NATURAL RESOURCE INVENTORY

Manchester Township, Ocean County, New Jersey

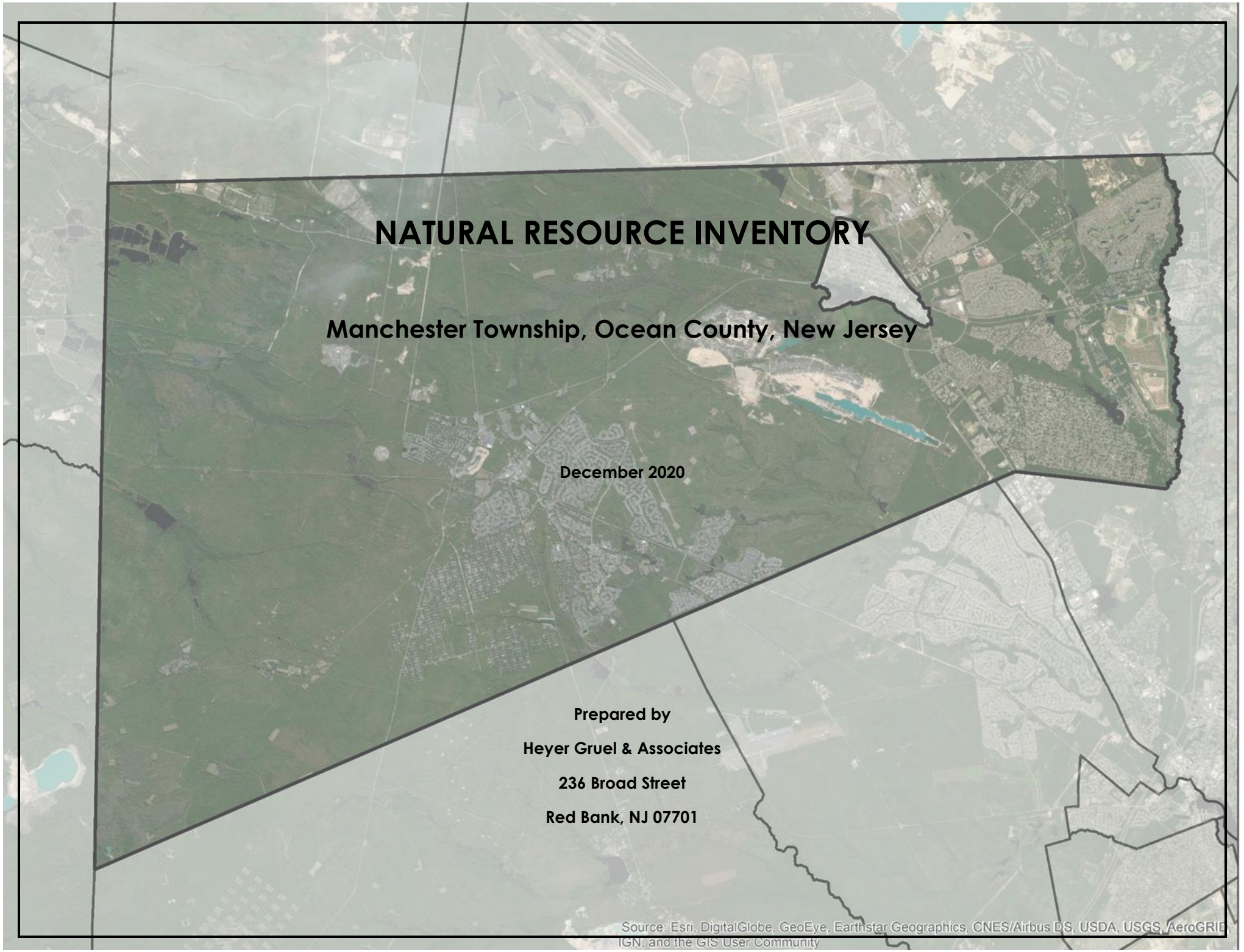
December 2020

Prepared by

Heyer Gruel & Associates

236 Broad Street

Red Bank, NJ 07701



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Community Planning Consultants

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The original of this report was signed and sealed in accordance with N.J.S.A. 45:14A-12

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Acknowledgements

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INTRODUCTION

This Natural Resource Inventory (NRI) serves as a comprehensive update to the 1992 NRI and the 2005 NRI. This NRI is prepared on behalf of the Manchester Township Environmental Commission and the Manchester Township Governing Body by Heyer Gruel & Associates.

The Township prepared its initial NRI in 1992, prior to the development of geographic information systems (GIS) and available Federal, State, County and local GIS data. In 2005, the NRI was updated to provide environmental resource mapping and data pertaining to habitat for threatened and endangered species, known contaminated sites, areas subject to the 300-foot buffer rule (as defined in the state stormwater management rules), surface water quality standards and well head protection areas.

This document is intended to comprehensively compile and update all data sources used in the preparation of the 1992 and 2005 NRIs to better inform land use policy and to ground land use decision-making with an understanding of the underlying environmental conditions upon which all development occurs.

An NRI has a two-pronged benefit. First, the NRI provides a point-in-time snapshot of the environmental resources and features that exist in a community. It is not a policy statement or a plan. Rather, it is an objective listing of the resources in the community. As an unbiased report of data that provides baseline documentation of existing environmental conditions, the NRI is a comprehensive source of information related to a community's environment that better informs the public and municipal officials, catalogs the unique ecology of a place, and assists in tracking changes over time.

Beyond its informational value, the real benefit of an NRI comes through its use as a planning tool, employed by the community to evaluate, and possibly revise planning documents, policy initiatives, and local ordinances to better protect existing natural resources and to improve the health of the natural environment. The NRI is useful to Environmental Commissions, Planning Boards, Zoning Boards, municipal administration, and to the public at large. NRI's are often the basis for resource protection ordinances in a community. Overall, using the NRI to guide land use planning can improve the likelihood of successful long-term land development because it assists in the formulation of policies that balance environmental realities with the needs of human settlement. Development is directed to locations least affected by environmental constraints, and environmentally sensitive areas are preserved from development impacts.

Note that all the information included in this NRI should be reasonably accurate for planning purposes but does not replace site-specific investigations for regulatory purposes. Data sources used herein are the most up-to-date versions available as of September 2020.

GEOGRAPHY & TOPOGRAPHY

Manchester Township is located within the Outer Coastal Plain physiographic province of New Jersey. A physiographic province is a geographic region with distinctive landscape features (also referred to as geomorphology), with characteristic topography, subsurface rock, and environmental conditions. Within New Jersey, the Coastal Plain Province is an area of about 4,667 square miles and makes up three-fifths of the state. It occupies all of Cape May, Cumberland, Salem, Gloucester, Camden, Atlantic, Burlington, Ocean, and Monmouth Counties, and portions of Middlesex and Mercer Counties. The Coastal Plain tends to have gently undulating topography with low relief. Land gradually slopes downward toward the Atlantic seaboard. Elevation in Ocean County's Coastal Plain ranges from sea level to a maximum of 225 feet in Plumsted Township. Swamps, streams, and salt marshes predominate through the low-lying portions of the Coastal Plain.

Elevations

The topography of Manchester Township is typical of land within the Coastal Plain, generally decreasing in elevation as it nears the coast and coastal waterbodies. The highest elevations in the Township are approximately 218 feet above sea level, located in the south-eastern portion of the Township near its border with Lacey Township. The lowest elevations occur along the mouth of the Forked River and Union Branch near the Township's municipal border with Toms River Township. Elevations in these areas are as low as 19 feet above sea level. (See Topography Map).

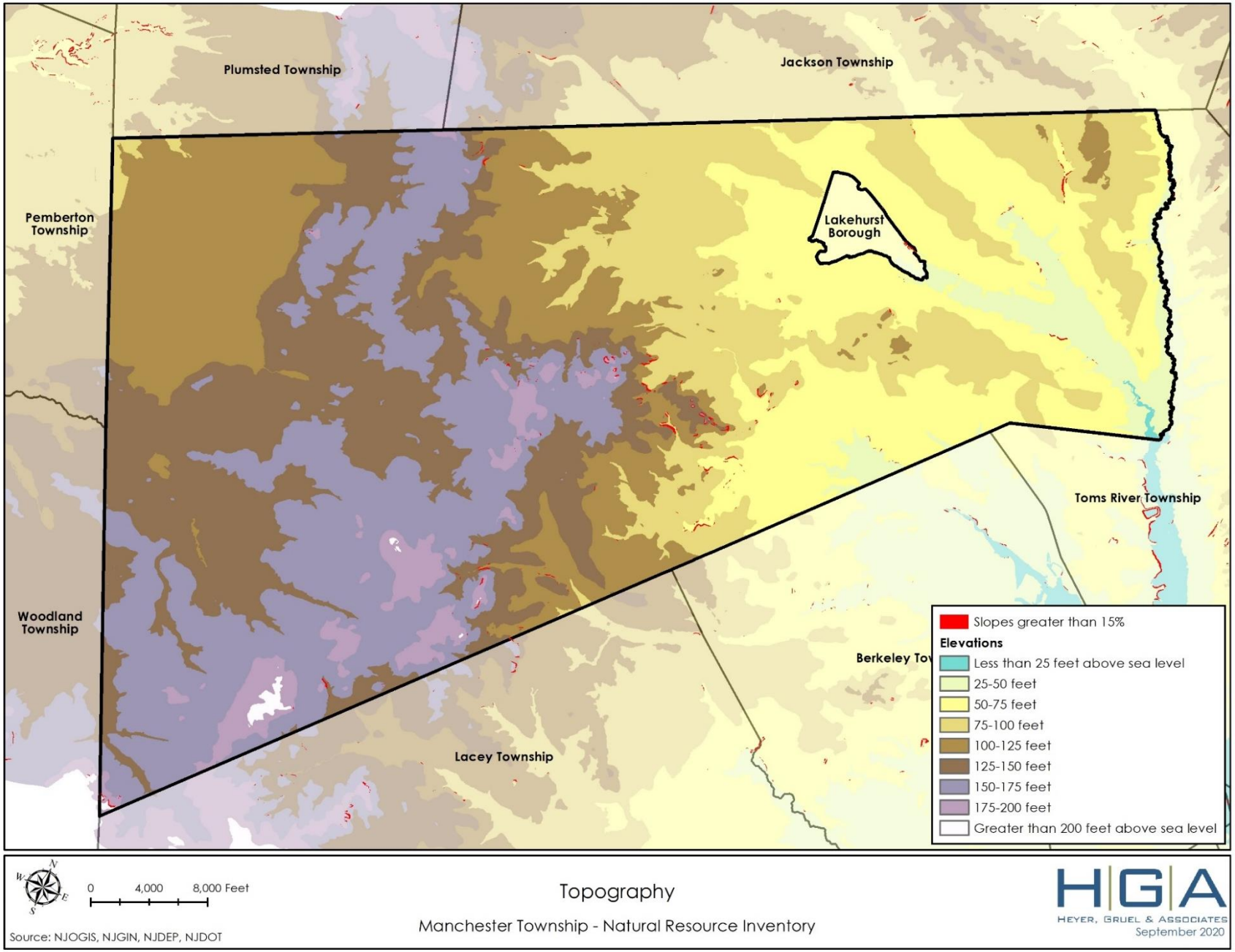
Steep Slopes

The Toms River, Union Branch, Mount Misery Brook North Branch, and other streams and creeks shape the Township's terrain. Very few areas of the Township have steep slopes, defined as areas with land topology gradient greater than 15 percent. As shown on the Topography Map, steep slope areas are located around the banks of stream and creek corridors and within the central portion of the Township, where the elevations increase.

GEOLOGY

Geology describes the physical and chemical properties of land, both below and at the surface. Geological characteristics control a number of natural processes, including how ground water recharges and moves through aquifers, how contaminants seep into and move through soil and ground water, where natural hazards like sinkholes and seismic instability may occur and where resources such as sand, gravel, peat, clay, quarry rock and mineral ores are located. Geologic properties also have implications for the physical development of the built environment, determining the suitability of an area for the use of septic systems, the management of stormwater and surface runoff, and the stability of foundations for buildings, bridges, tunnels, and other structures.

Geology of a place is generally discussed as two layers: surficial geology, which extends from a few to a few hundred feet in depth; and subsurface geology, which is the underlying rock extending deeper into the Earth's crust.


Plumsted Township
Jackson Township
Pemberton Township
Lakehurst Borough
Toms River Township
Woodland Township
Berkeley Tov
Lacey Township
Slopes greater than 15%
Elevations
Less than 25 feet above sea level
25-50 feet
50-75 feet
75-100 feet
100-125 feet
125-150 feet
150-175 feet
175-200 feet
Greater than 200 feet above sea level
0 4,000 8,000 Feet
Source: NJOGIS, NJGIN, NJDEP, NJDOT
Topography
Manchester Township - Natural Resource Inventory
HGA
Heyer, Gruel & Associates
September 2020

Subsurface Geology

Manchester Township is entirely located within the Outer Coastal Plain which was formed over the last 170-200 million years as a result of deposition and erosion. It is comprised of a wedged-shaped series of unconsolidated layers of sands, clays and marls on a gently southwestward dipping bedrock (80 to 100 feet per mile) which is 1,300 to 6,000 feet below surface. These layers extend seaward into the submerged Continental Shelf and are overlain by deposits of both Continental and Marine origin dating from 136-65 million years before present (MYBP).

During the Tertiary Age (66-2.6 MYBP), the sea covered the Outer Coastal Plain several times. After depositing the Cohansey Sand, the sea regressed for the last time and the present topography began to form, about 5 MYBP. Later, Beacon Hill Gravel was deposited over the Cohansey Sand in the northern and central portions of the Coastal Plain. Composed of quartzose and cherty sand and gravel, the Beacon Hill Gravel appears to result from extensive stream channel development. This river system deposited gravel on exposed coastal deposits when sea level lowered in the middle and late Miocene, between 12 and 6 MYBP. The strata of the Tertiary Age are, oldest to youngest, the Hornerstown Sand, Vincentown and Manasquan Formations, Kirkwood Formation, Cohansey Sand, and Beacon Hill Gravel. The Bridgeton and Pennsauken Formations in the southwest portion of the Pinelands are also thought to be Tertiary deposits. They appear fluvial in origin.

Overlying the Tertiary deposits are those which were laid down during the Quaternary Period. The Cape May Formation deposited during this time extends from sea level to 30 to 50 feet above sea level and is considered to be of marine origin.

There are many significant geologic strata in Manchester Township. The following is a discussion of the geologic strata in Manchester Township based upon the United States Geologic Service and the New Jersey Geologic Survey's Bedrock Geologic Map of Central and Southern New Jersey (1999), specifically those formations that were identified at drillhole 29-0429, which is located approximately one-third of a mile east of the intersection of Route 70 and Beckerville Road in Manchester Township. A copy of the cross-section at the drillhole is found at the end of this section.

The *Potomac, Raritan, and Magothy Formations* are the oldest, thickest, and most extensive units known to occur throughout the Township and the entire Pinelands portion of the Outer Coastal Plain. These interrelated units consist of alternating layers of clay, silt, sand, and gravel.

The Potomac Formation is found approximately 400 meters below sea level and is approximately 110 meters thick. the Raritan Formation approximately 350 meters below sea level and 40 meters thick, and the Magothy Formation approximately 300 meters below sea level and is approximately 50 meters thick.

The Potomac Group and Raritan Formation are believed to be continental in origin, although marine fossils have been found in the Raritan Formation. The Magothy is believed to be both marine and non-marine in origin.

The *Cheesequake Formation* underlies most of central and southern New Jersey. This formation consists of fine-detrital silt and clay lithologic constituents. The Cheesequake Formation is found approximately 260 meters below sea level and is

approximately 20 meters thick. This formation overlies the Magothy Formation.

The *Merchantville, Woodbury and Englishtown Formations* are found above the Cheesequake Formation, at approximately 205 meters below sea level.

The *Merchantville Formation* consists of coarse-detrital sand with a high quartz and glauconite content, that has minor lithologic components of fine-detrital silt and clay. The Merchantville formation is overlaid by the Woodbury Formation. In some parts of this formation, dinosaur remains have been found.

The *Woodbury Formation* was deposited in a marine setting between 80.5 and 78.5 million years ago. The Woodbury Formation consists primarily of clay with minor thin beds of very fine quartz sand. It is generally dark gray and black where unweathered, and yellowish brown to brown where weathered.

Englishtown Formation is a late Cretaceous, 75-millon-year-old deposit of fine- to coarse-grained sand, locally interbedded with thin to thick beds of dark clay that contain abundant carbonaceous (woody) material. Municipalities in Monmouth and northern Ocean County utilize the Englishtown Aquifer as a public water supply.

The *Marshalltown, Wenonah and Mount Laurel* formations are found approximately 125 meters below sea level and together are approximately 45 meters thick beneath the Township.

The *Marshalltown Formation* is comprised of quartz-glauconite clayey sand that is fine- to medium-grained. It is olive to dark gray in color when unweathered and appears gray when weathered. The Marshalltown Formation can act as an aquitard (a layer which inhibits the free movement of water).

The *Wenonah Formation* and *Mount Laurel Sand* function hydraulically as one, with the latter unit predominating and are overlain by the *Navesink Formation*, generally an aquitard. The unit outcrops from Raritan Bay southwestward to Delaware Bay and reaches a thickness of over 200 feet in the subsurface. The upper surface of the *Mount Laurel Sand* dips about 40 feet per mile to the southeast. It ranges in elevation from over 100 feet above sea level in its outcrop in the northern end of the Coastal Plain to over 1,200 feet below sea level below the barrier beach in northeast Ocean County. This unit is believed to underlie the entire Pinelands area.

The *Navesink* and *Red Bank Formations* lie above the Wenonah-Mount Laurel Formations. These formations are found approximately 140 feet below sea level, and combined are approximately 20 feet thick.

The *Navesink Formation* was deposited approximately 66 to 70 million years ago during the Cretaceous period. The Navesink Formation consists of greensand glauconitic marl and sand. The Red Bank Formation

The Navesink Formation overlays the Mount Laurel Formation, and the *Red Bank Formation* overlays the Navesink Formation.

The *Hornerstown Formation* is approximately 2 meters thick in Manchester Township, and is primarily composed of sand and glauconite at base, overlain by a thin laminated, dark-gray clay-silt that grades upward into a fine-grained, clayey glauconite quartz sand.

The *Vincentown Formation* overlays the Hornertown Formation and is approximately 95 meters below sea level. The Vincentown Formation is approximately 20 meters thick and

consists primarily of medium-grained sand and quartz, with feldspar and mica as minor sand constituents.

The *Manasquan Formation* is approximately 24 meters thick and is approximately 70 meters below sea level. This formation consists of several lithologies- Along the Manasquan River near Farmingdale in Monmouth County, the formation consists of a lower, clayey, quartz-glauconite sand and an upper, fine-grained quartz sand or silt, which is exposed along Hog Swamp Brook west of Deal. However, near Pemberton in Burlington County, this formation becomes a blue-green clay-silt.

The *Shark River Formation* overlays the Manasquan Formation, is approximately 35 meters below sea level, and 40 meters thick. Like many of the other geologic formations, the Shark River Formation is composed of glauconite sand, silt, and clay.

The *Kirkwood Formation* overlaps several formations, including the Piney Point, Marshalltown, Hornerstown, and Navesink, depending on location in the Pinelands. It is overlain by the Cohansey Sand. The top of the Kirkwood Formation ranges in elevation from over 100 feet above sea level in its outcrop area to over 300 feet below sea level along the eastern edge of Cape May Peninsula. It has an irregular surface. The formation is between 50 and 100 feet thick in its outcrop and thickens to over 800 feet in the Atlantic City area.

The Kirkwood has variable lithology both along its outcrop and downdip. The outcrop consists of a lower component that is a very fine, dark, micaceous sand with a pebbly glauconitic basal layer two to four feet thick, and an upper component of silt and clay. The Kirkwood Formation is approximately 40 meters thick and is found at sea level, primarily along the Toms River, Ridgeway Branch and Union Branch adjacent to Pine Lake.

Cohansey Sand is the dominant formation in the Township of Manchester. The Cohansey overlies the Kirkwood Formation. It either outcrops at the surface or is overlain by a thin veneer of Pleistocene deposits. The areal extent of the Cohansey outcrop is 2,350 square miles, southeast of the Kirkwood outcrop. The occurrence of outliers within the Kirkwood outcrop indicates that the Cohansey was more extensive at one time. The combined thickness of the Cohansey and overlying Pleistocene deposits ranges from less than 20 feet to more than 300 feet.

The Cohansey Sand Formation typically consists of fine to coarse grained quartzose sand with lenses of gravel that are usually one foot thick or less. In most areas, overall clay content is less than 20 percent. Lenses of white, yellow, red, and light gray clay occur generally in the upper part of the formation and may be as much as 25 feet thick. The sand is predominantly yellow (limonite staining), but shades of white, red, brown, and gray also occur. Parallel bedding and cross-stratification are present in the sand. The Cohansey is interpreted to be a mixed or transitional environment deposit that, in overall aspect, is a partly dissected ancient subdelta plain. This is because the Cohansey has deposits which have been identified as stream, fluvial plain, deltaic, estuarine, lagoonal, beach, and nearshore marine in origin. The Cohansey Sand is found at or above sea level in Manchester Township.

