea	Scarlet oak	
	Quercus falcata	Southern red oak	
	Quercus montana	Chestnut oak	
	Quercus palustris	Pin oak	
	Quercus phellos	Willow oak	
	Quercus rubra	Northern red oak	
	Quercus velutina	Black oak	
	Reynoutria japonica	Japanese knotweed	non-native, invasive
	Rhododendron periclymenoides	Wild azalea	
	Rhus typhina	Staghorn sumac	
	Ribes uva-crispa	Gooseberry	non-native
	Rosa multiflora	Multiflora rose	non-native, invasive
	Rubus armeniacus	Himalayan blackberry	non-native
	Rubus	Blackberry	
	Salix	Willow	large shrub, planted
	Salix babylonica	Weeping willow	non-native

Table A-1: Vegetation Found in the Borough of Westville Continued

Category	Scientific Name	Common Name	K. Anderson Notes
Trees and Shrubs (continued)			
	Salix matsudana	Corkscrew willow	non-native, planted
	Salix nigra	Black willow	
	Sambucus canadensis	American black elderberry	
	Sassafras albidum	Sassafras	
	Taxodium distichum	Bald cypress	non-native, planted
	Tilia cordata	Little-leaf linden	non-native
	Ulmus americana	American elm	
	Vaccinium corymbosum	Highbush blueberry	
	Vaccinium pallidum	Blue Ridge blueberry	
	Vaccinium stamineum	Deerberry	
	Viburnum dentatum	Arrowwood	
	Viburnum nudum	Wild raisin	
	Viburnum opulus	European cranberry-bush	non-native, planted
	Viburnum trilobum	American cranberry-bush	planted at one location
Woody Vines			
	Ampelopsis glandulosa	Porcelainberry	non-native, invasive
	Campsis radicans	Trumpet creeper	
	Celastrus orbiculatus	Asiatic bittersweet	non-native, invasive
	Clematis terniflora	Sweet autumn clematis	non-native, invasive
	Dioscorea polystachya	Chinese yam	non-native, invasive
	Euonymus fortunei	Winter creeper	non-native, invasive
	Hedera helix	English ivy	non-native, invasive
	Lonicera japonica	Japanese honeysuckle	non-native, invasive
	Menispermum canadense	Common moonseed	
	Parthenocissus quinquefolia	Virginia creeper	
	Smilax glauca	Catbrier	
	Smilax rotundifolia	Round-leaved greenbrier	
	Toxicodendron radicans	Poison ivy	

Table A-1: Vegetation Found in the Borough of Westville Continued

Category	Scientific Name	Common Name	K. Anderson Notes
Woody Vines (continued)			
	Vitis	Grape	
	Vitis labrusca	Fox grape	
	Vitis riparia	Riverbank wild grape	
	Vitis vulpina	Frost grape	
	Wisteria	Wisteria	non-native, invasive
	Wisteria floribunda	Japanese wisteria	non-native, invasive
	Wisteria sinensis	Chinese wisteria	non-native, invasive
Forbs (Herbaceous Flowing Plant)			
	Acalypha rhomboidei	Copperleaf	
	Achillea millefolium	Yarrow	non-native
	Ageratina altissima	White snakeroot	
	Alliaria petiolata	Garlic mustard	non-native, invasive
	Ambrosia artemisiifolia	Ragweed	
	Apios americana	Groundnut	
	Apocynum cannabinum	Hemp dogbane	
	Aquilegia canadensis	Columbine	presumably planted
	Aralia nudicaulis	Wild sarsaparilla	
	Artemisia vulgaris	Mugwort	non-native, invasive
	Asclepias syriaca	Common milkweed	
	Bidens bipinnata	Spanish needles	
	Bidens connata	Purplestem beggarticks	
	Bidens frondosa	Beggarticks	
	Boehmeria cylindrica	False nettle	
	Calystegia sepium	Hedge bindweed	
	Cephalanthus occidentalis	Buttonbush	
	Chaerophyllum procumbens	Spreading chervil	
	Chimaphila maculata	Striped wintergreen	
	Commelina communis	Asiatic dayflower	non-native

Table A-1: Vegetation Found in the Borough of Westville Continued

Category	Scientific Name	Common Name	K. Anderson Notes
Forbs (Herbaceous Flowing Plant) (continued)			
	Conoclinum coelestinum	Mistflower	possibly escaped from Thomas West Park butterfly garden
	Convallaria majalis	Lily of the valley	non-native
	Cuscuta gronovii	Scaldweed	
	Diodea virginiana	Virginia buttonweed	non-native
	Eclipta prostrata	False daisy	non-native
	Erechtites hieracifolia	American burnweed	
	Erigeron canadensis	Horseweed	
	Eupatorium serotinum	Late-flowering thoroughwort	
	Euthamia graminifolia	Grass-leaved goldenrod	
	Eutrochium dubium	Joe-pye weed	
	Ficaria verna	Lesser celandine	non-native, invasive
	Glechoma hederacea	Ground ivy	non-native, invasive
	Helianthus strumosus	Pale-leaved sunflower	
	Hemerocallis fulva	Orange daylily	non-native
	Hibiscus moscheutos	Rose mallow/Swamp rose mallow	
	Hosta ventricosa	Plantain lily	non-native, presumably planted
	Hyacinthoides hispanica	Spanish bluebell	non-native, presumably planted
	Impatiens capensis	Jewelweed	
	Iris	Iris	
	Liriope muscari	Lilyturf	non-native, presumably planted
	Lobelia cardinalis	Cardinal flower	possibly escaped from Thomas West Park butterfly garden
	Ludwigia palustris	Marsh seedbox/Water purslane	
	Lycopus virginicus	Virginia water horehound	
	Lysimachia quadrifolia	Whorled loosestrife	
	Lythrum salicaria	Purple loosestrife	non-native, invasive

Table A-1: Vegetation Found in the Borough of Westville Continued

Category	Scientific Name	Common Name	K. Anderson Notes
Forbs (Herbaceous Flowing Plant) (continued)			
	Maianthemum racemosum	Feathery false lily of the valley	
	Mikania scandens	Climbing hempweed	
	Monarda	Beebalm	presumably planted
	Monotropa uniflora		Indian pipes
	Narcissus	Daffodil	non-native, presumably planted
	Oenothera biennis	Evening primrose	
	Ornithogallum umbellatum	Star of Bethlehem	non-native
	Persicaria hydropiper	Marshpepper knotweed	non-native
	Persicaria longiseta	Oriental lady's thumb	non-native
	Persicaria maculosa	Spotted Lady's thumb	non-native
	Persicaria perfoliata	Mile-a-minute vine	non-native, invasive
	Persicaria punctata	Dotted smartweed	
	Persicaria sagittata	Arrowleaf tearthumb	
	Phytolacca americana	American pokeweed	
	Podophyllum peltatum	Mayapple	presumably planted
	Polygonatum biflorum	Solomon's seal	
	Polygonum	Knotweeds	
	Potentilla simplex	Common cinquefoil	
	Pycnanthemum muticum	Clustered mountainmint	presumably planted
	Rudbeckia hirta	Black-eyed susan	non-native
	Rudbeckia	Coneflower	presumably planted
	Rumex obtusifolius	Broad-leaved dock	non-native
	Rumex verticillatus	Swamp dock	
	Saponaria officinalis	Bouncingbet	non-native
	Solanum dulcamara	Bittersweet nightshade	non-native
	Solidago canadensis	Canada goldenrod	
	Solidago gigantea	Giant goldenrod	
	Solidago	Goldenrod	

Table A-1: Vegetation Found in the Borough of Westville Continued

Category	Scientific Name	Common Name	K. Anderson Notes
Forbs (Herbaceous Flowing Plant) (continued)			
	Symphyotyrichum racemosum	Small white aster	
	Symphyotrichum pilosum	White oldfield aster	
	Tradescantia virginiana	Spiderwort	presumably planted
	Typha latifolia	Broad-leaved cattail	
	Typha x glauca	Hybrid cattail	
	Uvularia sessilifolia	Sessile-leaved bellwort	
	Verbascum Thapsus	Common mullein	non-native
	Vinca minor	Common periwinkle	non-native, invasive
	Viola primulifolia	Primrose-leaved violet	
	Viola sororia	Common blue violet	
	Xanthium strumarium	Cocklebur	
	Yucca filamentosa	Adam's needle	
Grasses, Sedges, and Rushes			
	Arthraxon hispidus	Small carpgrass	non-native
	Carex	Sedges	
	Carex annectans	Yellow-fruited sedge	
	Carex lurida	Sallow sedge	
	Carex pennsylvanica	Pennsylvania sedge	
	Carex stricta	Tussock sedge	
	Carex swanii	Swan's sedge	
	Chasmanthium laxum	Slender woodoats	
	Danthonia spicata	Poverty oatgrass	
	Dichanthelium	Rosette-grass	
	Dichanthelium clandestinum	Deertongue	
	Eleocharis tenuis	Thin spike-rush	
	Elymus riparius	Riverbank wild rye	
	Juncus effusus	Common rush	
	Juncus tenuis	Poverty rush	

Table A-1: Vegetation Found in the Borough of Westville Continued

Category	Scientific Name	Common Name	K. Anderson Notes
Grasses, Sedges, and Rushes (continued)			
	Leersia oryzoides	Rice cutgrass	
	Leersia virginica	Whitegrass	
	Microstegium vimineum	Stiltgrass	non-native, invasive
	Peltandra virginica	Green arrow arum	
	Phragmites australis	Common reed	non-native, invasive
	Tridens flavus	Purpletop tridens	
Emergent and Rotating Plants			
	Heteranthera multiflora	Bouquet mudplantain	
	Ludwigia peploides	Floating primrose-willow	non-native
	Lemna minor	Duckweed	
	Nuphar advena	Spatterdock	
Ferns			
	Onoclea sensibilis	Sensitive fern	
	Osmundastrum cinnamomeum	Cinnamon fern	
	Ophioglossum pusillum	Northern adder's tongue	
	Pteridium aquilinum	Bracken	
	Sceptridium dissectum	Cutleaf grapefern	

Mr. Anderson Botantical Inventory Field Trip May 7, 2006

Some plant species noted between Delaware View Avenue and river, Westville, NJ on May 7, 2006, roughly between Summit and Highland Avenues, not including obviously planted species. This is not a complete inventory.

Table A-2: Mr Anderson Botanical Inventory Field Trip May 7, 2006

Category	Common Name	Non-Native Species
Trees		
	Black Cherry	
	Hackberry	
	Ailanthus	yes
	Southern Catalpa	yes
	Norway Maple	yes

Table A-2: Mr. Anderson Botanical Inventory Field Trip May 7, 2006 Continued

Category	Common Name	Non-Native Species
	Silver Maple	yes
	Sassafras	
	Box Elder	
	Pin Oak	
	Sycamore Maple	yes
Shrubs		
	Arrowwood	
	Indigobush (Amorpha Fruticosa)	
	Blackberry	
	Raspberry	
	Multiflora Rosa	yes
Vines		
	Wisteria	yes
	Round-leaved greenbrier	
	Yam-leaved Clematis	yes
	Virgina Creeper	
	Poison Ivy	
	Grape sp.	
	Trumpet Creeper	
	Japanese Honeysuckle	yes
Forbs and Grasses		
	Garlic Mustard	yes
	Cow Parsnip	
	Wild Rye (Elymus sp.)	
	Deertongue Grass	
	Field Garlic	yes
	Blue Violet	
	Gill-over-the-ground	yes
	Common Chickweed	yes

Table A-2: Mr. Anderson Botanical Inventory Field Trip May 7, 2006 Continued

Category	Common Name	Non-Native Species
	Tawny Daylily	yes
	White Snakeroot	
	Canada Goldenrod	
	Cleavers (Galium aparine)	
	Spreading Chervil	

Notes:

Habitat for Birds:

This small stretch of woods may concentrate neotropical migrants in spring and fall. It also provides abundant food for resident species. Dominant trees here are black cherry and hackberry, both of which produce abundant fruit that is eaten by birds. Other bird-friendly species already present are grape, Virginia creeper, poison ivy, and arrowwood. There is no need to plant additional species to attract birds to the site. Birds noted on or from the site on May 7 included yellow-billed cuckoo, red-winged blackbird, Baltimore oriole, orchard oriole, northern parula warbler, common yellowthroat, black-throated blue warbler, yellow-rumped warbler, red-bellied woodpecker, catbird, cardinal, ruby-crowned kinglet, Eurasian starling, blue jay, mourning dove, robin, and mallard.

Invasive Species:

Of the trees on this site, Norway maple and Ailanthus are considered invasives. Neither one is a big problem at this site. The ailanthus could probably be killed by girdling if desired, and the Norway maple is a just a single tree. Of the shrubs, some effort should be made to get rid of the multiflora rose - although it provides both cover and food for birds, it will eventually take over the site if left uncontrolled. The wisteria should be cut back. The yam-leaved clematis should be eradicated - there is not much of it on the site, and the plants are mostly small - get it while you can! Japanese honeysuckle is everywhere in New Jersey forests - but I would not worry too much about it on a site like this. I did not notice any mile-a-minute vine - but it's abundant in the Wheelabrator property and it is spread by birds - watch for it and pull out any seedlings you might find. Garlic mustard is a very invasive forb, but on a site like this, where there are few if any native wildflowers, I would not worry about it too much.

Partial List of Terrestrial Invasive Non-Native Plant Species of New Jersey

Non-native invasive plants are able to colonize and spread in relatively undisturbed plant communities and displace or eliminate native species and the birds and insects associated with them. Large infestations of some of them are almost impossible to control, but small infestations can be eliminated if you have the time and the labor force. Almost all of them originated as escapes from cultivation. There is no official "State List" but the New Jersey Native Plant Society maintains an extensive list. The following is a partial list tailored to southern New Jersey.

Table A-3: Partial List of Terrestrial Invasive Non-Native Plant Species of New Jersey

Category	Scientific Name	Common Name	K. Anderson Notes
Trees and Shrubs			
	Ailanthus altissima	Tree of Heaven	horticultural escape
	Aralia elata	Japanese angelica tree	horticultural escape
	Pawlownia tomentosa	Princess tree	horticultural escape

Table A-3: Partial List of Terrestrial Invasive Non-Native Plant Species of New Jersey Continued

Category	Scientific Name	Common Name	K. Anderson Notes
Trees and Shrubs (continued)			
	Phyllostachys	Bamboo	horticultural escape
	Pyrus calleriana	Bradford pear	horticultural escape
Woody Vines			
	Ampelopsis glandulosa	Porcelainberry	horticultural escape
	Celastrus orbiculatus	Asiatic bittersweet	horticultural escape
	Clematis terniflora	Virgin's bower	horticultural escape
	Euonymus fortunei	Winter creeper	horticultural escape
	Hedera helix	English ivy	horticultural escape
	Lonicera japonica	Japanese honeysuckle	horticultural escape
	Wisteria floribunda	Japanese wisteria	horticultural escape
	Wisteria sinensis	Chinese wisteria	horticultural escape
Shrubs			
	Berberis thunbergii	Japanese barberry	horticultural escape
	Elaeagnus umbellata	Autumn olive	introduced for wildlife cover
	Euonymus alatus	Burning bush	horticultural escape
	Ligustrum obtusifolium	Border privet	horticultural escape
	Ligustrum vulgare	Common privet	horticultural escape
	Lonicera maackii	Amur honeysuckle	horticultural escape
	Lonicera morrowii	Morrow honeysuckle	horticultural escape
	Lonicera tatarica	Tatarian honeysuckle	horticultural escape
	Reynoutria japonica	Japanese knotweed	horticultural escape
	Rubus phoenicolasius	Wineberry	horticultural escape
	Rosa multiflora	Multiflora rose	introduced for wildlife cover
	Viburnum dilatatum	Linden viburnum	horticultural escape
Forbs and Non-woody Vines			
	Alliaria petiolata	Garlic mustard	garden weed
	Artemisia vulgaris	Mugwort	garden weed
	Cardamine impatiens	Narrowleaf bittercress	origin unknown

Table A-3: Partial List of Terrestrial Invasive Non-Native Plant Species of New Jersey Continued

Category	Scientific Name	Common Name	K. Anderson Notes
Forbs and Non-woody Vines (continued)			
	Centaurea stoebe	Spotted knapweed	ballast plant
	Cirsium arvense	Canada thistle	crop weed
	Dioscorea polystachya	Chinese yam	horticultural escape
	Ficaria verna	Lesser celandine	horticultural escape
	Glechoma hederacea	Gill over the ground	garden weed
	Hesperis matronalis	Dame's rocket	horticultural escape
	Humulus japonicus	Japanese hops	horticultural escape
	Iris pseudacorus	Pale yellow iris	horticultural escape
	Lespedeza cuneata	Sericea lespedeza	introduced as a ground cover
	Lythrum salicaria	Purple loosestrife	horticultural escape
	Persicaria longiseta	Oriental lady's thumb	garden weed
	Persicaria perfoliata	Mile-a-minute	introduced with nursery stock
	Securigera varia	Crown vetch	introduced as a ground cover
	Urtica dioica	Stinging nettle	garden weed
	Vinca minor	Periwinkle	horticultural escape
Graminoids (Herbaceous Plant with Grass Like Morphology)			
	Eragrostis curvula	Weeping lovegrass	Introduced as a ground cover
	Microstegium vimineum	Stiltgrass	accidentally introduced with nursery stock
	Phragmites australis	Common reed	non-native variety, ballast plant