The *Beacon Hill Gravel Formation* overlies the Cohansey Sand Formation in some parts of the Township. Chert, quartzose gravel and ilmenite are present in both the Cohansey Sand and Beacon Hill Gravel Formations.

Bridgeton Formation forms a discontinuous veneer lying above the Cohansey in portions of the Township. The Bridgeton Formation is generally derived from erosion and redeposition of

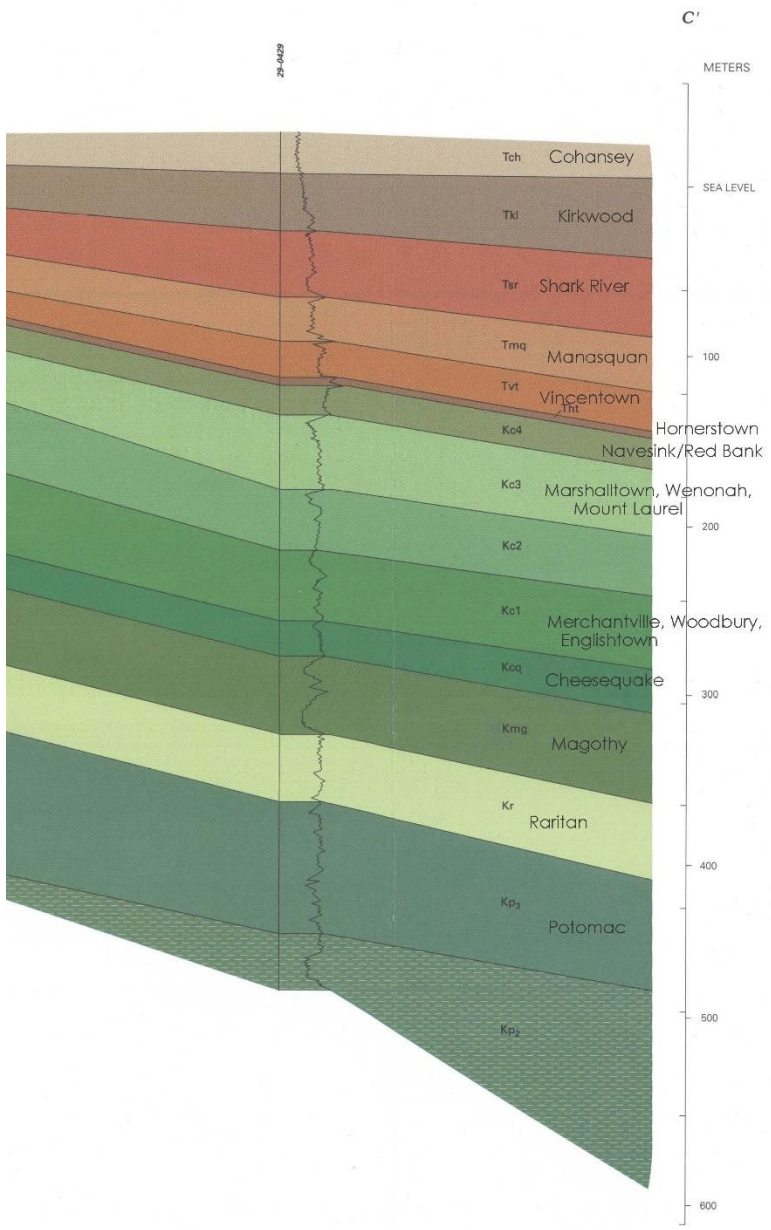
the Cohansey Sand and Beacon Hill Gravel. It caps the tops and mantles the upper slopes of the pronounced hills and narrow ridges.

The particular characteristics of the Township's geology-low relief with sandy, droughty soil, underlain with a number of water-bearing sand layers alternating with confining clay layers-give rise to a unique and fragile surface and groundwater system. In essence, precipitation is rapidly absorbed by the droughty sand, percolates through the soil to the relatively shallow water table, and in turn supports the region's stream flow as groundwater seepage.

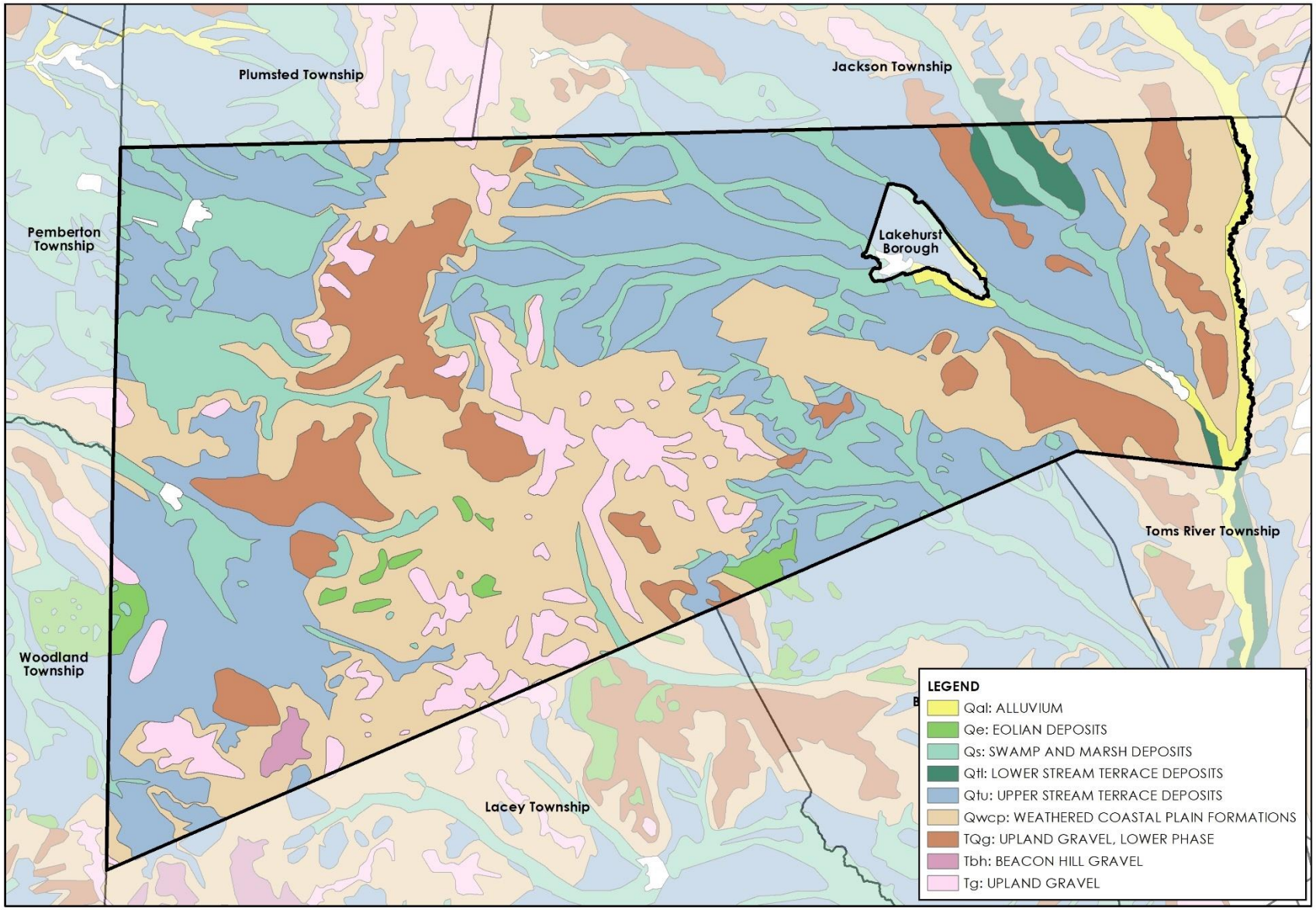
Surficial Geology

Surficial materials are the unconsolidated sediments that overlie the Coastal Plain formations and are the parent material for most soils. These materials are produced by weathering, sediment deposition, biological accumulation, and human and volcanic activity and affect the movement of ground water from the surface into underlying formations. Surficial materials also provide foundation support for structures and constitute a supply of materials for a variety of uses.

The table below gives a description of each of the surficial materials shown on the Surficial Geology Map.



Abbr.	Geology Name	Lithology	Depth of Layer	Geology Age	Notes	Acreage	% of Township
Qal	ALLUVIUM	Sand, gravel, silt, minor clay and peat; reddish brown, yellowish brown, brown, gray.	As much as 20 feet thick.	Holocene and late Pleistocene	Contains variable amounts of organic matter. Deposited in modern floodplains and channels.	491.1	0.9%
Qe	EOLIAN DEPOSITS	Windblown fine sand and silt; very pale brown, yellowish brown.	As much as 15 feet thick.	late Pleistocene, locally of early to middle Pleistocene and Pliocene age on uplands	Form sand sheets and, locally, dunes.	545.9	1.0%
Qs	SWAMP AND MARSH DEPOSITS	Peat and organic clay, silt, and minor sand; gray, brown, black.	As much as 40 feet thick.	late Pleistocene and Holocene	Deposited in modern freshwater wetlands.	8,286.8	15.8%
Qtl	LOWER STREAM TERRACE DEPOSITS	Sand, pebble gravel, minor silt and cobble gravel; reddish brown, yellowish brown, reddish yellow.	As much as 30 feet thick.	late Pleistocene, late Wisconsinan	Forms nonglacial stream terraces 5 to 20 feet above modern floodplains.	487.6	0.9%
Qtu	UPPER STREAM TERRACE DEPOSITS	Sand and pebble gravel, minor silt and cobble gravel; yellow, reddish yellow, yellowish brown.	As much as 20 feet thick.	middle to late Pleistocene	Form nonglacial stream terraces 20 to 50 feet above the modern floodplain.	17,143.5	32.6%
Qwcp	WEATHERED COASTAL PLAIN FORMATIONS	Exposed sand and clay of Coastal Plain bedrock formations. Includes thin, patchy alluvium and colluvium, and pebbles left from erosion of surficial deposits.	-	Chiefly Pleistocene, locally Miocene and Pliocene.	-	16,593.2	31.5%
Tbh	BEACON HILL GRAVEL	Sand, clayey sand, pebble gravel, minor cobble gravel; reddish yellow to yellow. Locally iron-cemented. Feldspathic gravel clasts and sand are weathered to clay.	As much as 30 feet thick.	late Miocene	Occurs as erosional remnants of a former fluvial plain	169.4	0.3%
Tg	UPLAND GRAVEL	Sand, clayey sand, pebble gravel, minor cobble gravel; yellow to reddish yellow. Locally iron-cemented.	As much as 20 feet thick.	Pliocene-early Pleistocene	Includes fluvial and minor colluvial deposits in erosional remnants	3,202.1	6.1%
TQg	UPLAND GRAVEL, LOWER PHASE	Sand, clayey sand, and pebble gravel, minor silt; yellow to reddish yellow.	As much as 20 feet thick.	late Pliocene-middle Pleistocene	Includes fluvial and minor colluvial deposits in erosional remnants	5,691.9	10.8%


Plumsted Township
Jackson Township
Pemberton Township
Lakehurst Borough
Toms River Township
Woodland Township
Lacey Township
LEGEND
Qal: ALLUVIUM
Qe: EOLIAN DEPOSITS
Qs: SWAMP AND MARSH DEPOSITS
Qtl: LOWER STREAM TERRACE DEPOSITS
Qtu: UPPER STREAM TERRACE DEPOSITS
Qwcp: WEATHERED COASTAL PLAIN FORMATIONS
TQg: UPLAND GRAVEL, LOWER PHASE
Tbh: BEACON HILL GRAVEL
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8,000 Feet
Source: NJOGIS, NJGIN, NJDEP, NJDOT
Surficial Geology
Manchester Township - Natural Resource Inventory
HGA
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September 2020

GROUNDWATER HYDROLOGY

The most important abiotic element of the Pinelands ecosystem is water, considering its availability and characteristic chemistry. Water is stored in the extensive sand aquifers below the surface. The Kirkwood-Cohansey Aquifer provides 90 percent of the flow in the Pinelands streams, rivers and wetlands in the form of baseflow. It is replenished solely by precipitation, of which about 44 percent of the annual total percolates through the sandy soil surface.

Although highly permeable, the uppermost soils tend to be chemically inert with a low absorptive capacity. It is, therefore, incapable of filtering out wastes. In addition, the waters are susceptible to various forms of pollution because they are weakly buffered against chemical change. Groundwater contamination in the Pinelands is a significant threat.

Aquifers

An aquifer is a ground water formation that can provide economically useful quantities of water to a pumping well for a single home, business, farm or municipality. In other words, all aquifers contain groundwater, but not all groundwater is an aquifer. For this reason, it is important to know what portion of total ground water recharge reaches aquifers and is available for human use. The rate of recharge is not the same for all aquifers, a fact which must be considered when pumping water from a well. Pumping too much water too fast draws down the water in the aquifer, causing a well to yield less and less water and eventually run dry or face saltwater intrusion. In addition, excessive human use can damage the surface waters to which ground water naturally flows, drying up streams during droughts.

The aquifers of New Jersey are classified as either consolidated (rock formations) or unconsolidated (sand and gravel) aquifers. Consolidated aquifers contain ground water in fractures and sometimes in pore spaces, while unconsolidated aquifers contain ground water primarily in the pore spaces between sand and gravel particles. The bedrock aquifers in New Jersey include fractured-rock aquifers of the Valley and Ridge, Highlands, and Piedmont physiographic provinces in the northern portion of the State. Unconsolidated aquifers include the aquifers of glacial sediment exceeding 50-foot thickness in northern New Jersey and the Coastal Plain physiographic province. Aquifer formations at the land surface without a confining layer are known as surficial aquifers. Where an aquifer is overlain by a confining layer, it is known as a confined aquifer. The water in a confined aquifer may be under pressure and could rise up above the land surface, the phenomenon that creates an artesian well.

All aquifers found beneath Manchester Township are unconsolidated aquifers. The Kirkwood-Cohansey aquifer system is an unconfined aquifer found at or near the water table, making it a surficial aquifer. Other aquifers (all of which are confined aquifers) in Manchester Township include the Wenonah-Mount Laurel, Englishtown, Magothy, and Potomac 2 and 3.

Descriptions of Aquifers in Manchester Township

The Kirkwood Cohansey Aquifer is a shallow water table aquifer, that provides 90% of the flow in Pinelands streams, rivers and wetlands. It is replenished solely by precipitation. On average, the Pinelands receives approximately 44 inches of precipitation annually, with half of it transpired by vegetation or evaporating. Only about 17 to 20 inches enters the ground, of which some is

absorbed by plants via root systems. A portion of this precipitation flows into nearby streams and wetlands.

In Manchester Township, the Kirkwood Cohansey Aquifer is found between 160 feet above sea level and as low as 80 feet below sea level.

The Kirkwood-Cohansey aquifer system consists of varied geologic units including parts of the Miocene Kirkwood and Cohansey Formations, and younger surficial deposits such Beacon Hill gravel, Bridgeton or Cape May Formations. The water in this aquifer is well connected to surface water bodies and some of the water leaks into deeper confined aquifers. It generally functions as a water table aquifer, although it may be semi-confined in some places. In some parts of Ocean County, it reaches a maximum thickness of approximately 400 feet. Overall, the water in this aquifer is typically fresh, acidic, highly corrosive and low in dissolved solids.

The Wenonah-Mount Laurel aquifer consists of slightly glauconitic medium sands of the Mount Laurel Formation and the fine sands of the Wenonah Formation. This aquifer is separated from the Englishtown aquifer system by silts and clays of the Wenonah and Marshalltown Formation.

In Manchester Township, this aquifer is found between 300 feet and 570 feet below sea level. The aquifer is roughly 60 feet in thickness, stored between two confining units.

The Englishtown Aquifer is a single aquifer in updip areas of Monmouth and Ocean Counties, but two distinct aquifers separated by a clay-silt confining bed in downdip areas in northeastern Ocean County and southeastern Monmouth County. Within Manchester Township, the aquifer is mostly split by a confining layer, creating two separate aquifers.

The Englishtown Aquifer is located between 420 feet and 730 feet below sea level.

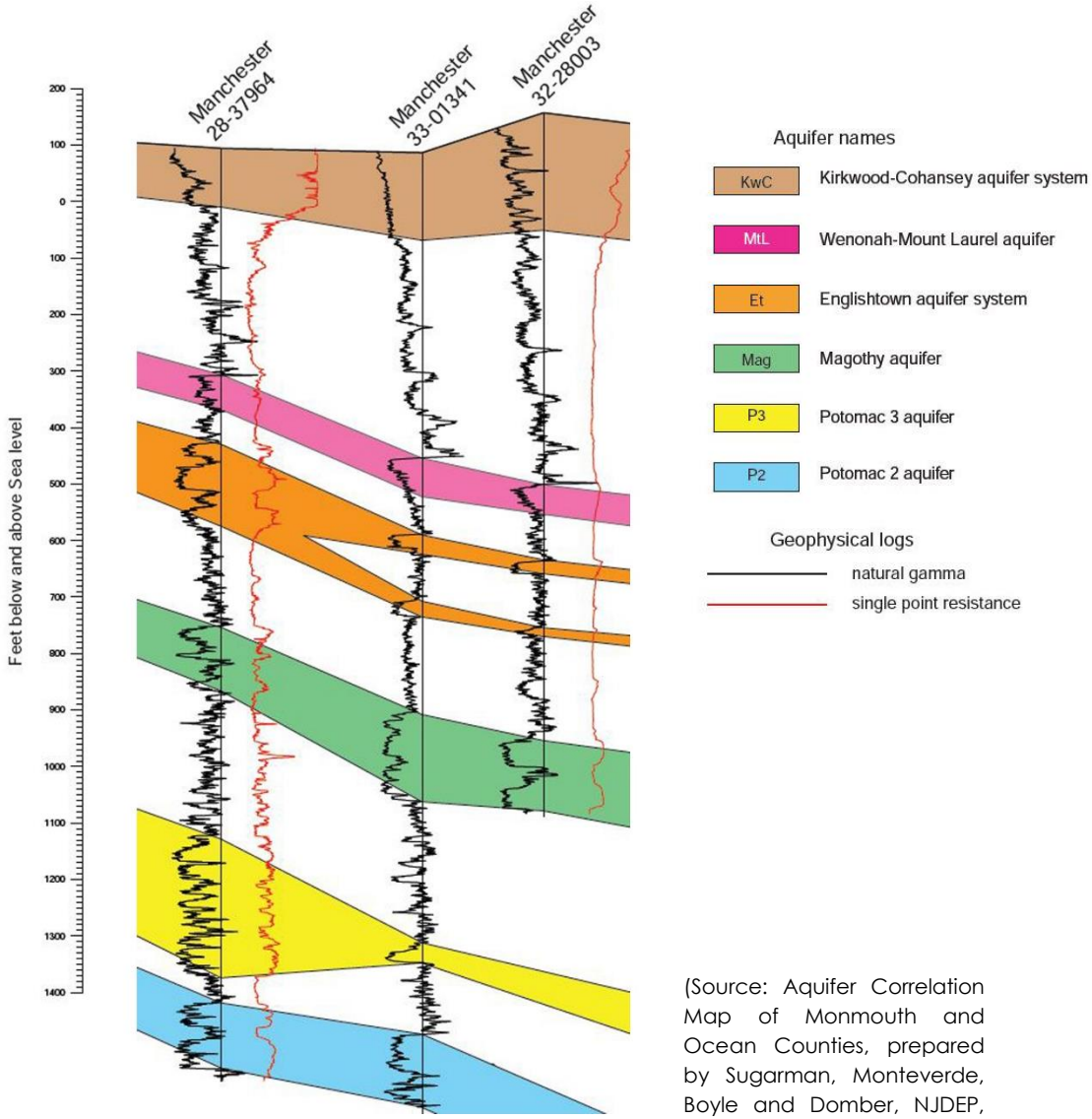
The Potomac-Raritan-Magothy (PRM) Aquifer series are deep confined aquifers found throughout the southern portion of New Jersey.

The Magothy Aquifer consists of fine-to-coarse sand inter-stratified with dark, carbonaceous clay and is found approximately 700 to 1,000 feet below sea level in Manchester Township. The Magothy Aquifer's thickness varies between 100 feet and 160 feet in the Township.