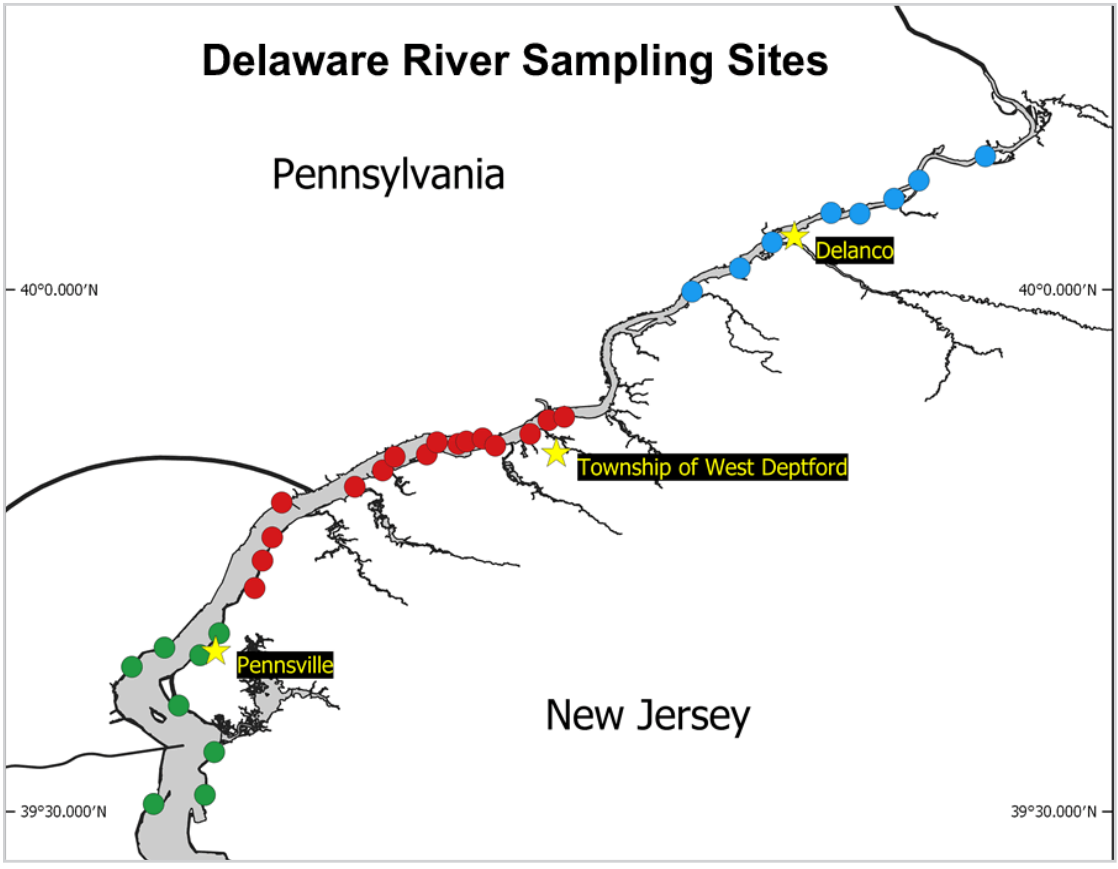
APPENDIX B:

Fish Counted in the Borough of Westville's Vicinity

Delaware River Seine Survey

The Delaware River Seine Survey has been conducted annually since 1980. It is a Fishery Independent Monitoring Project required by the Interstate Fisheries Management Plan for Striped Bass. As the Bureau of Marine Fisheries longest running fishery-independent survey, it provides opportunities for long-term population studies which are important for fishery management plans and assessing sustainable harvest levels. Monitoring sites for the survey are shown in Figure B-1 and range from just south of Trenton, New Jersey to the Augustine State Wildlife Management Area in Delaware. The most recent survey was completed in 2019 from June 18 to November 4 and the results are shown in Table B-1.

Figure B-1: Delaware River Sampling Sites



Source: NJDEP

Table B-1: 2019 Delaware River Seine Survey

Common Name	Number
Bay Anchovy	8,225
White Perch	3,939
Banded Killifish	2,700
Spottail Shiner	1,669
Blueback Herring	1,475
Eastern Silvery Minnow	1,461
Atlantic Menhaden	1,425
Mummichog	1,205
Striped Bass	958
Atlantic Silverside	946
Tessellated Darter	673
Rough Silverside	526
American Shad	522
Blue Crab	199
Atlantic Croaker	186
Gizzard Shad	150
Bluegill Sunfish	64
Spot	53
Yellow Perch	51
Bluefish	48
Pumpkinseed Sunfish	45
Hogchoker	38
White Sucker	34
Inland Silverside	15
American Eel	14
Alewife	12
Largemouth Bass	11
Atlantic Needlefish	9

Common Name	Number
Black Drum	6
Comely Shiner	5
Golden Shiner	5
Carp	4
Weakfish	3
Goldfish	2
Northern Hog Sucker	2
Spotfin Shiner	2
Summer Flounder	2
Chain Pickerel	1
Crevalle Jack	1
Silver Perch	1
Striped Anchovy	1
White Catfish	1

Source: NJDEP, 2019

Bureau of Freshwater and Biological Monitoring

The New Jersey Department of Environmental Protection also monitors the species and number of fish all over the state. The closest monitoring station to the Borough of Westville is FIBI230 SB Big Timber Creek UNT. This station is located in Washington Township south of the Borough of Westville and the most recent data for this location is shown in Figure B-2.

Table B-2: NJDEP Bureau of Freshwater and Biological Monitoring, Big Timber Creek

Common Name	Scientific Name	Number
Tessellated Darter	Etheostoma olmstedi	88
Bluegill	Lepomis macrochirus	85
Redbreast Sunfish	Lepomis auritus	45
Pumpkinseed	Lepomis gibbosus	37
Largemouth Bass	Micropterus salmoides	18
White Sucker	Catostomus commersoni	9
American Eel	Anguilla rostrata	8
Bluespotted Sunfish	Enneacanthus gloriosus	4
Eastern Mudminnow	Umbra pygmaea	3
Chain Pickerel	Esox niger	2
Brown Bullhead	Ameiurus nebulosus	1

Source: NJDEP, 2015

APPENDIX C:

Amphibians and Reptiles in New Jersey

Table C-1 lists the Amphibians and Reptiles recorded by NJDEP found throughout the State.

Table C-1: Amphibians and Reptiles in New Jersey

	Common Name	Scientific Name	Endangered	Threatened
Turtles				
	Bog Turtle	Clemmys muhlenbergii	Yes	
	Common Map Turtle	Graptemys geographica		
	Common Musk Turtle	Sternotherus odoratus		
	Common Snapping Turtle	Chelydra serpentina		
	Diamondback Terrapin	Malaclemys t. terrapin		
	Eastern Box Turtle	Terrapene c. carolina		
	Eastern Mud Turtle	Kinosternon s. subrubrum		
	Eastern Painted Turtle	Chrysemys p. picta		
	Eastern Spiny Softshell	Apalone s. spinifera		
	Redbelly Turtle	Pseudemys rubriventris		
	Red-eared Slider	Trachemys scripta elegans		
	Spotted Turtle	Clemmys guttata		
	Wood Turtle	Clemmys insculpta		Yes
Lizards				
	Fve-lined Skink	Eumeces fasciatus		
	Ground Skink	Scincella lateralis		
	Northern Fence Lizard	Sceloporus undulatus hyacinthinus		
Snakes				
	Black Rat Snake	Elaphe o. obsoleta		
	Corn Snake	Elaphe g. guttata	Yes	
	“Coastal Plain” Milk Snake	L. t. triangulum X L. t. elapsoides		
	Eastern Garter Snake	Thamnophis s. sirtalis		
	Eastern Hognose Snake	Heterodon platyrhinos		
	Eastern Kingsnake	Lampropeltis g. getula		

Table C-1: Amphibians and Reptiles in New Jersey Continued

	Common Name	Scientific Name	Endangered	Threatened
Snakes (continued)				
	Eastern Milk Snake	Lampropeltis t. triangulum		
	Eastern Ribbon Snake	Thamnophis s. sauritus		
	Eastern Smooth Earth Snake	Virginia v. valeriae		
	Eastern Worm Snake	Carphophis a. amoenus		
	Northern Black Racer	Coluber c. constrictor		
	Dekay's Brown Snake	Storeria d. dekayi		
	Northern Copperhead	Agkistrodon contortrix mokasen		
	Northern Pine Snake	Pituophis m. melanoleucus		Yes
	Northern Redbelly Snake	Storeria o. occipitomaculata		
	Northern Ringneck Snake	Diadophis punctatus edwardsii		
	Northern Scarlet Snake	Cemophora coccinea copei		
	Northern Water Snake	Nerodia s. sipedon		
	Queen Snake	Regina septemvittata	Yes	
	Rough Green Snake	Opheodrys aestivus		
	Smooth Green Snake	Opheodrys vernalis		
	Southern Ringneck Snake	Diadophis p. punctatus		
	Timber Rattlesnake	Crotalus horridus	Yes	
Salamanders				
	Blue-spotted Salamander	Ambystoma laterale	Yes	
	Eastern Mud Salamander	Pseudotriton m. montanus		Yes
	Eastern Tiger Salamander	Ambystoma t. tigrinum	Yes	
	Four-toed Salamander	Hemidactylium scutatum		
	Jefferson Salamander	Ambystoma jeffersonianum		
	Longtail Salamander	Eurycea l. longicauda		Yes
	Marbled Salamander	Ambystoma opacum		
	Mountain Dusky Salamander	Desmognathus ochrophaeus		