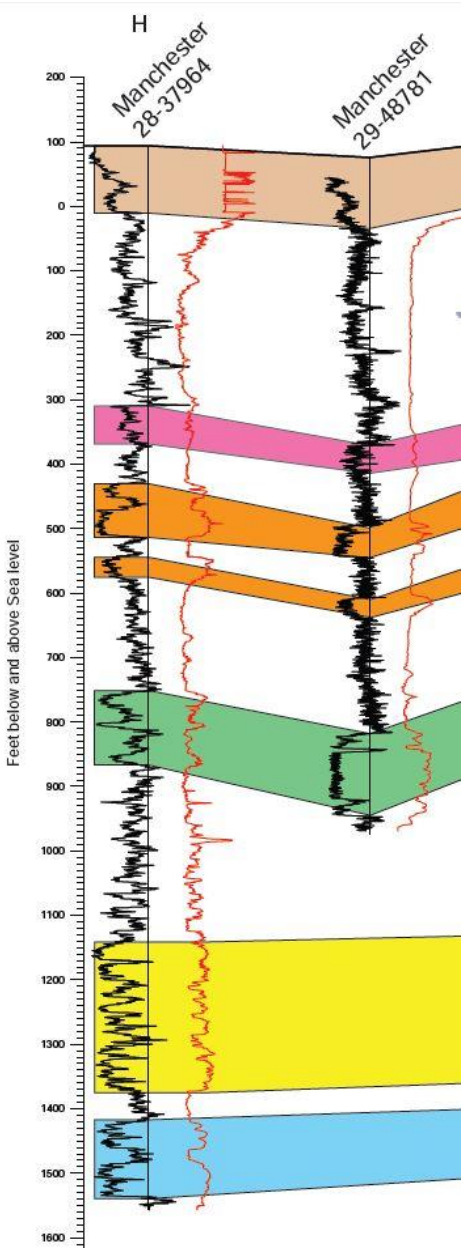
The Potomac 3 Aquifer consists of fine-to-coarse sand, and sparse gravel, interbedded with white or variegated clay. The Potomac Unit 3 Aquifer has been correlated with the Farrington Sand aquifer by G. M. Farlekas, as well as the middle aquifer of the PRM aquifer system by O.S. Zapecza. The Potomac 3 Aquifer is located between 1,060 feet and 1,400 feet below sea level and varies in thickness between 240 feet and 60 feet. Although the Potomac 3 is a major aquifer, its use is limited by its depth and the possibility of producing brackish water containing high chlorides exceeding 250 mg/L isochlor, which is an EPA secondary drinking water standard.

The Potomac 2 Aquifer is only present in deep wells, and consists of fine-to-coarse sand, and sparse gravel, interbedded with white of variegated clay, similar to the Potomac 2 Aquifer. The Potamac 2 is approximately 1,400 feet below sea level and has a thickness of approximately 120 feet.

The following hydrogeologic sections detail the aquifers in Manchester Township.



(Source: Aquifer Correlation Map of Monmouth and Ocean Counties, prepared by Sugarman, Monteverde, Boyle and Domber, NJDEP, NJGWS, 2013, revised 2019)



Median Aquifer Yields for Ocean County		
Aquifer	**County Rank**	**State Rank**
Kirkwood Cohansey	B	B
Wenonah-Mount Laurel	C	C
Englishtown	B	B
Potomac-Raritan-Magothy	A	A

Aquifer Rank	Range of Median Yields (gpm)
A	> 500
B	250 to 500
C	100 to 250
D	25 to 100
E	< 25

As shown in the charts above, each aquifer has been ranked according to the range of median yield by the New Jersey Geological and Water Survey. With the exception of the Wenonah-Mount Laurel Aquifer, Manchester Township's aquifers rank highest in the state and county.

Groundwater Recharge Areas

Groundwater is water below land surface that is stored in the cracks and spaces in rock, sand and gravel formations. Ground water recharge refers to the water that infiltrates the ground and reaches the water table, providing for aquifer recharge, the maintenance of stream baseflow and hydration of wetlands. This water movement is the result of natural infiltration and percolation processes whereby rainwater from land areas or streams pass through permeable soils into water-holding rocks or unconsolidated materials (such as sands and gravels) that provide underground storage in saturated zones known as ground water. Where ground water can yield potable water supplies to wells it is known as an aquifer.

The model for representing ground water recharge in New Jersey is published by the New Jersey Division of Water Supply and Geoscience. Their method combines land-use/land-cover, soil, and municipality-based climatic data to produce an estimate of ground-water recharge in inches/year, using average annual precipitation values. Recharge is then ranked by volume (billions of gallons/year) using natural breaks in the percentage of total volume.

County Groundwater Recharge Rank	Rate of Recharge	Acreage	Percentage
A	17 to 18 inches/year	2,802.6	5.3%
B	15 to 16 inches/year	29,847.1	56.6%
C	12 to 14 inches/year	5,309.9	10.1%
D	1 to 11 inches/year	1,918.5	3.6%
E	0 inches/year	350.9	0.7%
L	Hydric Soils (No recharge calculated)	1,722.1	3.3%
W	Wetlands/Open Water (No recharge calculated)	10,805.4	20.5%
Total		**52,756.5**	**100.0%**

Most areas, unless composed of solid rock or covered by impervious surface, allow a certain percentage of total precipitation to reach the water table. Overall, the Township has moderate recharge potential in the sense that at least 72% of the land has the potential to infiltrate water at a recharge rate of 12 to 18 inches per year. (See Groundwater Recharge Areas

Map). However, in some areas of the Township this rate may be optimistic given the fact that only undisturbed soils have the ability to recharge at these rates.

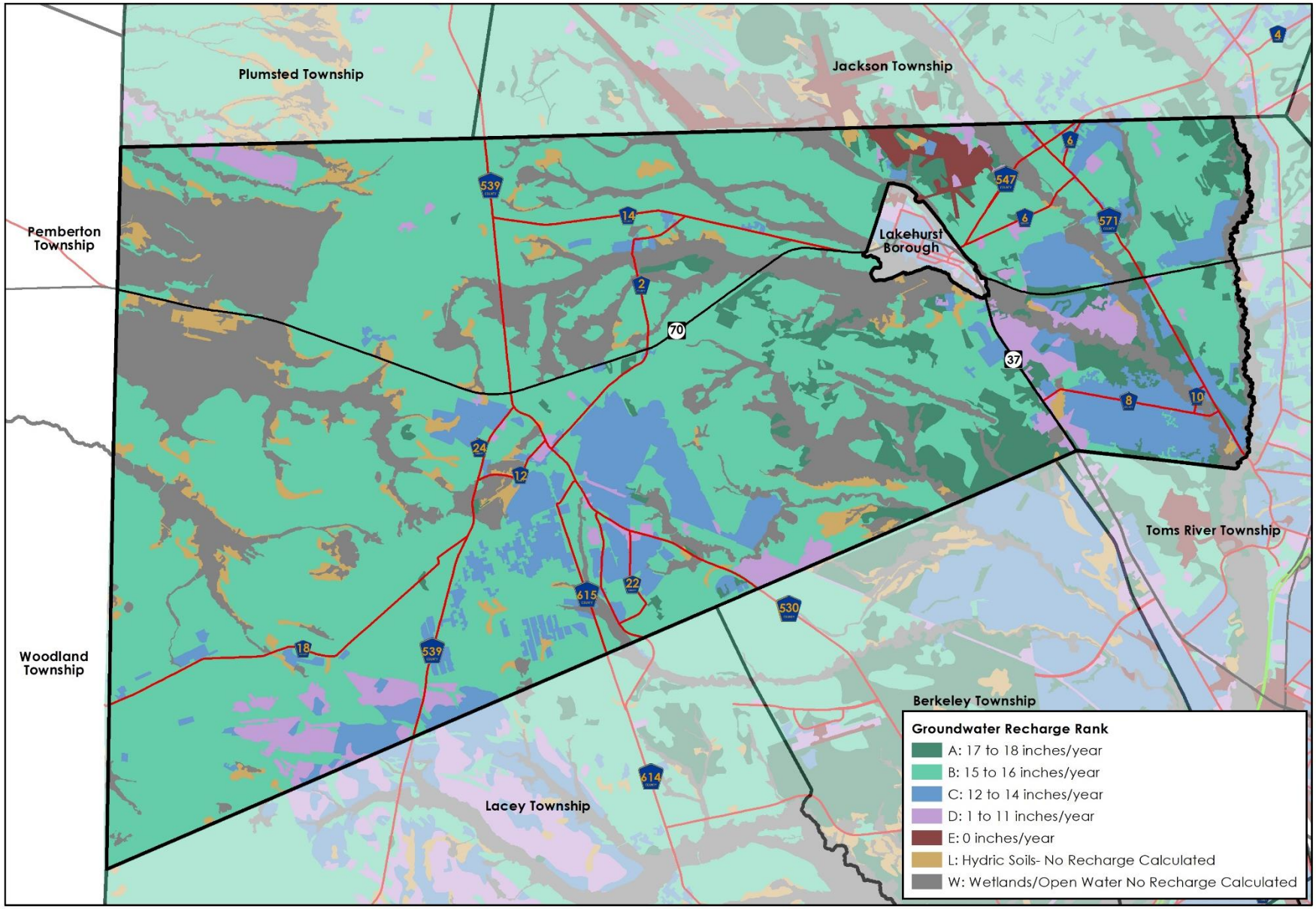
Wellhead Protection Areas

A wellhead protection area (WHPA) is the portion of an aquifer through which groundwater moves to a well. Well Head Protection Area delineations are conducted in response to the Safe Drinking Water Act Amendments of 1986 and 1996 as part of the Source Water Area Protection Program (SWAP). The delineations are the first step in defining the sources of water to a public supply well. Within these areas, potential contamination is assessed and monitored.

As mapped by the NJDEP, Well Head Protection Areas are comprised of three tiers, defined as the travel time for water to reach a particular well. Thresholds delineate the horizontal extent of ground water captured by a well pumping at a specific rate over a two, five, and twelve-year tiers for unconfined wells.

The WHPAs can be broken down into two separate classes: Public Community and Public Non-Community Protection Areas. The Public Community WHPAs are the well head protection areas for a water system that has at least 15 service connections used by year-round residents, or regularly serves at least 25 year-round residents. Examples of community water systems are mobile home communities and municipalities. Non-Community WHPAs are the well head protection areas of a public water system used by individuals other than year-round residents for at least 60 days of the year. A noncommunity water system can be either transient or nontransient. A nontransient noncommunity water system serves at least 25 of the same people over a period of six months during the year, such as schools, factories, and office buildings. A transient noncommunity water system is a system that serves year-round for at least 60 days of the year, but it does not serve the same individuals during that time period. Examples of transient noncommunity water systems include rest stop areas, restaurants and motels.

The attached Wellhead Protection Areas Map shows the locations of the Public Community WHPAs and Public Non-Community WHPAs in Manchester Township.



Groundwater Recharge

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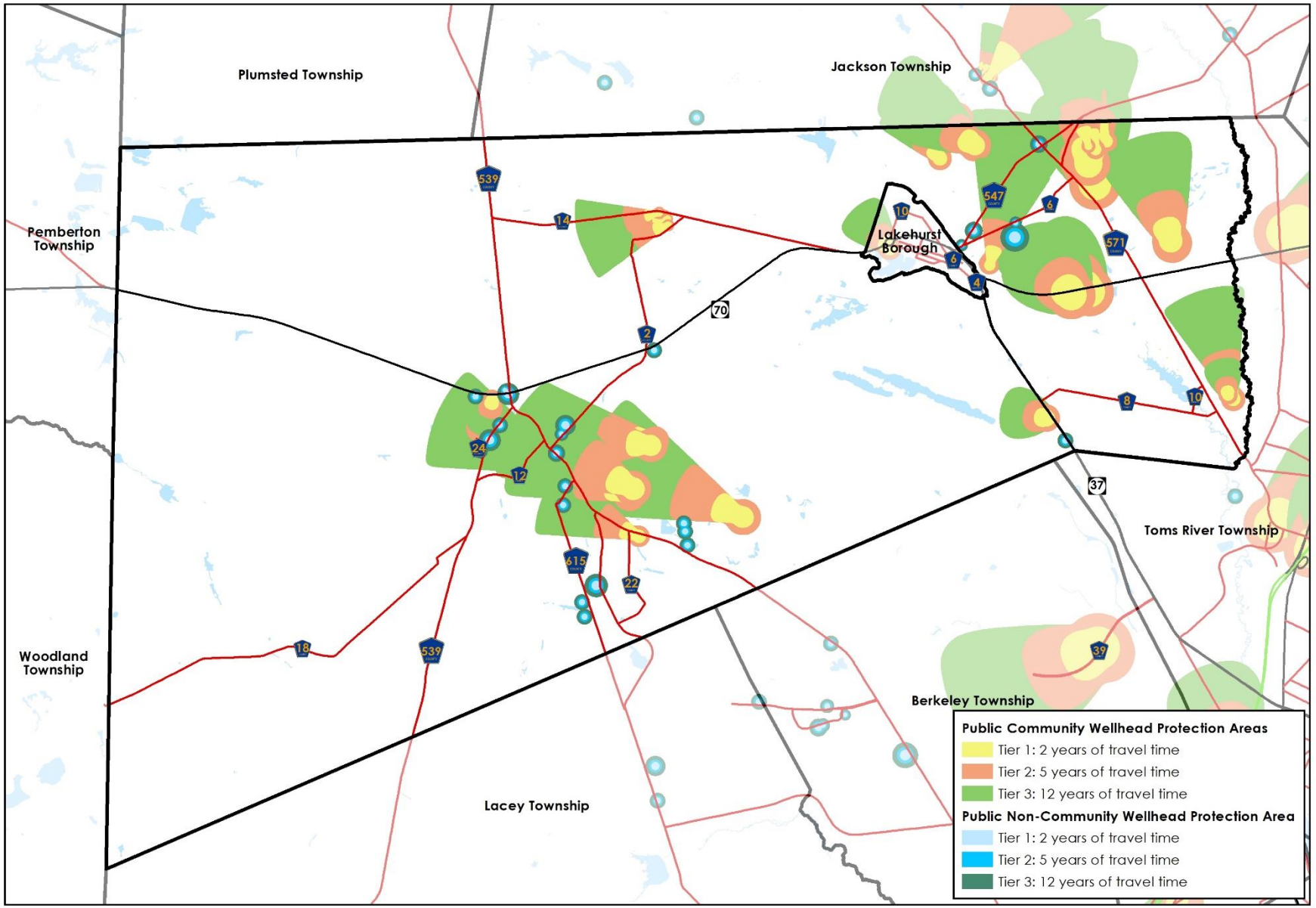
Plumsted Township
Jackson Township
Pemberton Township
Lakehurst Borough
Toms River Township
Woodland Township
Berkeley Township
Lacey Township
539
547
571
615
70
37
Public Community Wellhead Protection Areas
Tier 1: 2 years of travel time
Tier 2: 5 years of travel time
Tier 3: 12 years of travel time
Public Non-Community Wellhead Protection Area
Tier 1: 2 years of travel time
Tier 2: 5 years of travel time
Tier 3: 12 years of travel time
0 4,000 8,000 Feet
Source: NJOGIS, NJGIN, NJDEP, NJDOT
Wellhead Protection Areas
Manchester Township - Natural Resource Inventory
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September 2020

SURFACE WATER HYDROLOGY

Watersheds

A watershed is an area that drains into a common waterway, such as a stream, lake, estuary, wetland, or, ultimately, the ocean. The watershed includes both the waterway itself and the entire land area that drains into it. Geographical features such as hills and slopes separate distinct watershed systems. Watershed Management Areas (WMAs) are the regulatory units used by NJDEP's Division of Watershed Management for categorizing, managing, and protecting watersheds throughout the State.

Manchester Township falls within two Watershed Management Areas- Barnegat Bay Watershed Management Area (WMA 13), and the Rancocas Watershed Management Area (WMA 19).

Approximately 31,608 acres or 60% the Township falls within the Barnegat Bay Watershed Management Area. The Barnegat Bay Watershed Management Area is 660-square mile area that includes most of Ocean County, a small portion of southern Monmouth County, and Barnegat Bay that drains into the Atlantic Ocean. The remainder of the Township (21,148 acres or 40%) falls within the Rancocas Watershed Management Area. The Rancocas Watershed Management Area encompasses portions of Ocean, Burlington and Camden County. The watershed is approximately 350-square miles and drains into the Delaware River in the vicinity of Delanco Township in Burlington County.

The decisions that communities make about land use and development (where, how intensely, and with what design it can occur) directly affect the health of a watershed. According to the NJDEP, "urbanization…changes how water flows in the watershed and what flows in the water." Adding development and its associated impervious surfaces and infrastructure changes the natural flow, pathways, volume and speed of water and runoff as it transitions from precipitation to ground or surface water. Ultimately, these effects can cause drastic changes to natural water features, such as an erosion of stream beds, and the ability of the ground to absorb water. Human use of the land also contributes pollutants to the watershed, coating impervious surface or open space with chemicals, contaminants or litter that are carried into flowing water and runoff during precipitation events.

The protection of waterbodies is impacted by the characteristics of all of the land that drains to them, i.e. by the characteristics of all the land in their watershed. Protecting the health of waterbodies must, therefore, involve measures across the entirety of the watershed, which can be difficult to implement given that watersheds and watershed management areas cross administrative boundaries and include multiple municipalities.

Utilizing the NJDEP Land Use Land Cover from 2015, Manchester Township has over 7,900 acres of urban cover within the Barnegat Bay WMA. Overall, approximately 22% of the land (111,628.3 acres) in the Barnegat Bay WMA is classified as urban. While Manchester Township occupies 6.2% of the total area of the entire WMA, it represents approximately 7% of the total urbanized land cover for the watershed.

NJDEP has data that can provide an even closer estimate of the amount of impervious surface within the WMA, assigning an estimated percent impervious cover to each land use/land cover polygon. The estimated impervious surface was developed by NJDEP using LiDAR (light detection and ranging)

data. It is estimated that Manchester Township has 3,955.5 acres of impervious surface within the Barnegat Bay Watershed, while the WMA as a whole has an estimated 55,045.7 acres of impervious surface. Thus, while Manchester Township occupies 6.2% of the total land area in the WMA, it contains an estimated 7.2% percent of its impervious surface. The Watershed Management Areas map shows the extent of both the Barnegat Bay and Rancocas Watersheds and urban land coverage within the watersheds.

Watershed Management Areas are made up of a number of HUC11 watersheds, and each of these watersheds is further divided into HUC14 sub-watersheds. A sub-watershed is the smaller drainage basin of a local stream that eventually drains to a central point of the larger watershed. Six HUC11 watersheds and twenty-three HUC14-level sub-watersheds are located within Manchester Township. The Barnegat Bay and its associated subwatersheds drain into the Atlantic Ocean. The Rancocas WMA drains into the Lower Delaware.

As noted in the Watersheds of Manchester Township table, the Map Key column corresponds to the HUC14 watershed shown on the Watersheds Map.

Surface Waterbodies

The surface water system in Manchester Township is characterized by streams, ponds, lakes, and wetlands. These resources provide for aquifer recharge for groundwater, potable water supply, wildlife habitat, recreation areas, scenic value and beauty, and water supplies for agriculture, commerce, and industry. Manchester Township has over 155 miles of streams within its border.

Surface water quality is determined by seasonal weather conditions and precipitation patterns; the depth, width, and flow rates of streams; soil characteristics; types of vegetation; and impacts of development. A system for protecting surface water quality is codified in the New Jersey Administrative Code's Surface Water Quality Standards, which categorize significant environmental characteristics of waterbodies and establish anti-degradation classes. Each waterway is assigned a category based on the combination of four attributes: stream classification, trout water status, surface water classification, and antidegradation status.

Definitions of key terms used in the classification system are as follows:

FW: Freshwater, generally having a salinity of less than or equal to 3.5 parts per thousand at mean high tide.

FW1: Fresh waters that are to be maintained in their natural state of quality (set aside for posterity) and not subjected to any man-made wastewater discharges or increases in runoff from anthropogenic activities.

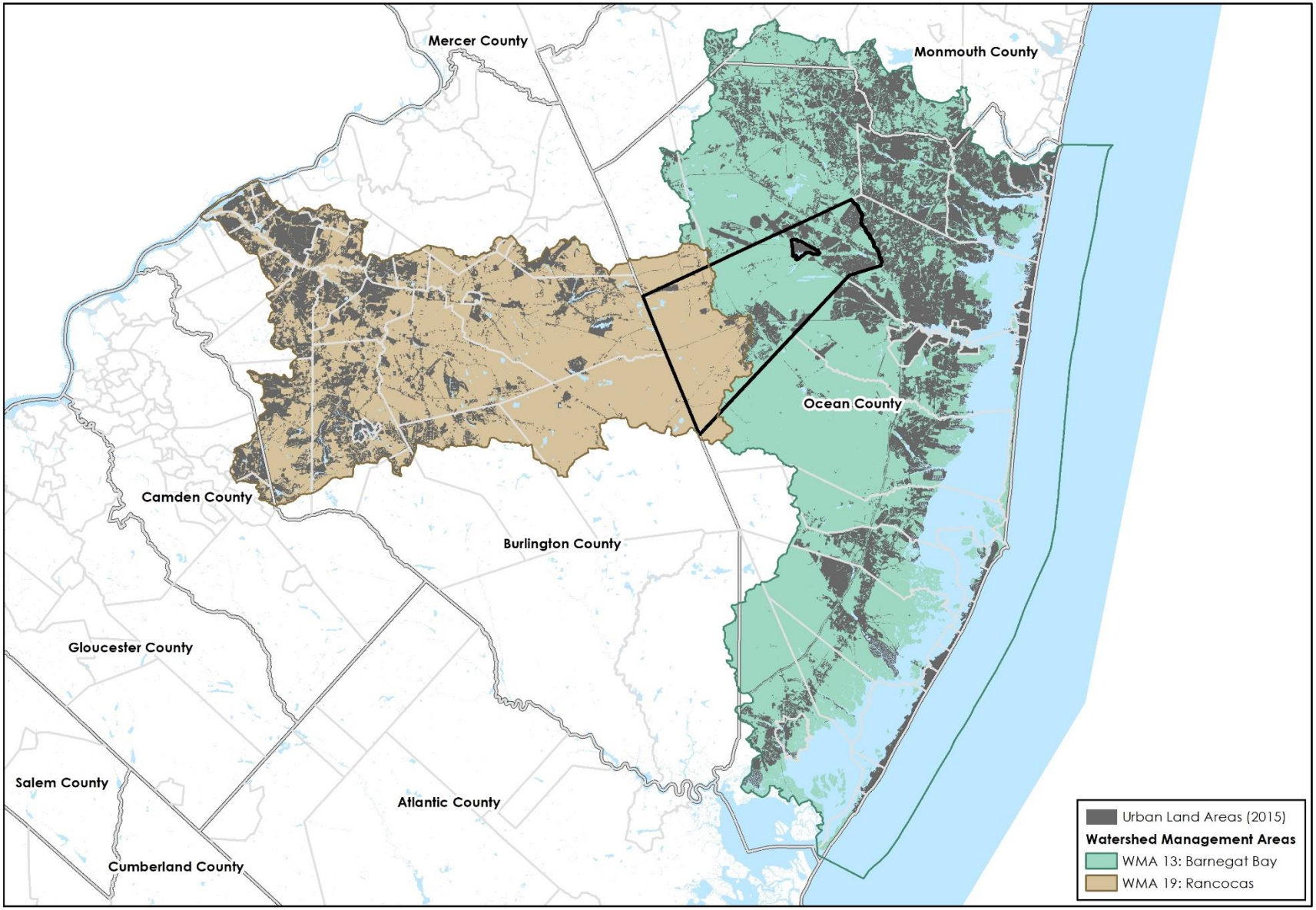
FW2: The general surface water classification applied to those fresh waters that are not designated as FW1 or Pinelands Waters.

PL: All waters within the boundaries of the Pinelands Area, except those waters designated as FW1.

SE: The general surface water classification applied to saline waters of estuaries.

NT: Non-trout waters.

TM: Trout maintenance waters designated for the support of trout throughout the year.


Mercer County
Monmouth County
Ocean County
Camden County
Burlington County
Gloucester County
Salem County
Atlantic County
Cumberland County
Urban Land Areas (2015)
Watershed Management Areas
WMA 13: Barnegat Bay
WMA 19: Rancocas
N
W
E
S
0
3.5
7 Miles
Source: NJOGIS, NJGIN, NJDEP, NJDOT
Watershed Management Areas
Manchester Township - Natural Resource Inventory
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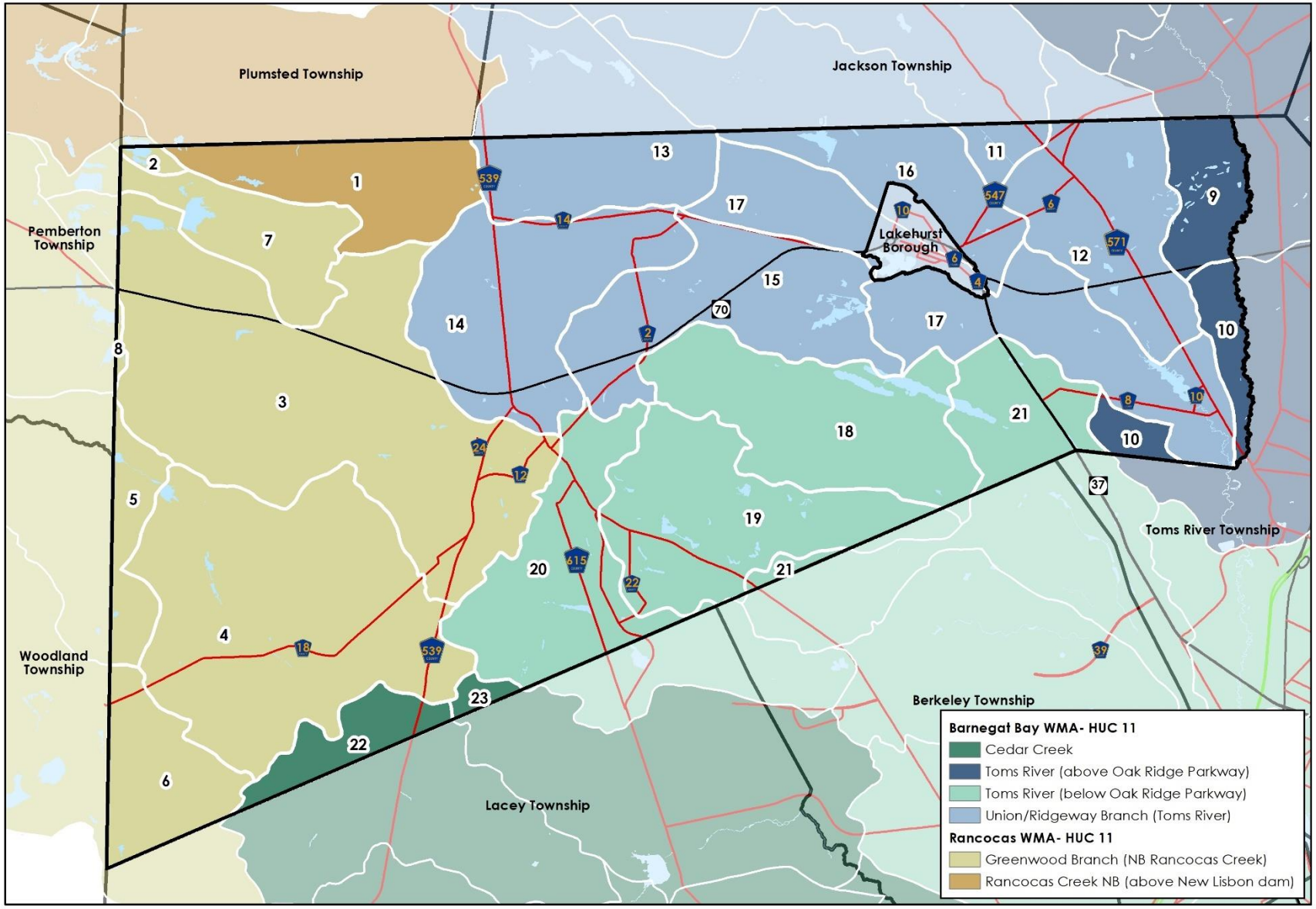
September 2020

Watersheds of Manchester Township					
Watershed Management Area	**Sub-Watershed (HUC 11)**	**Watershed (HUC 14)**	**Acres**	**Percent**	**Map Kay**
Rancocas	Rancocas Creek NB (above New Lisbon dam)	Gaunts Brook / Hartshorne Mill Stream	3,480.6	3.9%	1
		Rancocas Ck NB (incl Mirror Lk-GauntsBk)	198.2	0.2%	2
	Greenwood Branch (NB Rancocas Creek)	Pole Bridge Branch (above County line)	14,310.0	15.9%	3
		Mount Misery Bk NB (above 74d27m30s dam)	11,045.5	12.3%	4
		Mount Misery Bk MB/NB (below 74d27m30s)	1,476.9	1.6%	5
		Mount Misery Brook SB	2,677.6	3.0%	6
		Bucks Cove Run / Cranberry Branch	2,734.7	3.0%	7
		Pole Bridge Br (CountryLk dam - Co line)	92.8	0.1%	8
Barnegat Bay	Toms River (above Oak Ridge Parkway)	Toms River (Rt 70 to Hope Chapel Road)	1,758.9	2.0%	9
		Toms River (Oak Ridge Parkway to Rt 70)	1,516.7	1.7%	10
	Union/Ridgeway Branch (Toms River)	Ridgeway Br (Hope Chapel Rd to HarrisBr)	611.5	0.7%	11
		Ridgeway Br (below Hope Chapel Rd)	4,586.5	5.1%	12
		Blacks Branch (above 74d22m05s)	2,961.7	3.3%	13
		Old Hurricane Brook (above 74d22m30s)	6,062.4	6.7%	14
		Old Hurricane Brook (below 74d22m30s)	5,467.6	6.1%	15
		Manapaqua Brook	2,832.1	3.1%	16
		Union Branch (below Blacks Br 74d22m05s)	7,167.1	8.0%	17
	Toms River (below Oak Ridge Parkway)	Wrangel Brook (above Michaels Branch)	5,905.2	6.6%	18
		Michaels Branch (Wrangel Brook)	5,630.8	6.3%	19
		Davenport Branch (above Pinewald Road)	4,913.1	5.5%	20
		Wrangel Brook (below Michaels Branch)	2,725.5	3.0%	21
	Cedar Creek	Webbs Mill Branch	1,508.8	1.7%	22
		Cedar Creek (74-16-38 to Chamberlain Br)	277.0	0.3%	23
		Total	**89,941.2**	**100.0%**	


Plumsted Township
Jackson Township
Pemberton Township
Lakehurst Borough
Toms River Township
Woodland Township
Berkeley Township
Lacey Township
Barnegat Bay WMA- HUC 11
Cedar Creek
Toms River (above Oak Ridge Parkway)
Toms River (below Oak Ridge Parkway)
Union/Ridgeway Branch (Toms River)
Rancocas WMA- HUC 11
Greenwood Branch (NB Rancocas Creek)
Rancocas Creek NB (above New Lisbon dam)
0 4,000 8,000 Feet
Source: NJOGIS, NJGIN, NJDEP, NJDOT
Watersheds
Manchester Township - Natural Resource Inventory
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C-1: Category One waters, meaning those waters designated for protection from measurable changes in water quality based on exceptional ecological significance, exceptional recreational significance, exceptional water supply significance or exceptional fisheries resources to protect their aesthetic value (color, clarity, scenic setting) and ecological integrity (habitat, water quality and biological functions).

C-1 designation carries development regulations on adjacent land. A 300-foot buffer called Special Water Resource Protection Area (SWRPA) exists around all C-1 waterways, as well as any tributaries to C-1 waterways located within the same HUC-14 sub-watershed. Development in these areas beyond 1/4 acre increase in impervious surface or 1 acre of disturbance is generally not permitted, and all disturbance in the SWRPA must be approved by NJDEP with a Division of Land Use Regulation permit.

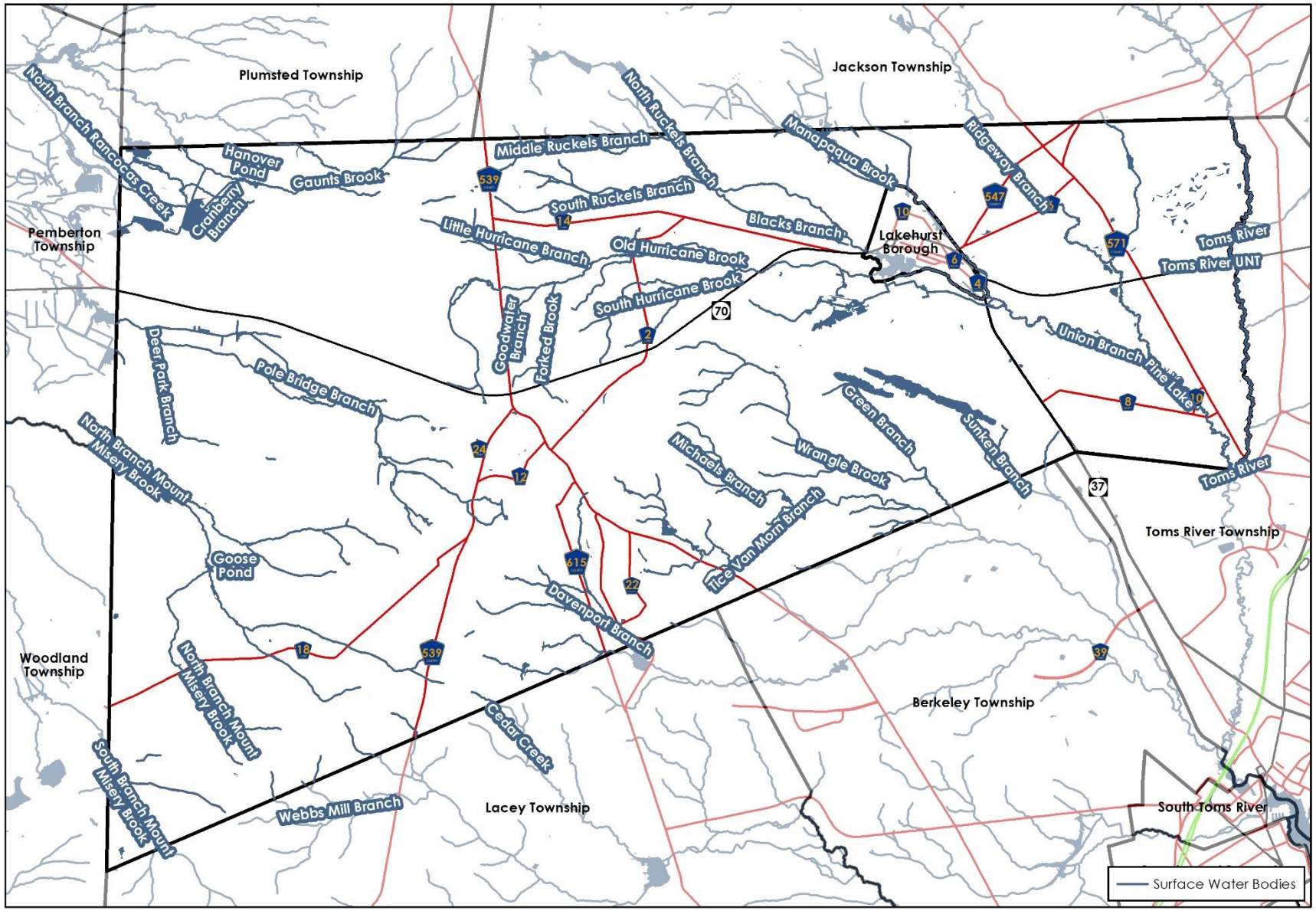
C-2: Category Two waters, meaning waters not designated as Outstanding National Resource Waters or C-1 waters for the purposes of implementing anti-degradation policies.

Some of these categories carry regulations for specific designated uses. The following use specifications apply to waters within Manchester Township:

- FW1
    - Set aside for posterity to represent the natural aquatic environment and its associated biota
    - Primary contact recreation
    - Maintenance, migration, and propagation of the natural and established aquatic biota
    - Any other reasonable uses
- FW2
    - Maintenance, migration, and propagation of the natural and established aquatic biota
    - Primary contact recreation
    - Industrial and agricultural water supply
    - Public potable water supply after conventional treatment and disinfection
    - Any other reasonable use
- SE1
    - Shellfish harvesting in accordance with NJAC 7:12
    - Maintenance, migration, and propagation of the natural and established aquatic biota
    - Primary contact recreation
    - Any other reasonable uses
- PL
    - Cranberry bog water supply and other agricultural uses
    - Maintenance, migration and propagation of the natural and established biota indigenous to this unique ecological community
    - Public potable water supply after conventional filtration treatment and disinfection
    - Primary contact recreation
    - Any other reasonable uses

The following table gives a breakdown of all the streams in Manchester Township and their classification. The Surface Water Bodies Map also shows the locations of each of the waterbodies within the Township.

Stream Classification	
Stream Name	**Classification**
Blacks Branch	PL
Cedar Creek	PL
Cranberry Branch	PL
Davenport Branch	PL
Deer Park Branch	FW1
Forked Brook	PL
Gaunts Brook	PL
Goodwater Branch	PL
Goose Pond	PL
Green Branch	FW2-NT
Hanover Pond	PL
Little Hurricane Branch	PL
Manapaqua Brook	PL / FW2-NT
Michaels Branch	FW2-NT
Middle Ruckels Branch	PL
North Branch Mount Misery Brook	PL
North Branch Rancocas Creek	PL
North Ruckels Branch	PL
Old Hurricane Brook	PL / FW2-NT
Pine Lake	FW2-NT
Pole Bridge Branch	PL
Ridgeway Branch	PL / FW2-NT
South Branch Mount Misery Brook	PL / FW21
South Hurricane Brook	PL
South Ruckels Branch	PL
Sunken Branch	FW2-NT
Tice Van Morn Branch	PL / FW2-NT
Toms River	FW2-TMC1 / PL-TM
Union Branch	FW2-NT / PL
Webbs Mill Branch	FW1
Wrangle Brook	FW2-NTC1 / FW2-NT / PL


Plumsted Township
Jackson Township
Pemberton Township
Lakehurst Borough
Toms River Township
Woodland Township
Berkeley Township
Lacey Township
South Toms River
North Branch Rancocas Creek
Hanover Pond
Cranberry Branch
Gaunts Brook
Middle Ruckels Branch
North Ruckels Branch
South Ruckels Branch
Manapaqua Brook
Ridgeway Branch
Blacks Branch
Little Hurricane Branch
Old Hurricane Brook
South Hurricane Brook
Goodwater Branch
Forked Brook
Deer Park Branch
Pole Bridge Branch
North Branch Mount Misery Brook
Goose Pond
Michaels Branch
Wrangle Brook
Green Branch
Sunken Branch
Union Branch Pine Lake
Toms River
Toms River UNT
Tice Van Morn Branch
Davenport Branch
Cedar Creek
Webbs Mill Branch
South Branch Mount Misery Brook
70
37
539
547
571
615
Surface Water Bodies
0 4,000 8,000 Feet
Source: NJOGIS, NJGIN, NJDEP, NJDOT
Surface Water Bodies
Manchester Township - Natural Resource Inventory
HGA
Heyer, Gruel & Associates
September 2020

SOILS

Manchester Township has 19 different soil series broken down into 31 different soil subseries. Throughout the Township, the land is relatively flat; slopes generally do not exceed 5%. For this section, please note that all acreages have been calculated using GIS.

The most prominent soil in Manchester is the Lakehurst soil series. The Lakehurst soils are moderately well-drained, and do not experience frequent flooding or ponding. The parent material of the Lakehurst soil is the sandy coastal plain sediments. The soil supports mostly woodland plants including pitch pines, shortleaf pines, black and white oaks, lowbush blueberries and scrub oaks. Areas that were once farmed have mostly been abandoned. The Lakehurst soil series represents 11,109.2 acres or 21.1% of the Township soil area.