Table C-1: Amphibians and Reptiles in New Jersey Continued

	Common Name	Scientific Name	Endangered	Threatened
Salamanders (continued)				
	Northern Dusky Salamander	Desmognathus f. fuscus		
	Northern Red Salamander	Pseudotriton r. ruber		
	Northern Slimy Salamander	Plethodon glutinosus		
	Northern Spring Salamander	Gyrinophilus p. porphyriticus		
	Northern Two-lined Salamander	Eurycea bislineata		
	Redback Salamander	Plethodon cinereus		
	Red-spotted Newt	Notophthalmus v. viridescens		
	Spotted Salamander	Ambystoma maculatum		
Frogs and Toads				
	American Toad	Bufo americanus		
	Bullfrog	Rana catesbeiana		
	Carpenter Frog	Rana virgatipes		
	Eastern Spadefoot (toad)	Scaphiopus h. holbrookii		
	Fowler's Toad	Bufo woodhousii fowleri		
	Green Frog	Rana clamitans melanota		
	New Jersey Chorus Frog	Pseudacris triseriata kalmi		
	Northern Cricket Frog	Acris c. crepitans		
	Northern Gray Treefrog	Hyla versicolor		
	Northern Spring Peeper	Pseudacris c. crucifer		
	Pickerel Frog	Rana palustris		
	Pine Barrens Treefrog	Hyla andersonii		Yes
	Southern Gray Treefrog	Hyla chrysoscelis	Yes	
	Southern Leopard Frog	Rana utricularia		
	Upland Chorus Frog	Pseudacris triseriata feriarum		
	Wood Frog	Rana sylvatica		

Source: NJDEP, 2002

APPENDIX D:

Birds in the Borough of Westville's Vicinity

Data on the species and location of birds in the Borough of Westville and surrounding area comes from a variety of sources.

eBird

Managed by the Cornell Lab of Ornithology, eBird is one of the world's largest bio-diversity related projects. Volunteer bird watchers around the world contribute more than 100 million bird sightings annually which are then filtered for accuracy by an algorithm created by the bird experts at the Cornell Lab. The Borough of Westville contains one bird count location next to Big Timber Creek along River Drive between 5th and 6th Avenue. The bird count data presented in Table D-1 is organized alphabetically by Species Common Name (i.e. Cormorant, Duck, Hawk, etc...).

Table D-1: eBird Sightings Data for Big Timber Creek along River Drive

Species Name	Count	Date
American Bittern	1	5/13/2022
Red-winged Blackbird	5	8/23/2022
Rusty Blackbird	1	4/7/2021
Bobolink	1	8/24/2022
Eastern Bluebird	1	4/13/2019
Northern Cardinal	1	8/27/2022
Gray Catbird	2	8/27/2022
Carolina Chickadee	1	8/11/2022
American Coot	2	11/10/2019
Double-crested Cormorant	3	8/27/2022
Great Cormorant	1	1/27/2022
Brown-headed Cowbird	2	7/19/2022
Brown Creeper	1	2/21/2022
American Crow	12	8/27/2022
Fish Crow	2	8/22/2022
Yellow-billed Cuckoo	1	7/20/2019
Mourning Dove	3	8/27/2022
Short-billed Dowitcher	2	8/22/2022
American Black Duck	2	7/10/2022

Table D-1: eBird Sightings Data for Big Timber Creek along River Drive Continued

Species Name	Count	Date
Long-tailed Duck	1	4/20/2022
Ring-necked Duck	1	3/3/2022
Ruddy Duck	2	2/20/2022
Wood Duck	4	8/24/2022
Bufflehead	2	4/21/2022
Canvasback	4	3/23/2022
Gadwall	2	1/23/2022
Mallard	38	8/27/2022
Redhead	3	3/13/2022
Bald Eagle	1	8/27/2022
Cattle Egret	1	10/22/2016
Great Egret	7	8/27/2022
Snowy Egret	8	8/19/2022
Peregrine Falcon	1	8/11/2022
Merlin	1	12/23/2019
House Finch	2	8/22/2022
Purple Finch	1	1/5/2022
Northern Flicker	1	5/28/2022
Great Crested Flycatcher	1	8/24/2022
Willow Flycatcher	1	5/30/2014
Blue-gray Gnatcatcher	1	7/7/2021
Hudsonian Godwit	2	9/23/2021
Marbled Godwit	1	8/10/2020
Common Goldeneye	1	3/13/2022
American Goldfinch	2	8/22/2022
Cackling Goose	1	12/27/2014
Canada Goose	16	8/27/2022
Snow Goose	1	12/18/2021
Common Grackle	8	8/22/2022

Table D-1: eBird Sightings Data for Big Timber Creek along River Drive Continued

Species Name	Count	Date
Horned Grebe	3	3/13/2022
Pied-billed Grebe	1	8/27/2022
Red-necked Grebe	1	2/13/2022
Evening Grosbeak	1	2/15/2021
Bonaparte's Gull	1	5/15/2022
Great Black-backed Gull	1	8/24/2022
Herring Gull	2	8/22/2022
Iceland Gull	1	2/26/2018
Laughing Gull	8	8/27/2022
Lesser Black-backed Gull	2	2/26/2022
Ring-billed Gull	4	8/24/2022
Northern Harrier	1	3/1/2022
Broad-winged Hawk	1	10/24/2016
Cooper's Hawk	1	8/24/2022
Red-shouldered Hawk	1	3/13/2022
Red-tailed Hawk	1	8/17/2022
Sharp-skinned Hawk	1	4/23/2022
Osprey	1	8/27/2022
Great Blue Heron	1	8/27/2022
Green Heron	1	8/17/2022
Little Blue Heron	1	8/17/2022
Tricolored Heron	4	8/19/2022
Ruby-throated Hummingbird	1	8/26/2022
Glossy Ibis	1	8/7/2020
Blue Jay	1	8/27/2022
Dark-eyed Junco	1	4/9/2022
American Kestrel	1	12/31/2017
Eastern Kingbird	1	8/22/2022
Belted Kingfisher	1	8/21/2022

Table D-1: eBird Sightings Data for Big Timber Creek along River Drive Continued

Species Name	Count	Date
Golden-crowned Kinglet	1	12/8/2021
Ruby-crowned Kinglet	2	10/20/2021
Common Loon	1	6/6/2022
Red-Throated Loon	1	11/29/2020
Purple Martin	1	8/24/2022
Common Merganser	1	4/9/2022
Hooded Merganser	2	2/6/2022
Red-breasted Merganser	5	4/25/2022
Northern Mockingbird	3	8/27/2022
Red-breasted Nuthatch	1	10/19/2020
White-breasted Nuthatch	1	6/2/2022
Baltimore Oriole	1	6/28/2022
Orchard Oriole	5	7/7/2022
Northern Parula	2	5/4/2014
Eastern Phoebe	1	8/22/2022
Rock Pigeon	6	8/24/2022
Northern Pintail	5	3/3/2022
Black-bellied Plover	1	5/14/2022
Semipalmated Plover	6	8/27/2022
Killdeer	12	8/27/2022
Common Raven	1	8/5/2022
American Redstart	1	5/24/2020
American Robin	2	8/23/2022
Least Sandpiper	5	8/27/2022
Pectoral Sandpiper	1	8/11/2022
Semipalmated Sandpiper	8	8/27/2022
Spotted Sandpiper	1	8/23/2022
Western Sandpiper	1	8/23/2022
White-rumped Sandpiper	1	5/26/2022

Table D-1: eBird Sightings Data for Big Timber Creek along River Drive Continued

Species Name	Count	Date
Dunlin	2	5/28/2022
Sanderling	5	5/26/2022
Yellow-bellied Sapsucker	1	12/27/2020
Greater Scaup	1	4/20/2022
Lesser Scaup	1	4/21/2022
Black Scoter	1	7/10/2022
Surf Scoter	6	11/1/2021
White-winged Scoter	1	12/30/2017
Northern Shoveler	3	2/18/2022
Pine Siskin	3	10/19/2020
American Tree Sparrow	1	4/7/2021
Chipping Sparrow	1	7/17/2022
Field Sparrow	1	8/10/2022
Fox Sparrow	1	3/19/2021
House Sparrow	6	8/22/2022
Savannah Sparrow	1	4/24/2022
Song Sparrow	1	8/22/2022
Swamp Sparrow	1	5/1/2022
White-crowned Sparrow	5	1/9/2016
White-throated Sparrow	1	5/2/2022
European Starling		8/24/2022
Bank Swallow	1	5/28/2022
Barn Swallow	12	8/24/2022
Northern Rough-winged Swallow	4	8/24/2022
Tree Swallow	3	8/27/2022
Mute Swan	3	2/21/2022
Tundra Swan	2	1/16/2015
Chimney Swift	4	8/24/2022
Blue-Winged Teal	2	10/12/2021