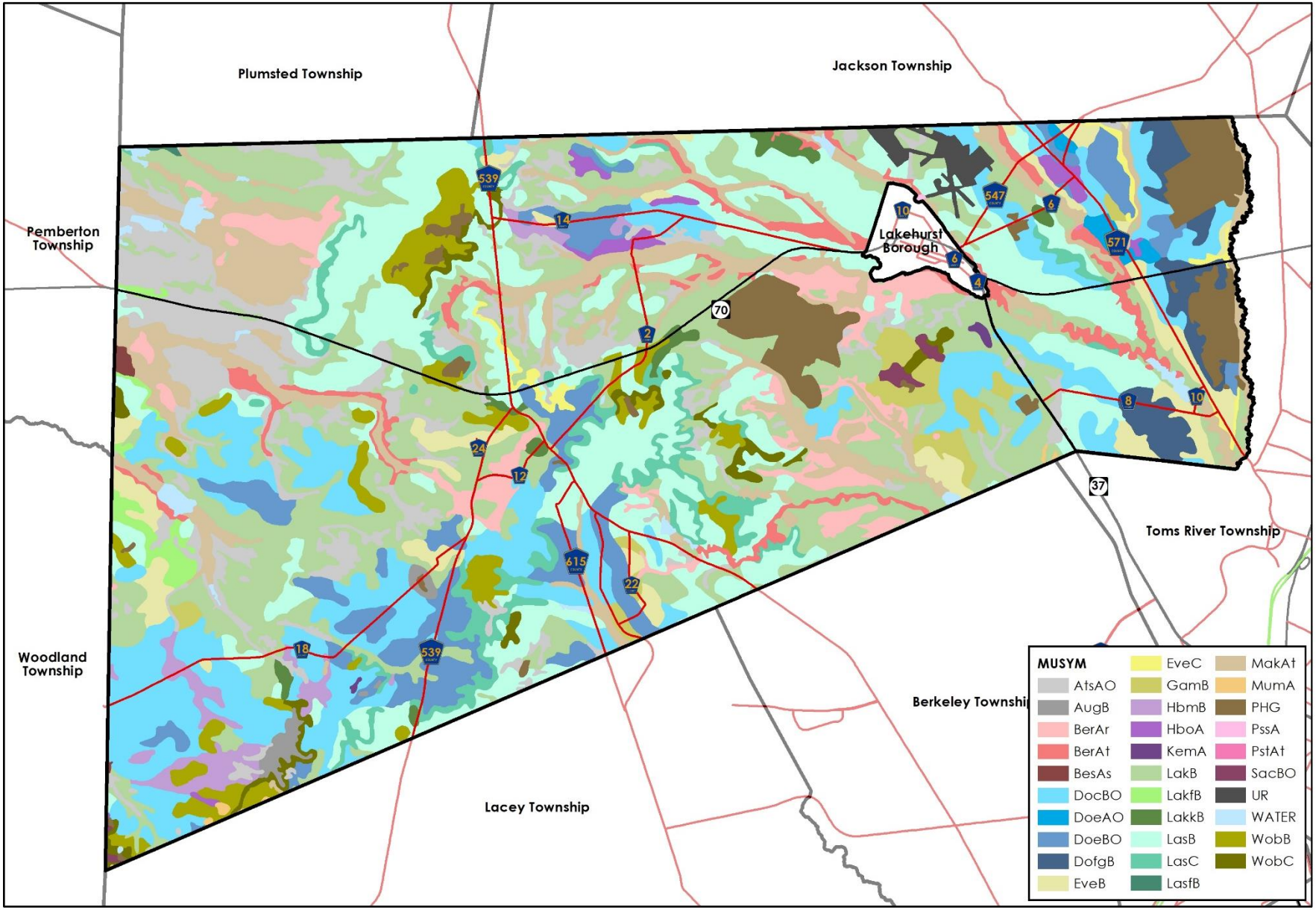
Another prominent soil is the Lakewood soil series which consists of sand and is excessively drained, resulting in very low water capacity. Vegetation consists of pitch pine, black oak, and white oak. Where wildfires have been severe, trees are dwarfed, growing less than 5 feet tall and consist primarily of pitch pine, scrub oak, and blackjack oak.

The third most prevalent soils are the Downer soil-series which consists of sandy loam, loamy sand, and gravelly loam. The Downer series is suitable for growing field crops, vegetables, flowers, and some fruit trees. Natural vegetation consists of mixed oaks, hickory, scattered pines, dogwood, green briar, American Holly, low bush blue berry and mountain laurel. The soil is well drained which makes it suitable for development. The Downer series occupies 10,183.7 acres, or 19.3% of Township.

Soils		
Soil Series	**Acreage**	**Percentage**
Atsion	4,375.6	8.3%
Aura	196.8	0.4%
Berryland	3,004.2	5.7%
Downer	10,183.7	19.3%
Evesboro	1,886.4	3.6%
Galloway	746.8	1.4%
Hammonton	978.0	1.9%
Keyport	34.5	0.1%
Lakehurst	11,109.2	21.1%
Lakewood	10,657.7	20.2%
Manahawkin	4,537.6	8.6%
Mullica	39.9	0.1%
Pits, sand, gravel	2,043.8	3.9%
Psamments	7.1	0.0%
Psammaquents	3.9	0.0%
Sassafras	103.9	0.2%
Urban land	326.6	0.6%
Water	354.8	0.7%
Woodmansie	2,171.8	4.1%
Total	**52,762.3**	**100.0%**

Descriptions of each of the soils and sub-soil series are found on the following tables. Locations of the soil subseries are also found on the Soils Map.

Soil Subseries			
Published Map Symbol	**Map Unit Name & Description**	**Acres**	**Percentage**
AtsAO	Atsion sand, 0 to 2 percent slopes, Northern Tidewater Area	4,375.6	8.3%
AugB	Aura sandy loam, 2 to 5 percent slopes, Northern Coastal Plain	196.8	0.4%
BerAr	Berryland sand, 0 to 2 percent slopes, rarely flooded	1,703.2	3.2%
BerAt	Berryland sand, 0 to 2 percent slopes, frequently flooded	1,251.9	2.4%
BesAs	Berryland mucky sand, 0 to 2 percent slopes, occasionally flooded	49.1	0.1%
DocBO	Downer loamy sand, 0 to 5 percent slopes, Northern Tidewater Area	6,387.5	12.1%
DoeAO	Downer sandy loam, 0 to 2 percent slopes, Northern Tidewater Area	183.3	0.3%
DoeBO	Downer sandy loam, 2 to 5 percent slopes, Northern Tidewater Area	2,783.5	5.3%
DofgB	Downer gravelly sandy loam, gravelly substratum, 2 to 5 percent slopes	829.4	1.6%
EveB	Evesboro sand, 0 to 5 percent slopes	1,633.4	3.1%
EveC	Evesboro sand, 5 to 10 percent slopes	253.0	0.5%
GamB	Galloway loamy sand, 0 to 5 percent slopes	746.8	1.4%
HbmB	Hammonton loamy sand, 0 to 5 percent slopes	668.1	1.3%
HboA	Hammonton sandy loam, 0 to 2 percent slopes	309.9	0.6%
KemA	Keyport sandy loam, 0 to 2 percent slopes	34.5	0.1%
LakB	Lakehurst sand, 0 to 5 percent slopes	10,448.0	19.8%
LakfB	Lakehurst sand, thick surface, 0 to 5 percent slopes	329.0	0.6%
LakkB	Lakehurst sand, clayey substratum, 0 to 5 percent slopes	332.2	0.6%
LasB	Lakewood sand, 0 to 5 percent slopes	9,058.9	17.2%
LasC	Lakewood sand, 5 to 10 percent slopes	1,582.6	3.0%
LasfB	Lakewood sand, thick surface, 0 to 5 percent slopes	16.2	0.0%
MakAt	Manahawkin muck, 0 to 2 percent slopes, frequently flooded	4,537.6	8.6%
MumA	Mullica sandy loam, 0 to 2 percent slopes	39.9	0.1%
PHG	Pits, sand and gravel	2,043.8	3.9%
PssA	Psamments, 0 to 2 percent slopes	7.1	0.0%
PstAt	Psammaquents, sulfidic substratum, 0 to 2 percent slopes, frequently flooded	3.9	0.0%
SacBO	Sassafras sandy loam, 2 to 5 percent slopes, Northern Tidewater Area	103.9	0.2%
UR	Urban land	326.6	0.6%
WATER	Water	354.8	0.7%
WobB	Woodmansie sand, 0 to 5 percent slopes	1,592.4	3.0%
WobC	Woodmansie sand, 5 to 10 percent slopes	579.4	1.1%
Total		**52,762.3**	**100.00%**



Soils

Manchester Township - Natural Resource Inventory

HEYER, GRUEL & ASSOCIATES
September 2020

NJDEP Land Use Land Cover

Manchester Township is dominated by forested areas that consist of coniferous and deciduous forests and shrub/scrub lands totaling approximately 30,717.9 acres or 58.2% of the entire Township. Wetlands also makes up a significant portion of the Township, occupying approximately 19.4% of the entire area. The next largest land cover in the Township is urban land, occupying 9,361.8 acres or 17.7% of the Township.

Land Use Land Cover (2015)		
Type	**Acres**	**Percent**
Agriculture	271.6	0.5%
Barren Land	1,359.2	2.6%
Forest	30,717.9	58.2%
Urban	9,361.8	17.7%
Water	792.9	1.5%
Wetlands	10,253.1	19.4%
Total	**52,756.5**	**100.0%**

The six major Land Use Land Cover types can be broken down in subcategories. As shown in the following tables, orchards, vineyards, nurseries/horticultural areas are the largest subcategory of agricultural land, totaling 121 acres or 44.6% of the total amount of agricultural land. Nearly half of the barren land cover stems from extractive mining, which represents 633 acres or 46.6% of all barren land. More than half of the forest land cover is coniferous forest with greater than 50% crown closure, totaling over 16,000 acres. Approximately 30% of the urban land category (or 2,864.3 acres) is high density or multiple dwelling residential. The second largest urban land subcategory is medium density single unit residential, which occupies approximately 1,941.5 acres. Nearly all of the water in the Township (95.3%) is due to artificial lakes. The largest subcategory of wetlands in Manchester Township are the Atlantic White Cedar wetlands, found along the riverbeds in the Township, occupying 2,683 acres or 26.2% of all wetlands.

Land Use Land Cover Subcategories		
Agriculture	**Acres**	**Pct of LU Class**
CROPLAND AND PASTURELAND	77.9	28.7%
ORCHARDS/VINEYARDS/NURSERIES/ HORTICULTURAL AREAS	121.0	44.6%
OTHER AGRICULTURE	72.7	26.8%
Total Agricultural Lands	**271.6**	**100.0%**

Barren Land	**Acres**	**Pct of LU Class**
ALTERED LANDS	571.1	42.0%
BEACHES	2.0	0.1%
EXTRACTIVE MINING	633.0	46.6%
TRANSITIONAL AREAS	118.0	8.7%
UNDIFFERENTIATED BARREN LANDS	35.1	2.6%
Total Barren Land	**1,359.2**	**100.0%**

Water	**Acres**	**Pct of LU Class**
ARTIFICIAL LAKES	755.8	95.3%
BRIDGE OVER WATER	0.2	0.0%
NATURAL LAKES	5.1	0.6%
STREAMS AND CANALS	31.7	4.0%
Total Water	**792.9**	**100.0%**

Forest	Acres	Pct of LU Class
CONIFEROUS BRUSH/SHRUBLAND	1,337.5	4.4%
CONIFEROUS FOREST (>50% CROWN CLOSURE)	16,009.6	52.1%
CONIFEROUS FOREST (10-50% CROWN CLOSURE)	3,191.7	10.4%
DECIDUOUS BRUSH/SHRUBLAND	103.9	0.3%
DECIDUOUS FOREST (>50% CROWN CLOSURE)	1,498.2	4.9%
DECIDUOUS FOREST (10-50% CROWN CLOSURE)	97.8	0.3%
MIXED DECIDUOUS/CONIFEROUS BRUSH/SHRUBLAND	492.9	1.6%
MIXED FOREST (>50% CONIFEROUS WITH >50% CROWN CLOSURE)	3,855.2	12.6%
MIXED FOREST (>50% CONIFEROUS WITH 10-50% CROWN CLOSURE)	229.4	0.7%
MIXED FOREST (>50% DECIDUOUS WITH >50% CROWN CLOSURE)	2,979.6	9.7%
MIXED FOREST (>50% DECIDUOUS WITH 10-50% CROWN CLOSURE)	132.5	0.4%
OLD FIELD (< 25% BRUSH COVERED)	695.9	2.3%
PHRAGMITES DOMINATE OLD FIELD	1.2	0.0%
PLANTATION	92.5	0.3%
Total Forest	**30,717.9**	**100.0%**

Urban Land	Acres	Pct of LU Class
ATHLETIC FIELDS (SCHOOLS)	61.5	0.7%
CEMETERY	13.6	0.1%
COMMERCIAL/SERVICES	384.8	4.1%
INDUSTRIAL	66.6	0.7%
MAJOR ROADWAY	32.0	0.3%
MILITARY INSTALLATIONS	794.0	8.5%
MIXED RESIDENTIAL	231.3	2.5%
MIXED TRANSPORTATION CORRIDOR OVERLAP AREA	0.1	0.0%
OTHER URBAN OR BUILT-UP LAND	672.2	7.2%
RAILROADS	97.3	1.0%
RECREATIONAL LAND	344.2	3.7%
RESIDENTIAL, HIGH DENSITY OR MULTIPLE DWELLING	2,864.3	30.6%
RESIDENTIAL, RURAL, SINGLE UNIT	544.0	5.8%
RESIDENTIAL, SINGLE UNIT, LOW DENSITY	821.8	8.8%
RESIDENTIAL, SINGLE UNIT, MEDIUM DENSITY	1,941.5	20.7%
STORMWATER BASIN	105.6	1.1%
TRANSPORTATION/COMMUNICATION/ UTILITIES	150.9	1.6%
UPLAND RIGHTS-OF-WAY DEVELOPED	0.9	0.0%
UPLAND RIGHTS-OF-WAY UNDEVELOPED	235.1	2.5%
Total Urban Land	**9,361.8**	**100.0%**

Wetlands	Acres	Pct of LU Class
AGRICULTURAL WETLANDS (MODIFIED)	248.0	2.4%
ATLANTIC WHITE CEDAR WETLANDS	2,683.0	26.2%
CONIFEROUS SCRUB/SHRUB WETLANDS	160.7	1.6%
CONIFEROUS WOODED WETLANDS	1,964.7	19.2%
DECIDUOUS SCRUB/SHRUB WETLANDS	284.7	2.8%
DECIDUOUS WOODED WETLANDS	1,520.7	14.8%
DISTURBED WETLANDS (MODIFIED)	22.2	0.2%
FORMER AGRICULTURAL WETLAND (BECOMING SHRUBBY, NOT BUILT-UP)	10.2	0.1%
HERBACEOUS WETLANDS	189.5	1.8%
MANAGED WETLAND IN BUILT-UP MAINTAINED REC AREA	3.2	0.0%
MANAGED WETLAND IN MAINTAINED LAWN GREENSPACE	8.1	0.1%
MIXED SCRUB/SHRUB WETLANDS (CONIFEROUS DOM.)	191.2	1.9%
MIXED SCRUB/SHRUB WETLANDS (DECIDUOUS DOM.)	302.9	3.0%
MIXED WOODED WETLANDS (CONIFEROUS DOM.)	1,858.1	18.1%
MIXED WOODED WETLANDS (DECIDUOUS DOM.)	782.8	7.6%
PHRAGMITES DOMINATE INTERIOR WETLANDS	1.1	0.0%
WETLAND RIGHTS-OF-WAY	22.0	0.2%
Total Wetlands	**10,253.1**	**100.0%**

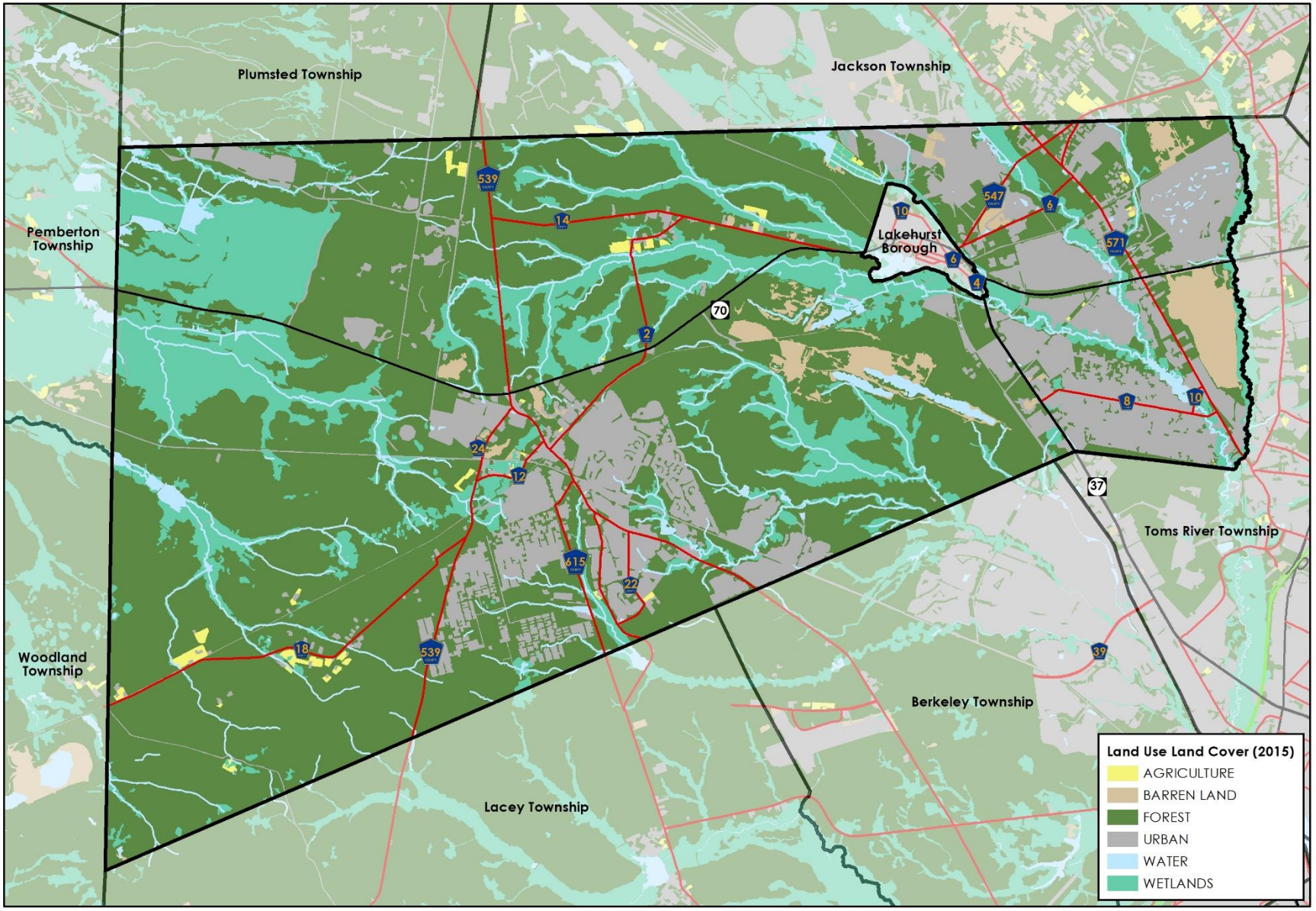
Changes to the Land Use Land Cover can be identified by comparing the dataset's years amongst one another. Generally, NJDEP releases the LULC dataset every 5 years, as a means to track changes to the State's natural resources, as well as monitoring the expansion of areas classified as "urban". The following chart compares the Township's LULC in 2007 and 2015.

Land Use Land Cover- 2007 to 2015						
Category	2007		2015		Changes	
	Acres	%	Acres	%	Acres	%
Agriculture	327.7	0.6%	271.6	0.5%	-56.1	-0.1%
Barren Land	1,585.9	3.0%	1,359.2	2.6%	-226.7	-0.4%
Forest	30,676.2	58.1%	30,717.9	58.2%	41.7	0.1%
Urban	9,107.3	17.3%	9,361.8	17.7%	254.5	0.5%
Water	826.2	1.6%	792.9	1.5%	-33.3	-0.1%
Wetlands	10,233.2	19.4%	10,253.1	19.4%	19.9	0.0%
Total	**52,756.5**	**100.0%**	**52,756.5**	**100.0%**	**-**	**-**

Generally speaking, the Township's land cover has not changed drastically over between 2007 and 2015. Agriculture and Barren Land decreased by 56 and 226 acres, respectively, while the Urban land category increased by over 250 acres. Forest areas increased slightly, by nearly 42 acres, while the wetlands area increased by nearly 20 acres.

WETLANDS

Wetlands are land area that are either submerged or retain water at ground level for a portion of the year, which may include marshes, swamps, and bogs. Wetland areas provide a number of benefits that help to protect both natural and man-made environments. They serve as filtration systems, removing pollutants, chemicals, and sediments from the water table and storing them in biomass. They act as groundwater recharge areas, releasing stored waters to streams during droughts.


Plumsted Township
Jackson Township
Pemberton Township
Lakehurst Borough
Toms River Township
Woodland Township
Berkeley Township
Lacey Township
Land Use Land Cover (2015)
AGRICULTURE
BARREN LAND
FOREST
URBAN
WATER
WETLANDS
0 4,000 8,000 Feet
Source: NJOGIS, NJGIN, NJDEP, NJDOT
Land Use Land Cover
Manchester Township - Natural Resource Inventory
HGA
HEYER, GRUEL & ASSOCIATES
September 2020

Wetlands are critical habitats for many of New Jersey's threatened and endangered species. Perhaps the most salient function of wetlands for many of New Jersey's shore and riverine communities is the natural flood control they provide by storing excess water and releasing it to surface waters over time. In situations where the total area of wetlands shrinks and their natural functions decrease, the overall quality and quantity of the surface water flow within the watershed is altered. Expensive man-made infrastructure is often required to make up for the loss of wetlands.

A community that incorporates growth while maintaining or improving wetlands and wetlands function can achieve lower flood peaks, fewer drought periods, more wildlife and wildlife habitat, and better surface water quality than comparable watersheds with fewer wetlands. Wetlands also provide recreational opportunities such as boating, hiking and bird watching. Based on NJDEP's land use/land cover classification, approximately 19.4% of Manchester Township (10,253.1 acres) is occupied by wetlands. Within the Township, wetlands are predominantly located along the existing streams, lakes, and ponds.

The Land Use Land Cover chart (above) gives a breakdown of the different types of wetlands found in the Township.

Freshwater wetlands protection is governed by section 404 of the "Federal Water Pollution Control Act Amendments of 1972" as amended by the Clean Water Act of 1977." In New Jersey, the Freshwater Wetlands Protection Act of 1987 requires the NJDEP to regulate virtually all activities proposed in wetlands, including cutting of vegetation, dredging, excavation or removal of soil, drainage or disturbance of the water level, filling or discharge of any materials, driving of pilings, and placing of obstructions. The presence of wetlands on a given property is determined through NJDEP's delineation and "Letter of Interpretation" process, which defines wetland as an area with hydric soils, wetland hydrology and hydrophytic vegetation. Land development activities are also regulated in buffer areas upland from wetlands. These transition areas also provide important habitat for wetlands species and serve as a sediment and stormwater control zone.

NJDEP has developed a system for the classification of freshwater wetlands that defines wetlands as exceptional resource value, intermediate resource value, or ordinary resource value. These classifications affect aspects of wetlands regulations, such as the buffer distance of the transition area, necessary development mitigation techniques, and other standards.

- Exceptional Resource Value (150-foot transition area)
    - Discharges into FW1 or FW2 trout production waters or their tributaries
    - Is a present habitat for threatened or endangered species (as determined through the Landscape Project method)
    - Is a documented habitat for threatened or endangered species, and which remains suitable for breeding, resting, or feeding by these species during the normal period these species would use the habitat.
- Ordinary Resource Value
    - Is an isolated wetland, as defined at N.J.A.C. 7:7A-1.4, which is smaller than 5,000 square feet and which has the uses listed below covering more than 50 percent of the area within 50 feet

of the wetland boundary. In calculating the area covered by a use, the Department will only consider a use that was legally existing in that location prior to July 1, 1988, or was permitted under this chapter since that date: Lawns; Maintained landscaping; Impervious surfaces; Active railroad rights-of-way; Graveled or stoned parking/storage areas and roads;

  - Is a drainage ditch;
  - Is a swale; or
  - Is a detention facility created by humans in an area that was upland at the time the facility was created.

- Intermediate Resource Value (50-foot transition area)
  - A freshwater wetland not defined as exceptional or ordinary.

The regulation of activity in tidal wetlands predates the standards enacted for freshwater wetlands. Passed in 1970, the New Jersey Wetlands Act required NJDEP to delineate areas meeting the definition of "coastal wetland," providing the official landward boundary limit of coastal wetland areas to which the Act's provisions would apply. Regulated actions within coastal wetlands include dredging, filling, removing or otherwise altering or polluting coastal wetlands.

All wetlands in Manchester Township are freshwater wetlands.

BIOLOGICAL RESOURCES

A community's biological resources provide insight into the overall environmental health of a community, and the quality of the community's environmental conditions directly impacts the biodiversity of an area. The Township's biological resources allow for balance of natural function within the community, important for the health of both the human and animal/plant populations.

Landscape Project Data

The NJDEP Endangered and Non-Game Species Program created the Landscape Project as an ecosystem level approach to identifying and protecting species habitat in the state. The Program divides the State into six regions; Atlantic Coastal Landscape, Delaware Bay Landscape, Piedmonts Plains Landscape, Pinelands Landscape, Skylands Landscape, and Marine Region. Manchester Township falls entirely within the Pinelands Landscape.

The Pinelands landscape encompasses portions of Ocean, Monmouth, Burlington, Camden, Gloucester, and Atlantic Counties. The Pinelands consists of agricultural lands, coniferous, deciduous and mixed forests, wooded wetlands, scrub and shrub wetlands, and cedar swamps. Within the Manchester Township, there are approximately 43,741 acres of ecologically sensitive habitat.

The program identifies critical habitat areas and ranks them by the presence of priority, threatened or endangered species. The habitat areas are given a Rank between 1 and 5.

Rank 1 is assigned to species-specific habitat patches that meet habitat-specific suitability requirements such as minimum size or core area criteria for endangered, threatened or special concern wildlife species, but that do not intersect with any confirmed occurrences of such species. Rank 1 habitat patches without documented occurrences are not necessarily absent of imperiled or special concern species. Patches with a lack of documented occurrences may not have been systematically

surveyed. Thus, the Rank 1 designation is used for planning purposes, such as targeting areas for future wildlife surveys.

Manchester Township has approximately 852.0 acres of Rank 1 habitat within its borders. The majority of the habitat area is located adjacent to the Ridgeway Branch, Union Branch and the Toms River, in the south east corner of the Township. Additional Rank 1 habitat areas are scattered throughout central portion of the Township.

Rank 2 is assigned to species-specific habitat patches containing one or more occurrences of species considered to be species of special concern. Species of special concern are nongame wildlife species that warrants special attention by the Department because of inherent vulnerability to environmental deterioration or habitat modification that would result in its becoming threatened if conditions surrounding the species begin or continue to deteriorate. Factors that can lead to classification as special concern include, but are not limited to, species rarity in the State, highly specialized food and/or habitat requirements, low reproductive rate, isolated populations of the species within the State and/or other characteristics that make the species particularly susceptible to environmental or habitat changes. This category includes a species that meets the foregoing criteria and for which there is little understanding of its current population status in the State. Species determined to be "special concern" are so-designated at N.J.A.C. 7:25-4.17. Manchester Township has approximately 1,271.8 acres of Rank 2 habitat.

Within the Rank 2 habitat in the Pinelands Landscape within Manchester Township, the following species of special concern have been located:

- Black-billed Cuckoo (Aves)
- Brown Thrasher (Aves)
- Dotted Skipper (Insecta)
- Fowler's Toad (Amphibia)
- Great Blue Heron (Aves)
- Hessel's Hairstreak (Insecta)
- Pine Barrens Bluet (Insecta)
- Scarlet Bluet (Insecta)
- Two-spotted Skipper (Insecta)
- Whip-poor-will (Aves)
- Wood Thrush (Aves)

Rank 3 is assigned to species-specific patches containing one or more occurrences of State threatened species. State threatened species are species which are an indigenous nongame wildlife species of New Jersey designated pursuant to the Endangered and Nongame Species Conservation Act, N.J.S.A.23:2A et. seq., and its implementing rules, N.J.A.C. 7:25-4.17, as most recently amended. Threatened species are generally defined to be species that may become endangered if conditions surrounding them begin or continue to deteriorate. Manchester Township has approximately 5,370.7 acres of Rank 3 habitat.

Within the Rank 3 habitat in the Township, the following species have been located:

- Barred Owl (Aves/State Threatened)
- Dotted Skipper (Insecta)
- Eastern Kingsnake (Reptilia)
- Fowler's Toad (Amphibia)
- Northern Pine Snake (Reptilia / State Threatened)
- Pine Barrens Bluet (Insecta)
- Pine Barrens Tree Frong (Amphibia / State Threatened)
- Two-spotted Skipper (Insecta)

Rank 4 is assigned to species-specific habitat patches with one or more occurrences of State endangered species. State endangered species are species are species included on the list of endangered species at N.J.A.C. 7:25-4.13 and any species or subspecies of wildlife appearing on any Federal endangered species list. The Endangered and Nongame Species Conservation Act (N.J.S.A. 23:2A et seq.) defines an endangered species (with respect to wildlife) to be a species or subspecies of wildlife whose prospects for survival or recruitment are in jeopardy or are likely within the foreseeable future to become so due to any of the following factors: (1) the destruction, drastic modification, or severe curtailment of its habitat, or (2) its overutilization for scientific, commercial or sporting purposes, or (3) the effect on it of disease, pollution, or predation, or (4) other natural or manmade factors affecting its prospects of survival or recruitment within the State, or (5) any combination of the foregoing factors. The term shall also be deemed to include any species or subspecies of wildlife appearing on any Federal endangered species list.

Manchester has approximately 36,047.3 acres of Rank 4 habitat. The following species have been located:

- American Bittern (Aves / State Endangered)
- Arogos Skipper (Insecta / State Endangered)
- Bald Eagle (Ave / State Endangered)
- Barred Owl (Aves / State Threatened)
- Black-throated Green Warbler (Aves)

Rank 5 is assigned to species-specific habitat patches containing one or more occurrences of wildlife listed as endangered and threatened pursuant to the Federal Endangered Species Act of 1973. The Township has 199 acres of Rank 5 habitat. The following species have been located:

- Black-throated Green Warbler (Aves)
- Bog Turtle (Reptilia / Federally Threatened / State Endangered)
- Cooper's Hawk (Aves)
- Great Blue Heron (Aves)

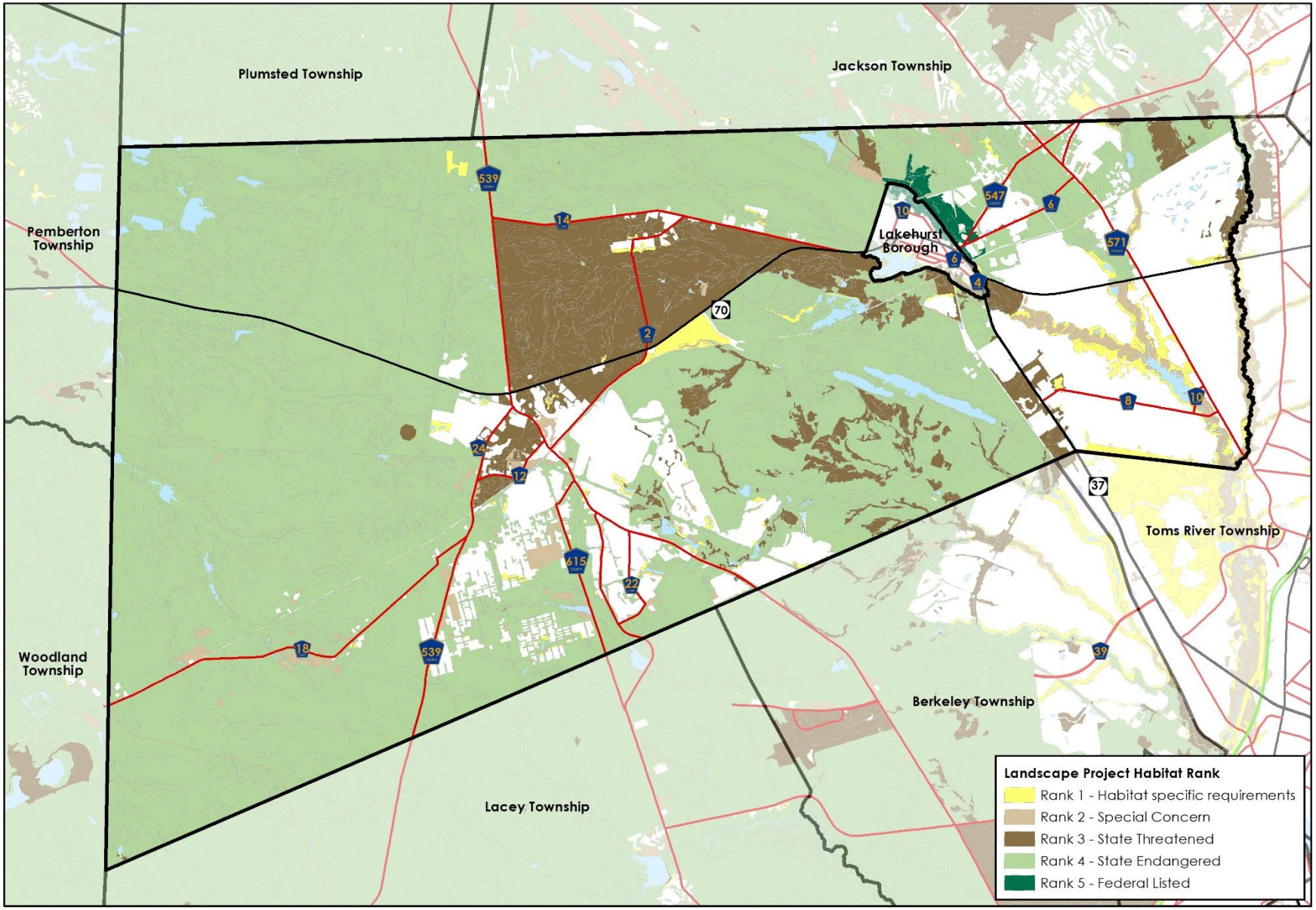
The following table gives a breakdown of each of the habitat ranks found in the Township.

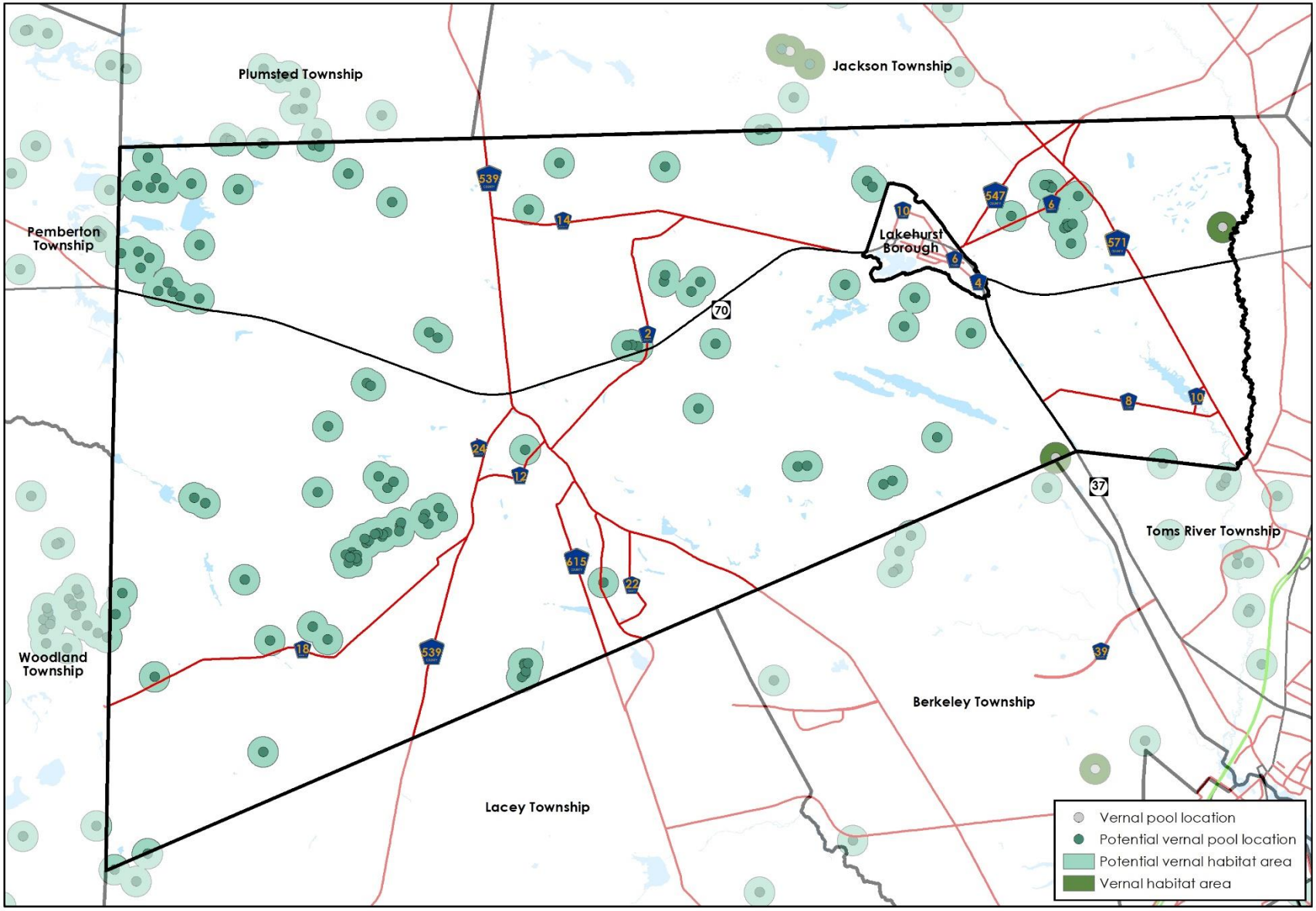
NJDEP Landscape Project Habitat Rankings		
Rank	**Acres**	**Percentage**
Rank 1: Habitat Specific Requirements	852.0	1.9%
Rank 2: Special Concern	1,271.8	2.9%
Rank 3: State Threatened	5,370.7	12.3%
Rank 4: State Endangered	36,047.3	82.4%
Rank 5: Federal Listed	199.0	0.5%
Total	**43,740.8**	**100.0%**

Vernal Pools

Vernal pools are confined depressions, either natural or man-made, which maintain ponded water for part of the year and are devoid of breeding fish populations. These temporary wetlands provide habitat to many species of amphibians, several of which breed exclusively in vernal pools, as well as a multitude of insects, reptiles, plants, and other wildlife. These areas contain very sensitive endangered species.

The approval of the Freshwater Wetlands Protection Act Rules in 2001 specified that vernal habitats would be protected. Any draining, filling, altering of the vernal pool habitats is subject to NJDEP review and standards.


Plumsted Township
Jackson Township
Pemberton Township
Lakehurst Borough
Toms River Township
Woodland Township
Berkeley Township
Lacey Township
539
547
571
615
70
37
Landscape Project Habitat Rank
Rank 1 - Habitat specific requirements
Rank 2 - Special Concern
Rank 3 - State Threatened
Rank 4 - State Endangered
Rank 5 - Federal Listed
0 4,000 8,000 Feet
Source: NJOGIS, NJGIN, NJDEP, NJDOT
Landscape Project
Manchester Township - Natural Resource Inventory
HGA
HEYER, GRUEL & ASSOCIATES
September 2020


Plumsted Township
Jackson Township
Pemberton Township
Lakehurst Borough
Toms River Township
Woodland Township
Berkeley Township
Lacey Township
539
547
571
615
70
37
Vernal pool location
Potential vernal pool location
Potential vernal habitat area
Vernal habitat area
0 4,000 8,000 Feet
Source: NJOGIS, NJGIN, NJDEP, NJDOT
Vernal Pools
Manchester Township - Natural Resource Inventory
HGA
Heyer, Gruel & Associates
September 2020

The NJDEP classifies vernal habitats utilizing the following factors:

- Standing water must be present in the pool for at least two continuous months between March and September in a year of normal rainfall.
- Pools having documented obligate or facultative vernal habitat species such as frogs and salamanders as listed by NJDEP, and free of fish populations.
- Pools having characteristic obligate species.

Together with the NJDEP, the Rutgers Center for Remote Sensing and Spatial Analysis have mapped potential and certified vernal pool locations throughout the State. This project has recently been incorporated into the NJDEP's Landscape Project Dataset. The dataset identifies 119 vernal pools within Manchester Township, of which 2 have been certified. The general locations of these pools are shown on the Vernal Pool Map.

Vernal pools receive the same regulatory buffers as other delineated freshwater wetlands, depending on the determined resource value. The NJDEP Division of Land Use Regulation extends an effort to verify that freshwater wetlands permit applications do not infringe on certified vernal pool habitat areas. The New Jersey Freshwater Wetlands Protection rules restrict the activities allowed in vernal pools and their regulated transition areas.

NJDEP established the Vernal Pool Project through the Division of Fish and Wildlife's Endangered and Nongame Species Program (ENSP)[1]. The Vernal Pool Project relies upon volunteers reporting data and documentation confirming the presence of vernal pools which upgrades the status of vernal pools from potential to confirmed.

The first step in the process is to identify a vernal pool for observation/survey. Many of the vernal pools throughout the state have been identified by NJDEP and incorporated into the Landscape Project dataset. These vernal pools have already been assigned a unique ID name which is required to be submitted on the report form/survey sheet. If a vernal pool is not currently identified in the Landscape Project dataset, data can still be submitted to ENSP for review.

The second step is to collect data at the vernal pool by completing the Vernal Habitat Data Sheet provided by ENSP. ENSP also requires the surveyors to secure landowner permission prior to surveying habitats on private land. Photographs of the pool and species observed are strongly encouraged to be submitted with the form to ENSP.

The last step of the process is to submit the data to ENSP for review. Based upon the review of the data submitted, potential vernal pools may be upgraded to certified, requiring the same protection as delineated freshwater wetlands.

Natural Heritage Grid & Priority Sites

The New Jersey Natural Heritage Program is a dataset which identifies the state's most significant natural areas through a comprehensive inventory of rare plant and animal species and representative ecological communities. The Database compiles information on the distribution, biology, status and preservation needs of these species and communities. The program is the result of a cooperative agreement between the NJ DEP and The

[1] https://www.state.nj.us/dep/fgw/ensp/vrnpoolupdate.htm
https://www.state.nj.us/dep/fgw/ensp/vernalpool.htm

Nature Conservancy, which contains a continuously updated inventory of these rare plants and animal species in New Jersey.

This data set lists different plant species and ecological communities according to Regional Status, State Status, Federal Status, State Rank and Global Rank.