Table D-1: eBird Sightings Data for Big Timber Creek along River Drive Continued

Species Name	Count	Date
Green-winged Teal	12	4/20/2022
Arctic Tern	4	5/13/2022
Black Tern	1	7/25/2022
Caspian Tern	2	8/24/2022
Common Tern	3	8/30/2018
Forster's Tern	2	6/6/2022
Gull-billed Tern	3	8/11/2021
Least Tern	2	6/5/2022
Brown Thrasher	1	5/28/2022
Hermit Thrush	1	5/8/2014
Swainson's Thrush	1	5/9/2016
Tufted Titmouse	1	6/24/2022
Eastern Towhee	1	7/26/2021
Wild Turkey	1	4/21/2022
Blue-headed Vireo	1	5/9/2016
Red-eyed Vireo	1	8/21/2022
Warbling Vireo	1	7/10/2022
Yellow-Throated Vireo	2	5/26/2022
Black Vulture	2	7/7/2022
Turkey Vulture	1	8/27/2022
Black-and-white Warbler	1	5/4/2019
Blackburnian Warbler	1	5/4/2014
Blackpoll Warbler	1	5/24/2020
Black-throated Warbler	1	5/14/2022
Canada Warbler	1	8/19/2022
Chestnut-sided Warbler	2	5/4/2014
Magnolia Warbler	1	9/27/2016
Palm Warbler	1	4/12/2021
Pine Warbler	1	5/9/2017

Table D-1: eBird Sightings Data for Big Timber Creek along River Drive Continued

Species Name	Count	Date
Yellow Warbler	1	8/17/2022
Yellow-rumped Warbler	1	5/7/2022
Cedar Waxwing	1	7/25/2022
American Wigeon	1	3/6/2022
American Woodcock	2	2/27/2013
Downy Woodpecker	1	8/11/2022
Hairy Woodpecker	1	9/4/2021
Red-bellied Woodpecker	1	8/27/2022
Eastern Wood-Pewee	1	10/17/2011
Carolina Wren	1	8/24/2022
House Wren	1	7/17/2022
Marsh Wren	1	6/24/2022
Winter Wren	1	11/9/2018
Greater Yellowlegs	1	8/27/2022
Lesser Yellowlegs	3	8/27/2022
Common Yellowthroat	1	7/26/2021

Gloucester County Christmas Bird Count

The Christmas Bird Count is a yearly event organized by the Gloucester County Nature Club where volunteers observe and record bird species around the County. This count has been conducted for several decades and can provide a long-term look at how the number and type of bird has evolved over the years. Usually volunteers record 85-95 distinct specieis of birds. Although the Borough of Westville is located outside the area observed, many bird species are common to the region and may be found in the Borough of Westville. More information about this event can be found on the website of the Gloucester County Nature Club at gcnatureclub.org.

APPENDIX E:

Westville Borough Wetland Mapping Project

Westville Borough
Wetland Mapping Project

February 2022; Revised May 2022

Prepared by

Joseph Arsenault

Environmental Consultant

Project, Purpose, and Survey Methods

This report is part of a Westville Borough resources inventory. This aspect of the project identifies the presence, type, and general location of lands defined as wetlands. The lands described are regulated by New Jersey's Department of Environmental Protection under the Freshwater Wetland Protection Act (1986) and the Coastal Wetlands Act (1970). Wetlands are well documented to provide critical habitat and water treatment, and their protection is an important component of modern landscape preservation.

Wetlands are defined by the federal definition cited in the 1989 Federal Manual for Identifying and Delineating Jurisdictional Wetland. Wetlands possess three essential characters: a predominance of wetland plants, the presence of wetland soils, and a wetland hydrology. The presence of these criteria is needed for an area to be delineated as a wetland. Land with these three criteria is jurisdictional and regulated under Section 404 of the Federal Clean Water Act. Wetlands in New Jersey are managed by the Department of Environmental Protection under the programs instituted in the 1970 Coastal Wetland Act and the 1986 Freshwater Wetlands Protection Act operating rules, NJAC 7:7 and NJAC 7:7A, et seq.

The wetlands mapped for this report are identified using remote sensing. Historic aerial photographs in conjunction with modern digital elevation models create images suitable for wetland interpretations. The wetland map created by this method relies on the assembly of digital data that includes State GIS generated municipal and county boundaries, digital aerial photography, and digital USGS 1-meter LiDAR processed by dedicated GIS software (Global Mapper Geographic Information System, version 23). The wetland boundaries are an approximation based on interpretation, using the skills and experience of the author. Their boundaries follow known hydrogeomorphic, topographic, or soil boundaries visible on the imagery. Wetlands, once mapped, are typed by a standard classification system. This report's nomenclature relies on accepted wetland types as applied by the NJDEP, following the Cowardin classification system (Cowardin et al, 1979; Brinson, 1993). The mapped wetlands are verified with ground-truth spot inspections.

The results report the land characters and landscape created by nature and the modern land uses that directly affect the creation and function of wetlands. The data is reported as total wetland area mapped, with each component identified and areas are tallied. The report also identifies those wet resources lost to historic land use changes.

The Study Area

Westville is a borough municipality within Gloucester County. It was formed in 1914 by an act of the NJ Legislature from the neighboring Deptford and West Deptford Townships. The Borough web page states the town is a 1.3 square mile tract in the county's northwestern corner, where the Borough abuts New Jersey's western boundary at the Delaware River edge, and the southern boundary of Camden County along the banks of the Big Timber Creek. Borough statistics indicate 0.35 square miles are open water. The open water includes the tidal Big Timber Creek and Delaware River (Figure 1: Topographic Map).

Westville has been occupied by man for thousands of years. Traces of Native Americans indicate their presence prior to the European colonization. Their uses impacted the native resources, yet their numbers and technology did not permit wholesale filling or draining of the Boroughs wetlands. The introduction to North America of the wheel, steel, and eventually fuel generated power created

opportunities never present in this area before the presence of European colonialists. Subsequent modern use has shaped the land providing the developed infrastructure of permanent housing, roadways, and facilitating water, electric, and gas services.

Results

Landscape

The Borough sits on the east shoreline of the river, where the Coastal Plain transitions into the Northern Piedmont. The Borough rests upon the Inner Coastal Plain landscape. This is one of New Jersey's five physical provinces. Together with the Outer Coastal Plain, this is the northern most extension of the Atlantic Coastal Plain. This plain is formed by millions of years of marine and river deposits. Westville's modern landscape is the result of natural erosion processes as well as the actions of modern man. The native terrain is the end result of eons of wind and rain erosion on the unconsolidated sand and clays found under the Borough. The resulting terrain includes a peninsula, various stream terraces, and floodplains of the river, Timber Creek and smaller stream corridors.

A peninsula exists between the Big Timber Creek and a highly altered stream system bordering the western edge of the Borough. This peninsula is an ancient stream terrace bisected by the erosion created by the Big Timber Creek and Ladd's Run. The elementary school pond (Ladd's Saw Mill Pond, Silver Lake) is formed on the narrow Ladd's Run stream corridor. Terraces form from down slope alluvial erosion and represent eons of landscape erosion. The near level areas at the Borough highest elevations are remnants of the ancient river gravel overburden. The floodplains are the lowest, and most recently created landscape components. Floodplains exist adjacent to the Delaware River and Big Timber Creek where water from tides and storms flood the low-lying terrain. The floodplain landscape occupies all of the land within the stream valleys and the channels of the river and Big Timber Creek. Engineering calculations identify a 100-year and 500-year elevation where storm waters would reach during flood events. The 100-year floodplain is confined to the land below 10 foot above mean sea level (MSL), whereas the 500-year plain is estimated to be areas with less than a 0.2% chance of flooding. These areas correspond to Borough land below the 15-foot MSL.

Geology

Base Geology: The Borough occupies the outcroppings of four base geology units. These formations were deposited during the Cretaceous period, more than 65-Million Years ago. Classified from the oldest to the youngest:

- Raritan – Magothy sand
- Merchantville clay
- Woodbury clay
- Englishtown sand

A fifth formation, the Potomac formation, underlies the tidal Delaware River and the dredge spoil on the river edge. The Potomac, the Raritan-Magothy, and the Englishtown sands are three of southern New Jersey's most important drinking water aquifers. The Merchantville and Woodbury clays are stiff, impermeable substrates separating the potable water sources.

Surface Deposits: Situated on top of the base units are unconsolidated sands, clays, silts, and gravel. These deposits are from Pleistocene glacial outwash floods that deposited silts and gravels from

approximately 5 million years ago up until the beginning of today's climatic period called the Holocene. The river and stream bottoms are covered in modern marsh and river deposits. Upslope of the fluvial muds are Late Pleistocene deposits called the Cape May Units 1 and 2. These represent a wide river deposit during the time of the Pleistocene glaciers. A small portion of the Borough is covered by the Pensauken formation, a river bed deposit dating from the earliest days of the early Pleistocene. The land at the intersection of Delsea Drive and Frontage Road north to Burr Avenue exist under this gravel deposit.

- Holocene / modern infill – mud/swamp deposits
- Cape May Units 1 and 2 – fine sand and pea gravel
- Pensauken Formation – silt loams with heavy gravel

Soils

Soils are derived from the underlying geology, in Westville's case the surface geology of the Cape May and Pensauken formations. Modern land uses have disturbed most of the Borough's soils, creating an urban land surface. The following soil types exist in the Borough.

- Wetland Soils
    - Mannington-Nanticoke Udorthents (MamuAv) – tidal waters of river and creek
    - Manahawkin Muck (MakAt) – headwater spring seeps/stream valleys; mis-mapped in the Borough by terminus of Ryan Avenue
    - Fallsington-Urban Land Complex – non-tidal palustrine forest and stream corridors
- Upland Soils
    - Urban Land on Downer (USDowB) - Cape May formation uplands
    - Freehold Urban Land Complex (USFreB) – Pensauken formation uplands
    - Freehold Loamy Sand Urban Land Complex (FrfB/FrrB) – Pensauken formation upland terraces

Wetlands

The Borough wetlands are found on the edges of the tidal creek and river, as well as the stream valleys for the small tributaries found throughout the Borough. Freshwater non-tidal wetlands are confined to narrow corridors surrounding the last of the stream valleys. The streams that originate in the Borough are spring and seep feed, and are the result of ground water discharge. Each originates at the junction of a base or surface geological unit, providing a source of precipitation sourced groundwater. No natural vernal pools or isolated depression wetlands exist within the Borough. All wetlands are connected to the tidal waters by ditches or pipes (Figure 2: Westville Wetlands).

Wetland Types

Four wetland cover types and two open water categories exist within the Borough. The wetlands that remain after centuries of clearing and filling include freshwater tidal and non-tidal wetlands. The cover types account for the regulated freshwater tidal and non-tidal wetlands, and non-tidal and tidal open water/mud flats (Figure 3: Wetland Types).

Freshwater Wetland-Non-Tidal: Two types exist within the Borough. The non-tidal wetlands are palustrine, swamps or marshes. Areas with a tree canopy are palustrine forests, whereas areas with thin

tree cover and a thicket of shrubs are defined as palustrine shrub / scrub. Both cover types are deciduous, and both occupy land with seasonally saturated soils.

Freshwater non-tidal wetlands occupy the remaining wet Borough land regulated by wetland and environmental statutes. Two major wetland cover types have been mapped within the Borough: deciduous forest and shrub/scrub. Deciduous forests with a seasonally saturated soil are dominant wetlands in the borough.

The wet forests are dominated by maples, gums, and other species tolerant of the persistent saturation. The Cowardin nomenclature for the wetlands is PF01b (palustrine deciduous dominated seasonal saturated hydrology). The wetlands mapped as shrub/scrub are disturbed habitats with young trees or shrubs as the dominate cover type. Additional wet areas include small areas of modified commercial and residential wetland along the Rt. 295 roadside, at the rail line, and other highway edges.

- Palustrine Forest (PF01) – 9.47 acres
- Palustrine Shrub / Scrub (PSS1) – 2.7 acres
- Palustrine Modified lawn (P-Mod-Lawn) – 0.0261 acres
    - Palustrine total = 12.2 acre

The tidal system is regulated by the Coastal Wetlands Act and the Waterfront Development Act. The tidal system is freshwater with a surface water salinity below 0.05 %. They are tied to the daily rise and fall within the Delaware River and its tributaries. This influences where vegetation can grow and where mud flats predominate. Land with elevations of -1 ft to +3 ft MSL are occupied by tide marsh plants. Karl Anderson prepared the Westville plant list that defines the species found within the Borough's tide marshes. Below -1 ft are the mud flats. These are typically unvegetated, and flowed by every high tide. The tidal wetlands are riverine tidal herbaceous, and identified as freshwater tidal marshes. The appropriate Cowardin designation is R1EM2 (riverine, tidal, emergent, nonpersistent). The mud flats have a wetland designation as R1UB3/4 (riverine, tidal, unconsolidated bottom-mud/organic).

- Tide Marsh (R2EM1) – 57.164 acres
- Tide Shrub/Scrub (R2SS1) – 3.36 acres
    - Tide marsh vegetation totals = 60.52 acres

Open Water / Borough Streams

The proximity to the tidal Delaware River and Big Timber Creek notwithstanding, the Westville Borough is drained by few natural streams. The longest is Ladd's Run, once known as Willow Run. The shortest are un-named tributaries, and most no longer exist. Ladd's Run originates in the Pensauken gravel near the intersection of Route 295 and Route 45. This stream meanders northeast under Olive Street and eventually enters Silver Lake. Silver Lake is the manmade impoundment created in the Ladd's Run stream corridor/floodplain. The lake is drained by the "Race", which is a manmade excavation that artificially connects Ladd's Run/Silver Lake with the tidal Big Timber Creek. Ladd's Run once followed its natural course northwest in the footprint of today's Willow Drive. The Ladd's Run channel and its floodplain were filled or piped sometime in the early 19th century, and the main stream flow diverted into the Race for mill power. Lake Martha is the tidal remnant of the former Ladd's Run. A small manmade pond exists in the residential neighborhood east of Edgewater Avenue and Klinger Avenue. This pond was constructed between 1940 and 1957.

- Non-Tidal – 1.96 acres; includes Silver Lake and small manmade pond
- Tidal – remainder

Wetland Tally

The wetland list defines the various mapped polygons by classification and size. Refer to the Westville Wetland Map Cover type and elevation maps for their locations (Figures 3, 4).

Polygons	Classification	Area (acres)
Freshwater Wetlands		14.931
• 1	PF01	0.402
• 2	PF01	0.1443
• 3	PF01	5.417
• 4	PF01	0.00819
• 5	PF01	0.521
• 6	PSS1	0.846
• 7	PF01	1.993
• 8	PF01	3.17
• 9	P-Mod-Lawn	0.0261
• 10	PF01	0.545
• 11	PF01/PSS1	0.594
• 12	PF01/PSS1	1.264
Tide Marsh / Tide Influenced		60.524
• 1	R2EM1	39.835
• 2	R2EM1	4.157
• 3	RSS/PSS1	2.881
• 4	R2EM1	8.392
• 5	R2EM1	1.604
• 6	RSS/PSS	0.4799
• 7	R2EM1	3.176
• Undifferentiated open water / mud flats		remainder
Non-Tidal Open Water		1.955
• 1	POWhx	1.78
• 2	POWx	0.1747

Alterations

Borough wetlands were first altered by clearing the original forest for farming. A second round of alterations occurred for the expansion of industrial and residential uses from the late 18th century into the early 20th century. This alteration modified the native wetlands by clearing, draining, and filling. Tide marsh alterations include filling for roadways, channel cuts for navigation and filling by dredge spoil. Figure 5, Westville Lost Water Resources, (appendix) illustrates where the major losses occurred.

Lost were small, un-named stream segments during the original development of the borough. Secondarily, large portions of the river edge were filled to act as a dredge spoils disposal area. Last, the wetland in the stream headwaters were filled during the construction of Route 295.

References, Citations and Data Sources

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USGS. 2022. Digital Data Warehouse: DEM downloads.

Appendix

- Maps:
  - Figure 1-USGS Topographic Map
  - Figure 2-Regulatory Areas
  - Figure 3-Wetland Cover Types
  - Figure 4-LiDAR Elevation Map
  - Figure 5-Wetland Polygons by Cover Type
  - Figure 6-Lost Water Resources