The Global Rank represents the rank for each species based upon its global rarity. These ranks were developed by The Nature Conservancy using elements of natural diversity most endangered with extinction and are used to prioritize conservation work so that the most endangered species receive attention first. The ranks are as follows:

- G1 - Critically imperiled globally because of extreme rarity (5 or fewer occurrences or very few remaining individuals or acres) or because of some factor(s) making it especially vulnerable to extinction.
- G2 - Imperiled globally because of rarity (6 to 20 occurrences or few remaining individuals or acres) or because of some factor(s) making it very vulnerable to extinction throughout its range.
- G3 - Either very rare and local throughout its range or found locally (even abundantly at some of its locations) in a restricted range (e.g., a single western state, a physiographic region in the East) or because of other factors making it vulnerable to extinction throughout its range; with the number of occurrences in the range of 21 to 100.
- G4 - Apparently secure globally; although it may be quite rare in parts of its range, especially at the periphery.
- G5 - Demonstrably secure globally; although it may be quite rare in parts of its range, especially at the periphery.
- GNR - Species as not yet been ranked.
- T - Element ranks containing a "T" indicate that the infraspecific taxon is being ranked differently from the full species.
- Q - Elements containing a "Q" indicates that the taxon is of questionable, or uncertain taxonomic standing, e.g. some authors regard it as a full species, while others treat it at the subspecific level.

Similar to the Global Rank, the State Rank is also a numerical rank given to each rare species based upon its State rarity. They are as follows:

- S1 - Critically imperiled in New Jersey because of extreme rarity (5 or fewer occurrences or very few remaining individuals or acres). Elements so ranked are often restricted to very specialized conditions or habitats and/or restricted to an extremely small geographical area of the state. Also included are elements which were formerly more abundant, but because of habitat destruction or some other critical factor of its biology, they have been demonstrably reduced in abundance. In essence, these are elements for which, even with intensive searching, sizable additional occurrences are unlikely to be discovered.
- S2 - Imperiled in New Jersey because of rarity (6 to 20 occurrences). Historically many of these elements may have been more frequent but are now known from very few extant occurrences, primarily because of habitat

destruction. Diligent searching may yield additional occurrences.

- S3 - Rare in state with 21 to 100 occurrences (plant species and ecological communities in this category have only 21 to 50 occurrences). Includes elements which are widely distributed in the state but with small populations/acreage or elements with restricted distribution, but locally abundant. Not yet imperiled in state but may soon be if current trends continue. Searching often yields additional occurrences.
- S4 - Apparently secure in state, with many occurrences.
- S5 - Demonstrably secure in state and essentially ineradicable under present conditions.

Plants and ecological communities can also be given a Regional Status code of either LP or HL. The LP code indicates taxa listed by the Pinelands Commission as endangered or threatened within their legal jurisdiction. The HL code indicates taxa or ecological communities protected by the Highlands Water Protection and Planning Act within the jurisdiction of the Highlands Preservation Area. Although the Township is not within the jurisdiction of the Highlands Water Protection and Planning Act, these species are still considered to be rare and should be protected.

The habitats listed in the table include the following:

- Lacustrine: Open standing waters without substantial emergent vegetation
- Riverine: Wetlands and deep-water habitat contained within the stream channel, except for wetlands dominated by persistent vegetation or habitats with brackish water
- Estuarine: Deepwater tidal habitats and adjacent tidal wetlands that are usually semi-enclosed by land but have open, partly obstructed or sporadic access to the open ocean, and in which ocean water is at least occasionally diluted by freshwater runoff from the land. This habitat can also include other intertidal habitats such as tidal flats and rocky intertidal shore that may be open to the ocean.
- Palustrine: Nontidal freshwater vegetated wetlands and also non-vegetated areas with a saturated substrate (water table at or very near the surface).
- Terrestrial: Upland, well-drained habitats, as opposed to aquatic (wetland or deep water) habitats; vegetation not adapted to saturated soil; surface not flooded or saturated for any period of time.

The State Status column indicates if a species is listed as endangered, from New Jersey's official Endangered Species Plan List. The Federal Status also indicates species and include the following:

- LE: taxa formally listed as endangered
- LT: taxa formally listed as threatened
- C: Candidate taxa for which the Service currently has on file sufficient information on biological vulnerability and threat(s) to support proposals to list them as endangered or threatened species.

Natural Heritage Grid - Rare Plant Species and Ecological Community Habitat							
Common Name	**Class**	**Habitat**	**Regional Status**	**State Status**	**Federal Status**	**Global Rank**	**State Rank**
Curtiss' Three-awn Grass	Vascular plant	TERRESTRIAL	HL	-	-	G5T5	S2
Northern Peatland Sedge Coastal Plain Pond	Ecological community	NO DATA AVAILABLE	HL	-	-	GNR	S1S3
Pine Barren Boneset	Vascular plant	PALUSTRINE	LP, HL	E	-	G3	S2
Pine Barren Gentian	Vascular plant	PALUSTRINE; TERRESTRIAL	LP, HL	-	-	G3	S3
Swamp-pink	Vascular plant	PALUSTRINE	LP, HL	E	LT	G3	S3
Narrow-panicle Rush	Vascular plant	PALUSTRINE	HL	-	-	G5	S2
Pitch Pine Lowlands (Undifferentiated)	Ecological community	PALUSTRINE		-	-	G3	S3
Pine-oak-shrub Oak Woodland (Pow)	Ecological community	-		-	-	G3	S3
Pitch Pine-pinelands Reedgrass Savanna	Ecological community	PALUSTRINE		-	-	G1	S1
Sickle-leaf Golden-aster	Vascular plant	TERRESTRIAL	LP, HL	-	-	G3G4	S3
Pine Barren Rattlesnake-root	Vascular plant	PALUSTRINE; TERRESTRIAL	LP, HL	-	-	G4G5	S2
Slender Horned-rush	Vascular plant	PALUSTRINE	LP, HL	-	-	G4?	S2
Knieskern's Beaked-rush	Vascular plant	PALUSTRINE	LP, HL	E	LT	G2	S2
Pale Beaked-rush	Vascular plant	PALUSTRINE	HL	-	-	G3	S3
Curly Grass Fern	Vascular plant	PALUSTRINE	LP, HL	-	-	G3G4	S3
Sphagnum	Nonvascular plant	PALUSTRINE	HL	-	-	G5	S2
Pickering's Morning-glory	Vascular plant	TERRESTRIAL	LP, HL	E	-	G4T3	S1
Purple Bladderwort	Vascular plant	LACUSTRINE; PALUSTRINE; RIVERINE	LP, HL	-	-	G5	S3

White-Tailed Deer Population

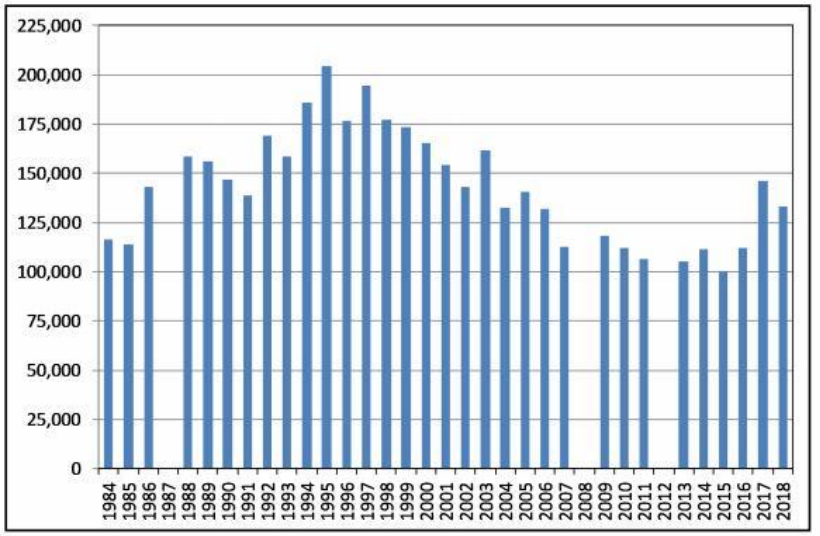
The overabundance of white-tailed deer (*Odocoileus virginianus*) throughout the state is also a local issue in Manchester Township.

Although deer populations are enjoyed by photographers, outdoor enthusiasts, and hunters, these populations can also have negative impacts on humans and ecosystems. Vehicle collisions, depredation of agricultural and ornamental plantings, and the potential for harboring parasites which can transmit diseases to other animals and humans are several negative impacts deer have on humans.

When deer populations and densities become too large for their environs, the population can exceed the carrying capacity of the land and degrade their habitats, which is especially prevalent in New Jersey's deciduous forests. Several studies in Pennsylvania have indicated that deer populations greater than 10 deer per square mile can result in a loss of biodiversity amongst plant and animal species.

The following chart shows the estimated deer population in New Jersey from 1984 through 2018, which is published by NJDEP's Division of Science and Research[2]. As shown in the chart, NJDEP's estimated deer population in New Jersey was approximately 130,000 in 2018. The peak estimated deer population occurred in 1995 when there were estimated to be over 200,000 deer in the State.

Management strategies can be implemented to reduce the number of deer and improve the conditions of the natural environment.



Throughout New Jersey, the deer population has typically been managed via sport hunting. NJDEP's Division of Fish & Wildlife has lengthened the hunting season, increased bag limits, increased the number of hunting permits issued, and offered incentives for hunters to harvest more antlerless deer as a means to control and reduce the deer population. However, these strategies may not be appropriate in more developed areas of the state due to a lack of open spaces and safety zone regulations.

Controlled hunting is generally the most cost-effective way to reduce the deer population in a community. Fencing is another option that can be used by homeowners and the agricultural community to prevent deer damage to crops, shrubs and flowers. Scare-based devices may also provide relief; however, deer may acclimate to the device over time.

[2] https://www.nj.gov/dep/dsr/trends/wildlife-whitetail.pdf

Repellents can also be used to protect cultivated vegetation that can either be applied directly to plants (contact repellents) or applied to an area near vegetation (area repellents). Contact repellents use taste as a deterrent whereas area repellents use odor.

Management techniques used throughout the state include:

- Trap and euthanize
- Shooting by Authorized Agents
- Chemical Fertility Control
- Surgical Sterilization
- Hunter-based programs including controlled hunting and opening additional land areas to the sport

It is important to note that the above listed management techniques may require a Community Based Deer Management program.

NJ Fish and Wildlife has a developed a Community Based Deer Management Manual for Municipalities to offer alternative deer control measures for local communities.[3] In order to implement Community Based Deer Management (CBDM), a municipality must submit a CBDM permit application which designates a Special Deer Management Area where control efforts are needed. The municipality must compile documentation pertaining to significant property damage and/or vehicle collisions within the designated area that can be measured numerically. The local government is also required to adopt a resolution endorsing the application for the CBDM.

FLOODPLAINS & FLOOD HAZARD AREAS

Floodplains are a vital part of any river or estuary ecosystem, acting as water filters and wildlife nurseries. They are important for the maintenance of water quality, providing fresh water to wetlands and backwaters while diluting salts and nutrients. Floodplains are major centers of biological life in the river and estuary ecosystem and improve the overall health of the habitat used by many species of birds, fish, and plants. They are important biologically, as they represent areas where many species reproduce and as such are important for breeding and regeneration cycles.

The floodplain is made up of two parts - the floodway and the flood fringe. The floodway is the inner area where floodwaters are deep and move fast. The floodway always includes the streambed or lakebed where the water normally flows, and usually extends to the top of the bank (if there is a defined bank) and sometimes beyond. The flood fringe is the outer area where floodwaters move more slowly or pool during a flood event. The severity of floods results from several factors, including rainfall intensity and duration, topography, tide, wind strength, and ground cover.

Flooding can be broken into two major categories; nuisance flooding, which refers to flooding that regularly occurs in communities during average storm events, and extreme flooding, which refers to flooding that results from heavy storms and major weather disturbances.

Regulating development in floodplains protects other properties from flood damage. Buildings within the floodplain cause the displacement of water during flood events, thus increasing the

[3] https://www.nj.gov/dep/fgw/pdf/cbdmp_manual.pdf

height of the rising waters farther away from the floodplain and worsening the effects of flooding. Impervious surfaces in the floodplain cover the natural ground surface, precluding infiltration processes that mitigate flooding. Even if development is permitted in the floodplain, regulations are necessary to ensure that it is constructed to withstand or accommodate floodwaters.

State regulations have been put in place to minimize the damage and protect individuals and communities from loss of life and property in areas at a high risk of flooding during weather events. New Jersey regulates construction in the floodplain under the Flood Hazard Area Control Act, N.I.S.A. 58:16A-50 et seq., and its implementing rules at N.J.A.C. 7:13. The NJDEP Land Use Regulation Program manages Stream Encroachment Permitting in the state.

At the Federal Level, the Federal Emergency Management Administration (FEMA) has established a methodology for classifying risks associated with flooding. FEMA publishes Flood Insurance Rate Maps (FIRMs), showing floodplain zone designations. These are primarily for insurance rating purposes, but the zone differentiation can be very helpful for other floodplain management purposes.

FEMA Region II, which covers New Jersey and New York, has created a suite of additional tools that communities can use to analyze and plan around potential flooding extents. In particular, the Areas of Mitigation Interest tool shows local features that impact flood risk, identifying areas with a history of flood claims, structures that contribute to flooding problems such as undersized culvers, and areas undergoing land use change and development. Communities can use this visualization tool to prioritize potential floodwater mitigation opportunities.

FEMA Flood Zone Classifications

100-year Floodplain: The 100-year floodplain boundary area has been established to denote floodwater impoundment areas. In most places, development in these areas is highly restricted in order to avoid destruction of flood areas and the destruction of property. The 100-year floodplain is known as the Special Flood Hazard Area (SFHA).

According to the FEMA definition, the SFHA is defined as the area that will be inundated by the flood event having a 1-percent chance of being equaled or exceeded in any given year. The 1-percent-annual-chance flood is also referred to as the "base flood." Note that the Special Flood Hazard Area (SFHA) includes only A and V Zones as defined below.

Zone A: Areas subject to inundation by the 1-percent-annual-chance flood event. Because detailed hydraulic analyses have not been performed, no BFEs or flood depths are shown. Mandatory flood insurance purchase requirements apply.

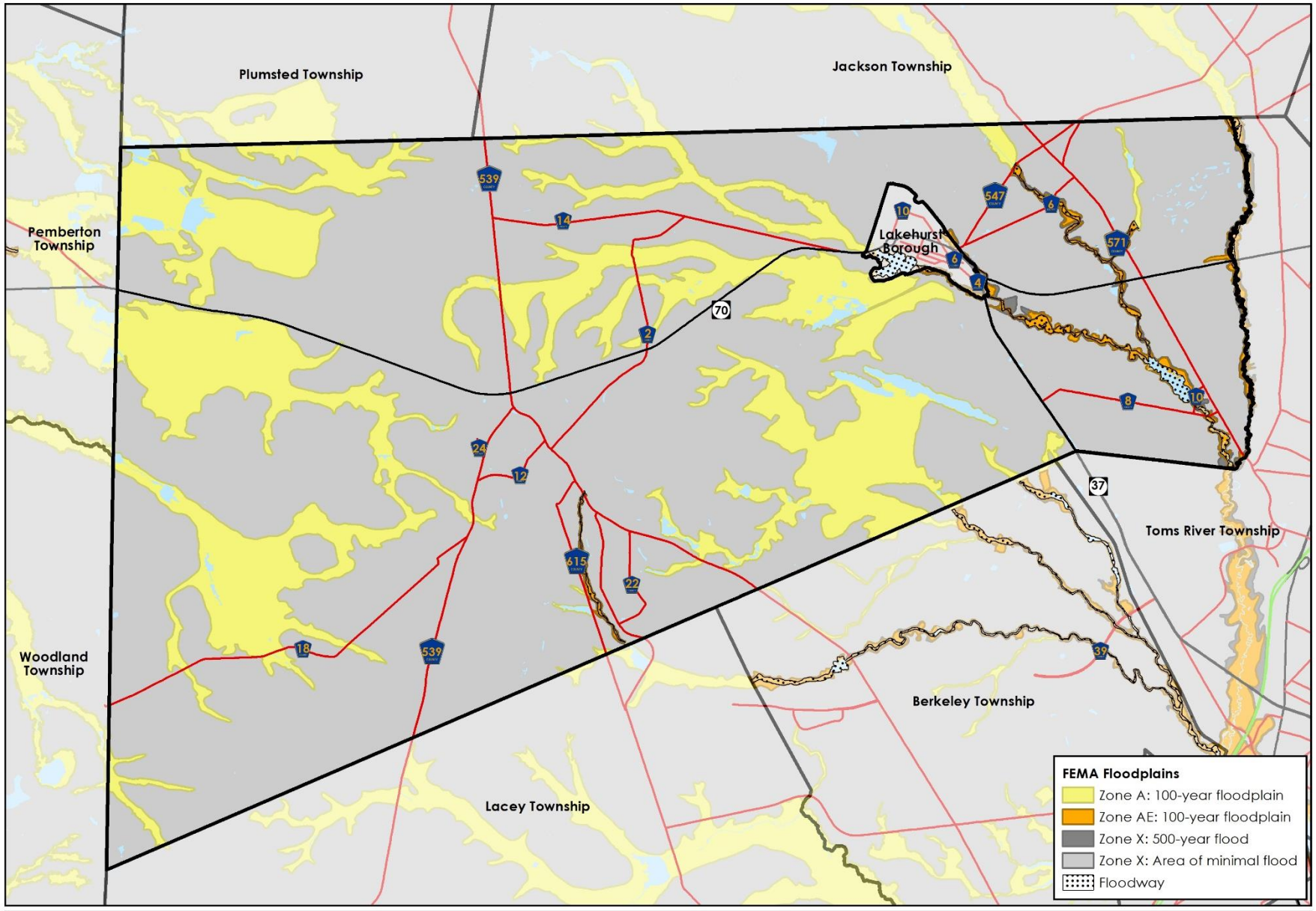
Zone AE: Areas subject to inundation by the 1-percent-annual-chance flood event, determined by detailed methods. BFEs are shown within these zones. Mandatory flood insurance purchase requirements apply. (Zone AE is used on new and revised maps in place of Zones A1-A30.)

Zone X: Area of moderate flood hazard, usually the area between the limits of the 100-year and 500-year floods. However, buildings in these zones could be flooded by severe, concentrated rainfall coupled with inadequate local drainage systems. Local stormwater drainage systems are not normally

considered in the community's FIS. The failure of a local drainage system creates areas of high flood risk within these rate zones. Flood insurance is available in participating communities but is not required by regulation in these zones. (Zone X is used on new and revised maps in place of Zones B and C.)

See the FEMA Floodplains Map for locations of these flood zones.

The New Jersey Climate Change Resource Center, established in January 2020, provides valuable tools and information pertaining to climate change, sea level rise, and floodplains. NJ Adapt is a suite of online tools designed to provide data addressing climate change in New Jersey. NJ Adapt includes NJ Floodmapper, an online interactive mapping tool which allows users to conduct flood exposure analysis based upon the best available science for sea-level rise, hurricane surge, FEMA floodzones, and Hurricane Sandy surge. The tool can be accessed here: www. https://www.njfloodmapper.org.



FEMA Floodplains

Manchester Township - Natural Resource Inventory

HEYER, GRUEL & ASSOCIATES
September 2020

KNOWN CONTAMINATED SITES

The Known Contaminated Sites List (KCSNJ) for New Jersey are those sites and properties within the state where contamination of soil or ground water has been confirmed at levels equal to or greater than applicable standards. This list of Known Contaminated Sites may include sites where remediation is either currently under way, required but not yet initiated or has been completed and addressed via an Institutional Control.

The NJDEP Site Remediation Program maintains and updates the data base daily to reflect those properties that are confirmed.

The Known Contaminated Sites in New Jersey report is produced by NJDEP in response to N.J.S.A. 58:10-23.16-17 that requires preparation of a list of sites affected by hazardous substances. It also satisfies the Site Remediation Program's obligations under the New Jersey New Residential Construction Off-Site Conditions Disclosure Act (N.J.S.A 46:3C1 et seq.).

Sites included on the KCSNJ can undergo a wide variety of remedial activities, ranging from relatively simple "cut and scrape" cleanups to highly complex cleanups. The sites with complex contamination issues can have several sources of contamination, which can affect both soil and ground water at the same time. Several groups or remedial bureaus within the Site Remediation and Waste Management (SRWM) Program manage these cleanups. It is possible for more than one bureau to be involved at one site at the same time. A site being regulated under more than one statute or regulation often drives this scenario.

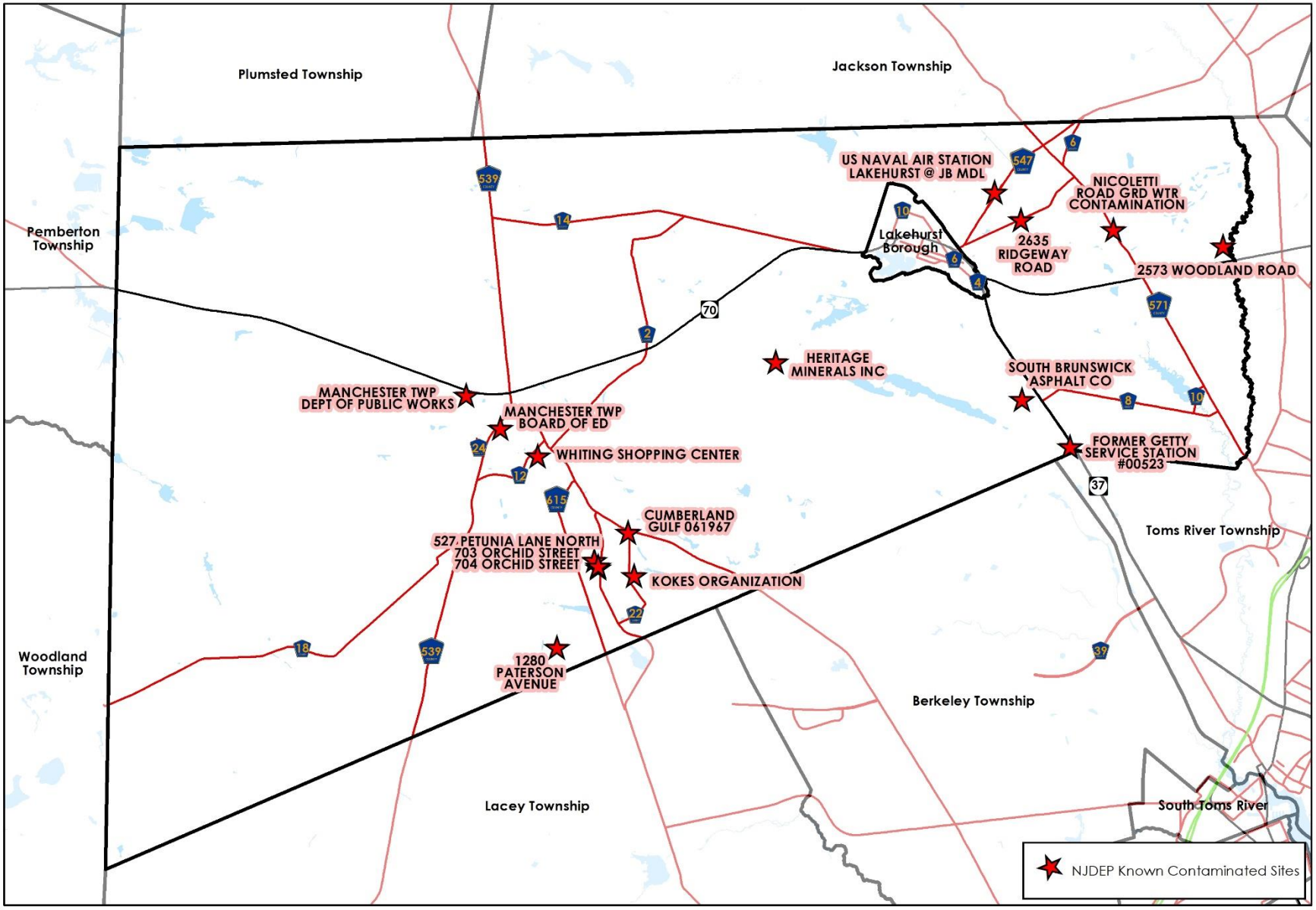
The following chart and map detail the Known Contaminated Sites in Manchester Township. The following definitions are relevant:

- LSRP: LSRP case- Case is being handled under the Licensed Site Remediation Professional (LSRP) program
- Traditional: Traditional Oversight case- Traditional Department oversight is maintained for CERCLA sites where EPA is the lead agency and at Federal Facilities under Federal agreements. Traditional oversight is also applicable at CERCLA sites where the Department is the lead agency. All traditional oversight cases are handled by the Bureau of Case Management (BCM).
- PUB FUNDED: NJDEP Publicly Funded case- Sites where targeted remediation is undertaken by the Department's Publicly Funded Element for situations where the responsible entity is unknown, unwilling or unable to perform the necessary remediation to ensure that the health and safety of the public and/or the environment are not jeopardized.
- UHOT: Unregulated Heating Oil Tank Program case - Homeowner heating oil UST discharge cases
- RAP: Remedial Action Permit case- Restricted Use or Limited Restricted Use No Further Action (NFA)/Remedial Action Outcome (RAO) case with an associated soil and/or ground water Remedial Action Permit. The case is now under the auspices of the Bureau of Remedial Action Permits, with biennial certification required.
- Remedial Level- Level of site complexity that is based on the Site Remediation Program's 1989 Case Assignment Manual. It is the intent of the Site Remediation Program

that remedial levels be determined for the overall degree of contamination at a site recognizing that individual areas of concern may involve remedial actions of varying levels.

- Remedial Level A- Emergency action/stabilization
- Remedial Level B- Single phase remedial action; single contamination affecting only soils.
- Remedial Level C1- No formal design; source known or identified; potential ground water contamination.
- Remedial Level C2- Formal design; known source or release with ground water contamination.
- Remedial Level C3- Multi-phased remedial action - unknown or uncontrolled discharge to soil or ground water.
- Remedial Level D- Multi-phased remedial action; multiple sources/releases to multi-media, including ground water.
- CAOC: Contaminated Area of Concern- An area at a site where contamination is identified or suspected.
- CEA: Classification Exemption Area- A CEA is an area within which one or more constituent standards and designated uses are suspended.
- Category A- Sites with on-site source(s) of contamination
- Category B- Sites with an unknown source(s) of contamination.
- Category C- Sites closed with an Institutional Control(s).

Known Contaminated Sites								
Name	**Address**	**Program ID Number**	**Lead Program**	**Status**	**Remedial Level**	**# of CAOC**	**CEA Status**	**Category**
SOUTH BRUNSWICK ASPHALT CO	2065 RTE 37	16764	LSRP	Active	D	LSRP 0-1 CAOC	Established & Active	A
CUMBERLAND GULF 061967	498 RT 530	6348	RAP	Active - RAP			Established & Active	C
MANCHESTER TWP BOARD OF ED	121 RTE 539	11704	LSRP	Active	B	LSRP 2-10 CAOC		A
FORMER GETTY SERVICE STATION #00523	1741 E RT 37	1734	RAP	Active - RAP			Established & Active	C
MANCHESTER TWP DEPT OF PUBLIC WORKS	87 ROUTE 70 E	12041	LSRP	Active	C2	LSRP 0-1 CAOC		A
HERITAGE MINERALS INC	RT 70 MM 41	12202	LSRP	Active	D	LSRP 2-10 CAOC		A
NICOLETTI ROAD GRD WTR CONTAMINATION	NICOLETTI & RIDGEWAY RDS & JOHNSON AVE	G000011638	PUB FUNDED	Active	C3			B
KOKES ORGANIZATION	55 SCHOOLHOUSE RD	30685	LSRP	Active	C2	LSRP 2-10 CAOC		A
US NAVAL AIR STATION LAKEHURST @ JB MDL	RT 547 & HANOVER RD	7040	TRADITIONAL	Active	C2		Established & Active	A
527 PETUNIA LANE NORTH	527 PETUNIA LN N	777408	UHOT	Active	C2			A
WHITING SHOPPING CENTER	108 LACEY RD	423960	RAP	Active - RAP			Established & Active	C
2635 RIDGEWAY ROAD	2635 RIDGEWAY RD	233273		Active	C1			A
1280 PATERSON AVENUE	1280 PATERSON AVE	721916	UHOT	Active	C2			A
703 ORCHID STREET	703 ORCHID ST	550234	UHOT	Active	C2			A
704 ORCHID STREET	704 ORCHID ST	529129	UHOT	Active	C1			A
2573 WOODLAND ROAD	2573 WOODLAND RD	830443		Active	C1			A



Known Contaminated Sites

Manchester Township - Natural Resource Inventory

HGA Heyer, Gruel & Associates September 2020

CULTURAL RESOURCES

Historic preservation is an important national policy and became apparent through the adoption of the National Historic Preservation Act of 1966. The Historic Preservation Act of 1966 authorizes the Department of the Interior to establish and maintain the National Register of Historic Places (NRHP) which is maintained federally by the National Park Service (NPS). The NPS in-turn establishes the State Historic Preservation Officer (SHPO) who administers the programs at the state level. It provides for the Advisory Council of Historic Preservation and also requires federal agencies to establish Agency Preservation Officers. The SHPO by far has one of the most important roles in preservation planning. Their office administers the preservation elements of the Act at the state level and consequently the SHPO is a key person to assist the county and municipalities in their respective historic preservation efforts, along with the New Jersey Historic Trust which provides funding for preservation capital projects. In the State of New Jersey, the SHPO is the Commissioner of the Department of Environmental Protection.

As noted in the Township's Historic Preservation Plan Element, historic sites within the Township are scattered and many do not physically exist, while others cannot be definitely located.

The Township's Master Plan Element details twenty-five cultural resources within the Township, based upon the New Jersey Historic Sites Inventory of Ocean County in 1981. Since this time, many of these sites have been removed from the State Inventory.

As shown in the following chart and map, Manchester has five Historic Districts- Keswick Grove, Lakehurst, Lighter-Than-Air, New Jersey Southern Railroad, and Whitesbog Historic Districts. Of these Historic Districts, only one, Whitesbog, has been listed on the State and National Register of Historic Places as a historic district. Of the remaining districts, Keswick Grove and the Lakehurst Historic Districts are "Identified", meaning they have been identified through a cultural resource survey or other documentation on file at the HPO. The Lighter-Than-Air and New Jersey Southern Railroad Historic Districts are considered "Eligible", meaning these districts have been determined Eligible for inclusion in the registers through federal or state processes administered by the HPO.

There are an additional 62 Historic Properties within the Township, of which most have been determined Eligible as a Historic District (58 properties). The remaining sites are designated as Identified (2 properties), Eligible (1 property), or Listed on the National and State Historic Registrars (1 property).

The following chart and map include an inventory of Historic Properties and Districts that are located within the Township, according to State Records.

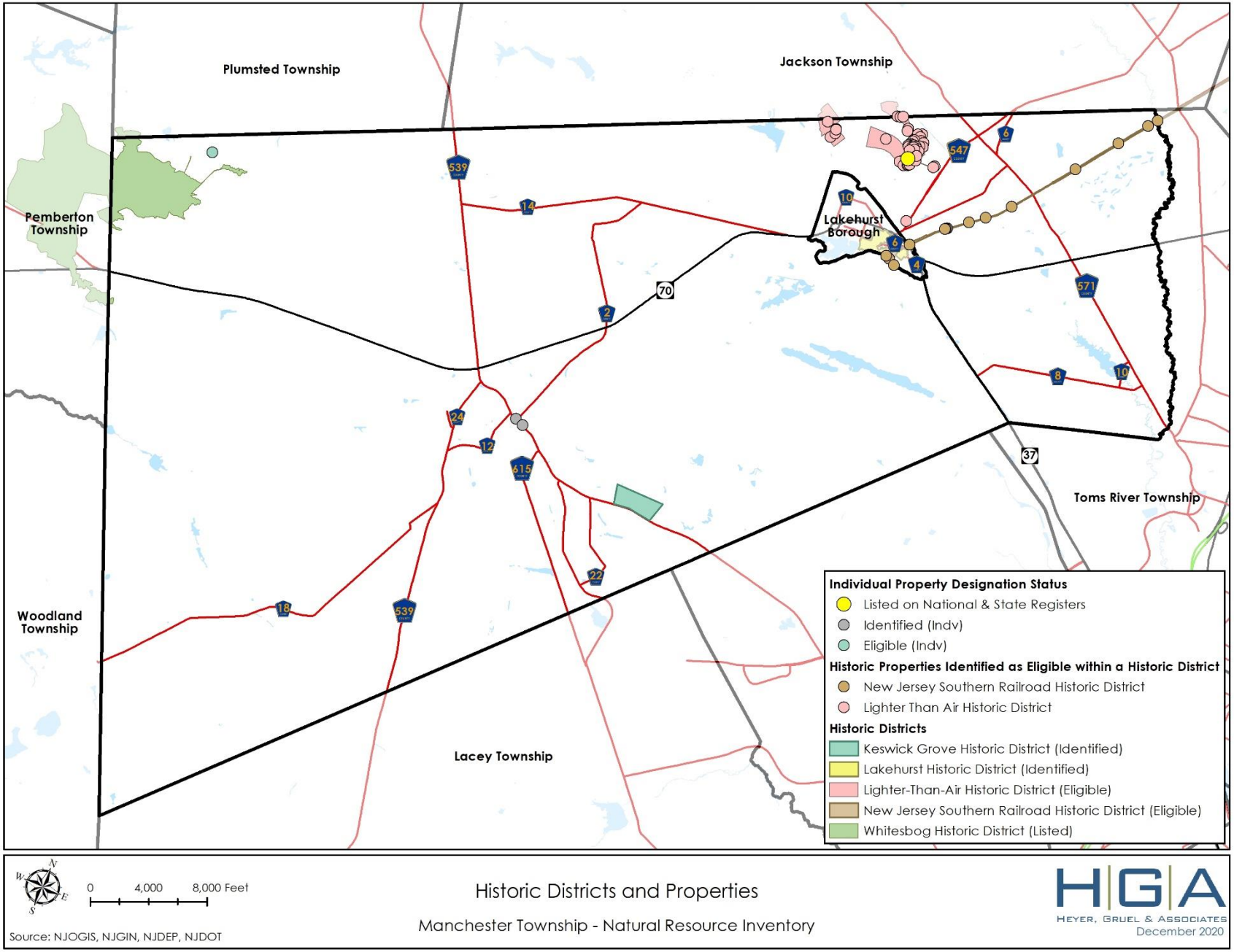
Historic Districts in Manchester Township	
NAME	**STATUS**
Keswick Grove Historic District	IDENTIFIED
Whitesbog Historic District	LISTED- State & National Registers
Lighter-Than-Air Historic District	ELIGIBLE
Lakehurst Historic District	IDENTIFIED
New Jersey Southern Railroad Historic District	ELIGIBLE

Properties Listed as Eligible for Lighter-Than-Air Historic District	
NAME	**ADDRESS**
Aerological Building / Building 38	Naval Air Engineering Station Lakehurst
Airplane Hangar / Building 124	Naval Air Engineering Station Lakehurst
Auxiliary Shop / Building 5	Naval Air Engineering Station Lakehurst
B.B.T. Light, Flood Light House / Building 101	Naval Air Engineering Station Lakehurst
Barracks/Administration/CO's Office / Building 26; Command Headquarters Building	Naval Air Engineering Station Lakehurst
Cathedral of the Air / Building 264	Naval Air Engineering Station Lakehurst
Dispensary / Building 39	Naval Air Engineering Station Lakehurst
Engine Test Cell Building / Building 199	Naval Air Engineering Station Lakehurst
Equipment Storage Shed / Building 144	Naval Air Engineering Station Lakehurst
Facility Number 447 (Transformer Vault)	Naval Air Engineering Station Lakehurst
Firehouse / Building 128	Naval Air Engineering Station Lakehurst
Garage / Building 136	Naval Air Engineering Station Lakehurst
Garage / Building 137	Naval Air Engineering Station Lakehurst
Garage / Building 138	Naval Air Engineering Station Lakehurst
Gas Cell Shop / Building 123; Gym and offices [after 1970s]	Naval Air Engineering Station Lakehurst
Gate House / Building 60; Guard House; Credit Union	Naval Air Engineering Station Lakehurst
General Service Building / Building 150	Naval Air Engineering Station Lakehurst
General Warehouse / Building 79	Naval Air Engineering Station Lakehurst
Ground Equipment Repair Shop / Building 99	Naval Air Engineering Station Lakehurst
Hangar 2 / Building 148	Naval Air Engineering Station Lakehurst
Hangar 3 / Building 149	Naval Air Engineering Station Lakehurst
Hangar 4 / Building 118	Naval Air Engineering Station Lakehurst
Hangar 5 / Building 194	Naval Air Engineering Station Lakehurst
Hangar 5 Oil Storage House / Building 258	Naval Air Engineering Station Lakehurst
Hangar 6 / Building 195	Naval Air Engineering Station Lakehurst
Helium Purification Plant / Building 8	Naval Air Engineering Station Lakehurst
Landing Mat 3 / 2-01234	Naval Air Engineering Station Lakehurst

Properties Listed as Eligible for Lighter-Than-Air Historic District (continued)	
NAME	**ADDRESS**
Main Garage Annex / Building 189	Naval Air Engineering Station Lakehurst
Motor Pool / Building 111	Naval Air Engineering Station Lakehurst
Powerhouse / Building 15; Power Plant 1	Naval Air Engineering Station Lakehurst
Public Works Garage / Building 88; Auto Maintenance Garage	Naval Air Engineering Station Lakehurst
Public Works Paint Shop / Building 198	Naval Air Engineering Station Lakehurst
Public Works Shop/Public Works Shop Building/Fire Station Annex (Building 272)	Naval Air Engineering Station Lakehurst
Public Works Storage / Building 191	Naval Air Engineering Station Lakehurst
Quarters T / Building T	Naval Air Engineering Station Lakehurst
Quarters X / Building X; Married Officers Quarters	Naval Air Engineering Station Lakehurst
Quarters X / Building X; Married Officers Quarters	Naval Air Engineering Station Lakehurst
Quarters Y / Building Y; Married Civilians Quarters	Naval Air Engineering Station Lakehurst
Quarters Z / Building Z; Married Civilians Quarters	Naval Air Engineering Station Lakehurst
Storage Shed / Building 179	Naval Air Engineering Station Lakehurst
Supply Office / Building 129; General Storehouse	Naval Air Engineering Station Lakehurst
Taxiway No. 6	Across Landing Mat 1, NAES Lakehurst
Warehouse / Building 108	Naval Air Engineering Station Lakehurst
Water Tank / Building 151	Naval Air Engineering Station Lakehurst

Properties Listed as Eligible for NJ Southern Railroad Historic District	
NJS Milepost 65	NJ Southern Railroad north from Durham Avenue
NJS Concrete Foundation and Manhole	NJ Southern Railroad north from Twyford lane
NJS Timber Trestle over Union Branch of Toms River (5)	NJ Southern Railroad over Union Branch
NJS Timber Trestle over Union Branch of Toms River (6)	MAIN LINE RR
NJS Concrete Foundation and Manhole	New Jersey Southern Railroad
NJS Manhole	New Jersey Southern Railroad
NJS Concrete Foundation and Manhole	New Jersey Southern Railroad
NJS Timber Trestle over Manapaqua Brook	NJ Southern Railroad over Manapaqua Brook
NJS Timber Trestle over Ridgeway Branch of Toms River	NJ Southern Railroad over Ridgeway Branch
NJS Timber Trestle over Toms River	RAILROAD TRACKS
NJS Switch and Turnout Track to Clayton Sand	RAILROAD TRACKS
NJS Concrete Foundation and Manhole	RAILROAD TRACKS
NJS Concrete Foundation	RAILROAD TRACKS
Timber Trestle (5)	Wye between NJ Southern and Tom's River Branch RRs over the Union Branch of the Tom's River

Individual Historic Property Status		
NAME	**ADDRESS**	**STATUS**
101 Lacey Road	101 Lacey Road, Whiting	Identified (Indv)
Whiting Schoolhouse / Whiting Sunday School	95 Lacey Road	Identified (Indv)
Hangar Number One, Lakehurst Naval Air Station / Building 1	County Route 547	LISTED- NR & SR
Building 9726	Range Road	Eligible (Indv)


Plumsted Township
Jackson Township
Pemberton Township
Lakehurst Borough
Toms River Township
Woodland Township
Lacey Township
Individual Property Designation Status
Listed on National & State Registers
Identified (Indv)
Eligible (Indv)
Historic Properties Identified as Eligible within a Historic District
New Jersey Southern Railroad Historic District
Lighter Than Air Historic District
Historic Districts
Keswick Grove Historic District (Identified)
Lakehurst Historic District (Identified)
Lighter-Than-Air Historic District (Eligible)
New Jersey Southern Railroad Historic District (Eligible)
Whitesbog Historic District (Listed)
0 4,000 8,000 Feet
Source: NJOGIS, NJGIN, NJDEP, NJDOT
Historic Districts and Properties
Manchester Township - Natural Resource Inventory
HEYER, GRUEL & ASSOCIATES
December 2020

USER NOTES

All data used to produce this document is publicly available and sourced through a variety of resources, including but not limited to New Jersey Department of Environmental Protection, United States Geological Service, Federal Emergency Management Agency, New Jersey Office of Geographic Information Systems, New Jersey Geological and Water Survey, and USDA Natural Resources Conservation Service SSURGO. Most of the data can also be viewed by accessing NJDEP's NJ-GeoWeb: https://njdep.maps.arcgis.com/apps/webappviewer/index.html?id=02251e521d97454aabadfd8cf168e44d.

The data used is a result of Geographic Information Systems. The data can be downloaded from these agencies and can be displayed utilizing software such as ESRI's ArcReader and ArcMap products, as well as QGIS.