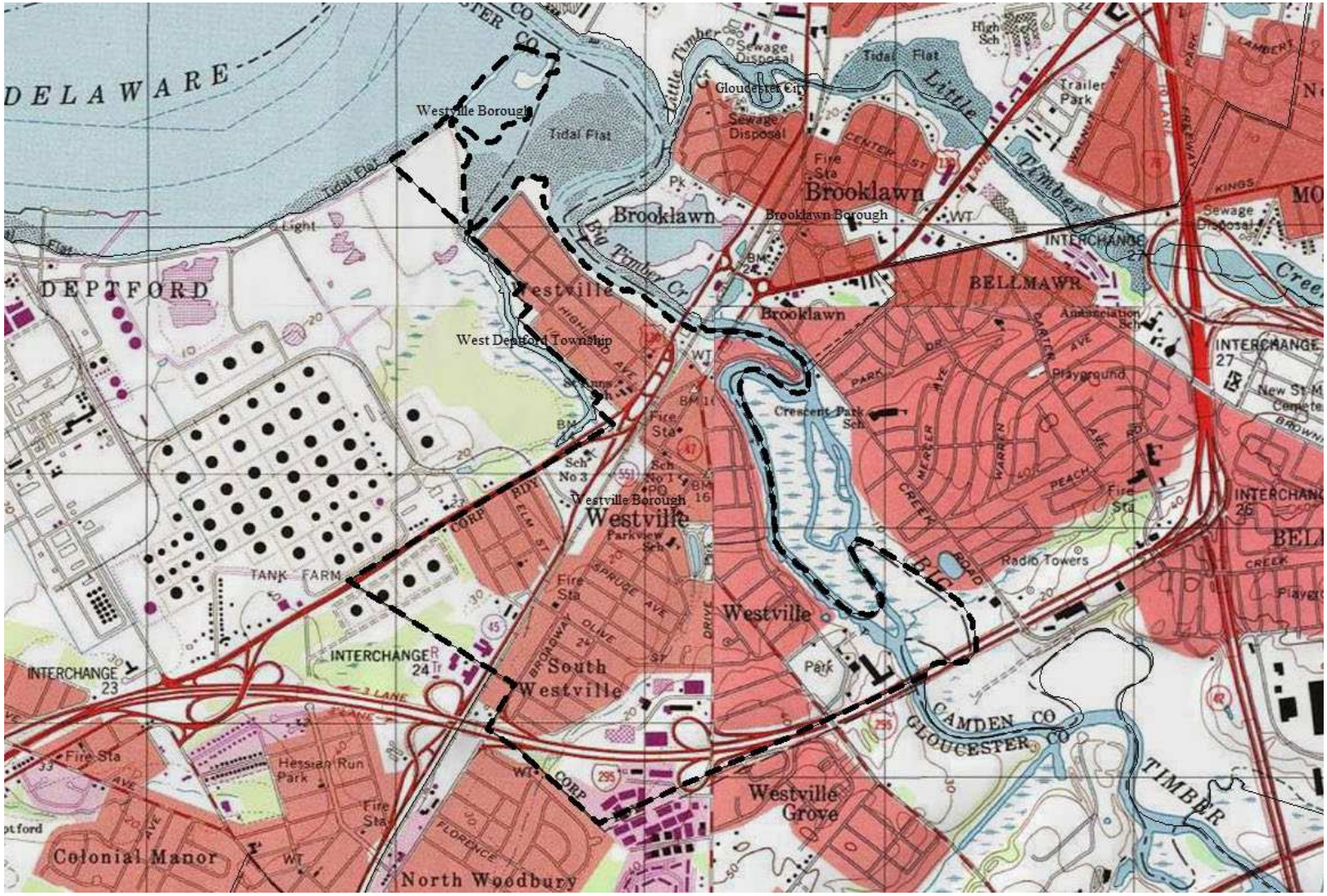

Figure 1: USGS Topographic Map of Westville and Vicinity

Figure 2: Wetlands of Westville Borough: **Red lines** represent the regulatory land / water interface

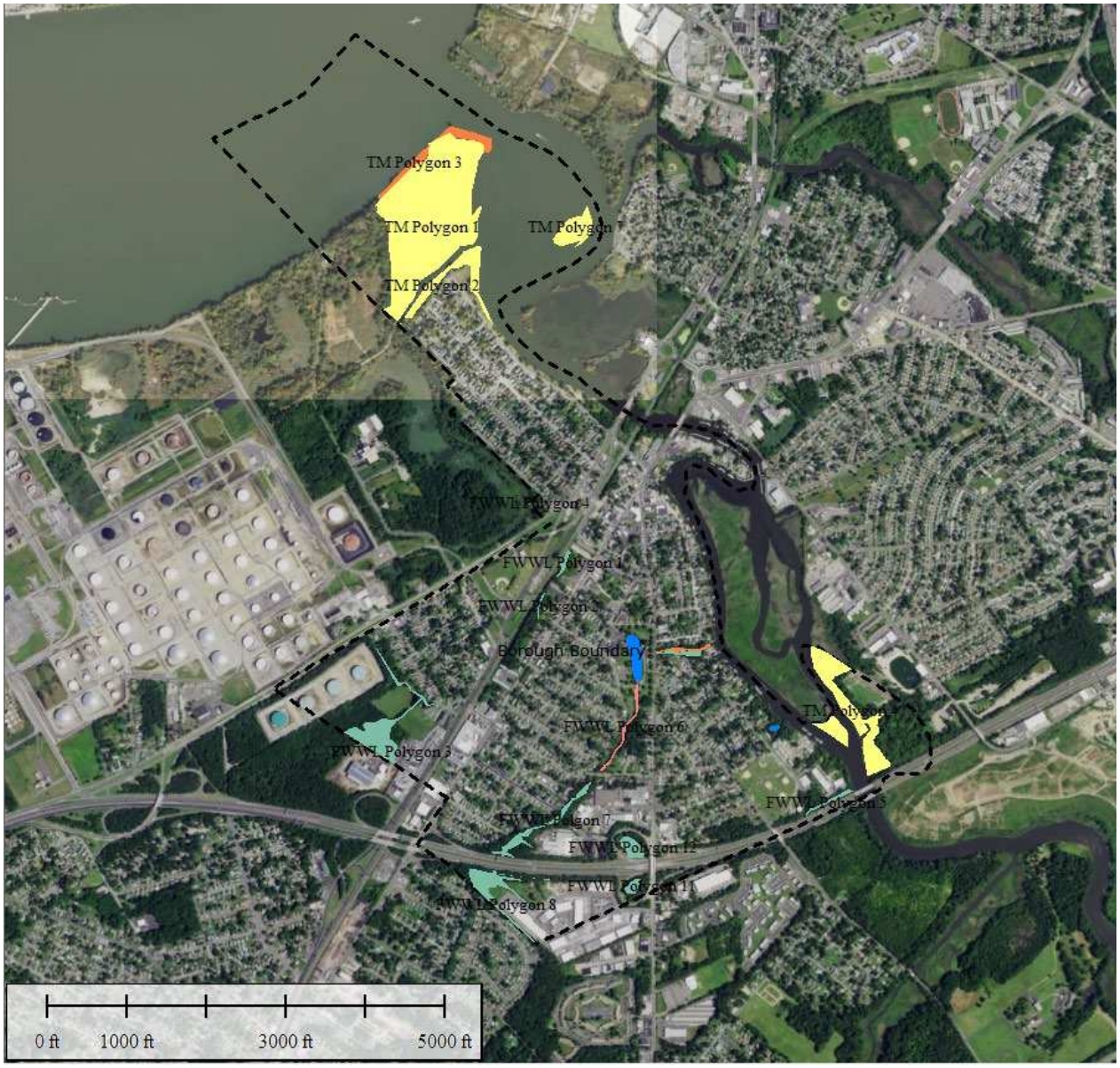

Figure 3: Wetland Cover Types: Freshwater non tidal and tidal; forest, shrub, and marsh dominant

Map Legend: Blue=Open water, Yellow=Tide Marsh; Green=Forest; Orange=Shrubs; Pink=Lawn

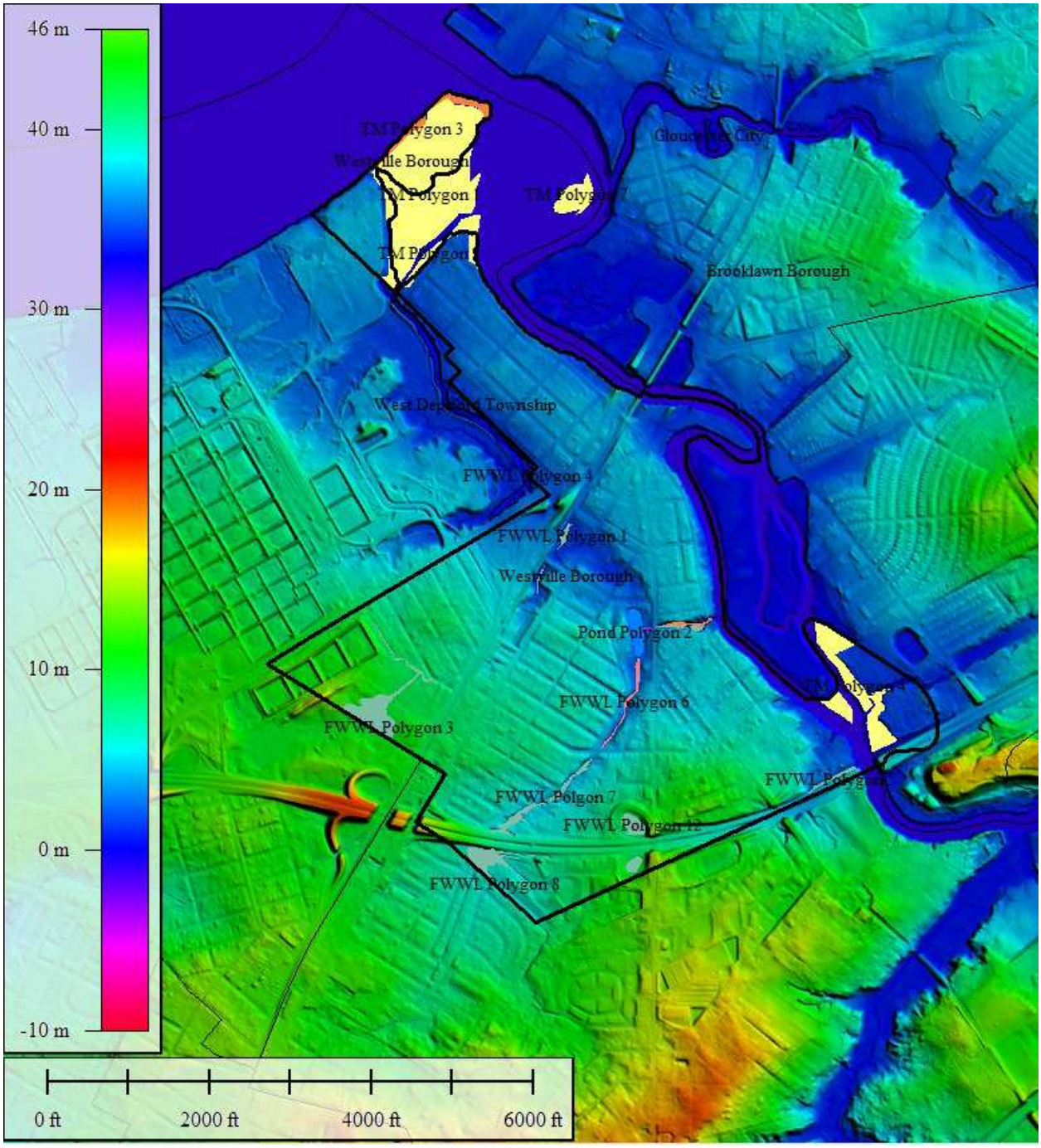

Figure 4: LiDAR elevation map with wetland polygons

Wetland Legend: Blue=Open water, Yellow=Tide Marsh; Green=Forest; Orange=Shrubs; Pink=Lawn

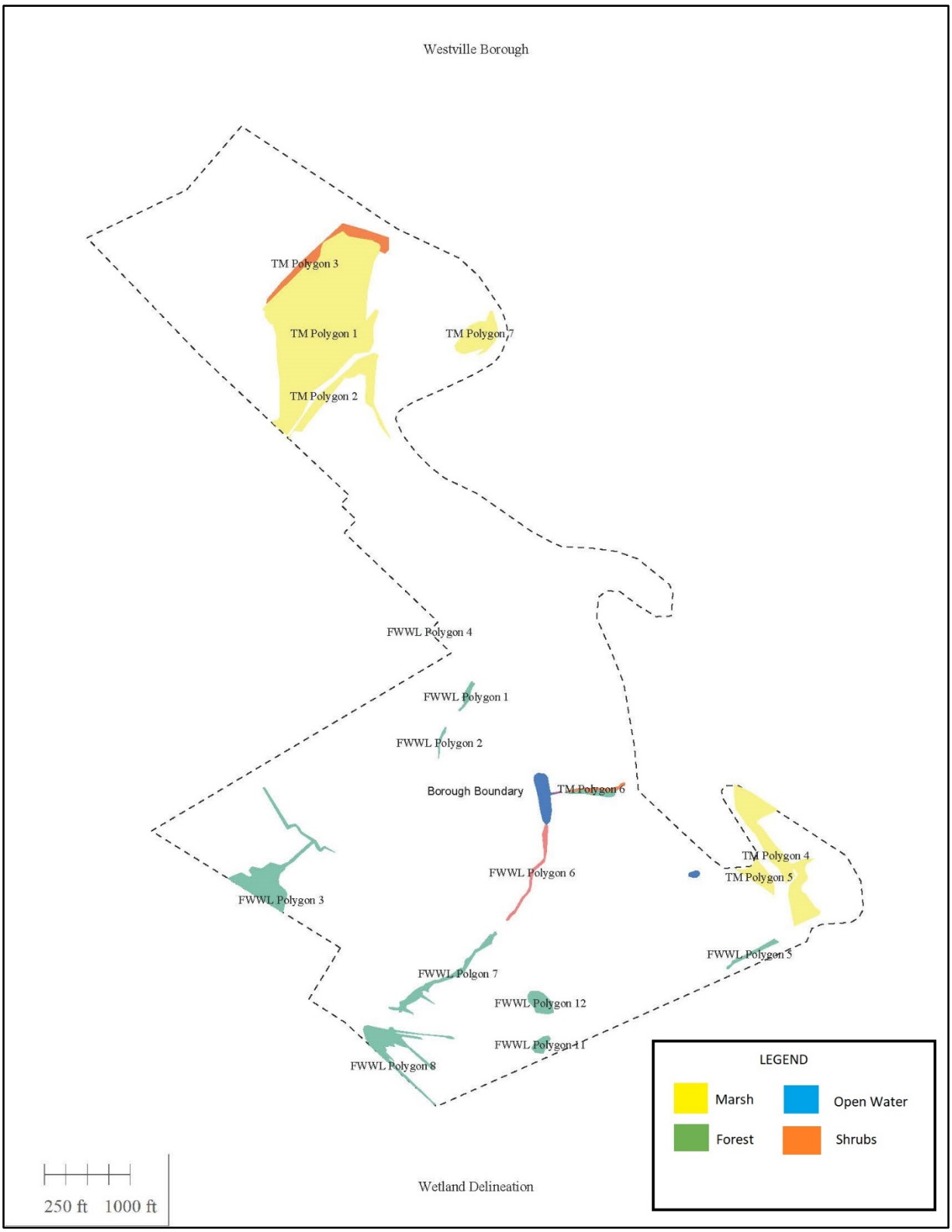

Figure 5: Wetland polygons by cover type: forest (green), shrubs (orange), marsh (yellow); lawn (pink), lake (blue)

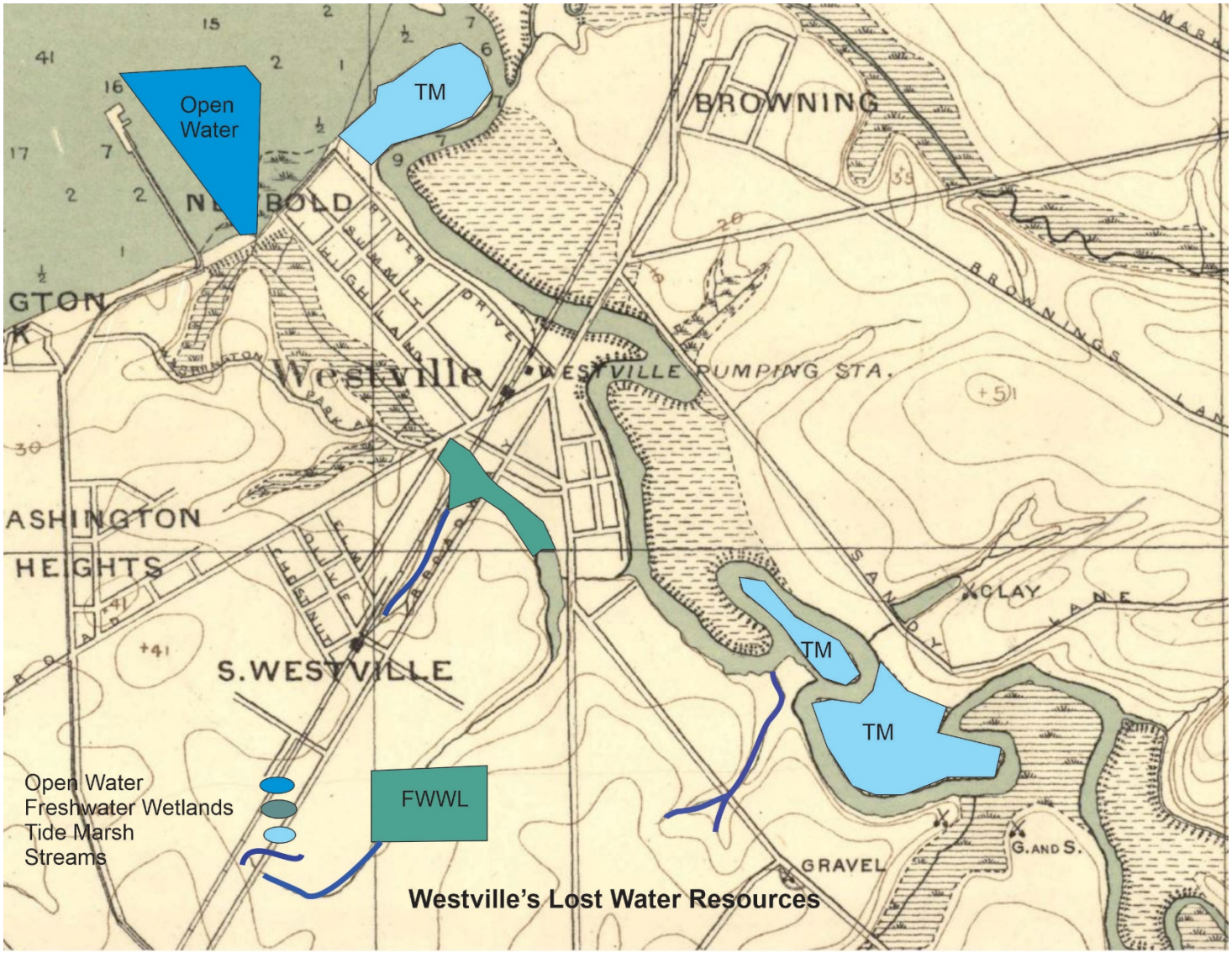

Figure 6: Lost water resources, Woodbury Topographic Name Sheet 1900

Environmental Resource Inventory for the Borough of Westville

Publication Number:
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Geographic Area Covered:
The Borough of Westville, Gloucester County, New Jersey

Key Words:
Agriculture, Aquifers, Big Timber Creek, Biodiversity, Biological Resources, Borough of Westville, Built Environment, Conservation, Contaminated Sites, Delaware River, Development, Endangered Species, Energy Use, Environmental Issues, Environmental Resource Inventory, Floodplains, Forests, Geology, Gloucester County, Grasslands, Groundwater, Habitat, Land Cover, Land Preservation, Land Use, Landscape Project, Master Planning, Natural Resources, New Jersey, Open Space, Soils, Steep Slopes, Streams, Topography, Water Quality, Watersheds, Wetlands

Abstract:
This publication documents the natural and community resources of the Borough of Westville, 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; Landscape Project Priority Habitats; and known contaminated sites. Community resources in the form of protected open space and recreation facilities are also briefly described. A short history of the community is also included.

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Unless otherwise noted, all photos in this report were taken by DVRPC staff and are available for public use. High-quality digital versions of these photos are available upon request.

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