ENVIRONMENTAL RESOURCE INVENTORY

for the

BOROUGH OF RIVERTON
COUNTY of BURLINGTON, NEW JERSEY

Prepared in collaboration with
the Riverton Planning Board and
the Riverton Environmental Commission

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With assistance from the
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Many of the maps and illustrative graphics within this report were originally created by other sources. See the reference section and visit their websites for more valuable information.

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PREFACE

Both the Environmental Commission Enabling Legislation (N.J.S.A. 40:56A) and the New Jersey Municipal Land Use Law (N.J.S.A. 40:55D-28b(2)) authorize municipalities to generate Environmental Resource Inventories. Also known as a Natural Resource Inventory (NRI) or an Index of Natural Resources, an Environmental Resource Inventory (ERI) is a collection of important environmental data that pertain to a specific municipality or planning area. In its purest form, it is simply a collection of data; a resource for local planners to use when developing local planning polices.

Riverton Memorial Park: The most easily recognized part of Riverton's open space.

In this case, the Riverton ERI is part of a larger project, funded in part by a smart growth grant from the New Jersey Department of Community Affairs. The entire scope of the project includes the ERI, an Open Space and Recreation Plan, a stream corridor buffer ordinance and riverbank guidelines. The ERI will help the community define a comprehensive local policy on open space within the Borough. The Municipality will draft a new Open Space and Recreation Plan Element for adoption into the Borough's Master Plan. Finally, a stream buffer ordinance and Delaware riverbank guidelines will be developed to complete the project.

INTRODUCTION

People who know Riverton might wonder what purpose an Environmental Resource Inventory could serve to a community that is as fully developed as the Borough of Riverton. After all, how much 'environment' is left to inventory?

Admittedly, many if not most ERI's are written for towns and planning areas that have an abundance of *natural* environmental resources. In 2004, the Riverton Environmental Commission and the Pompeston Creek Watershed Association completed a very thorough Environmental Inventory for the Pompeston Creek Watershed. The area included parts of Cinnaminson, Delran, Moorestown and the eastern corner of Riverton Borough. This is an important inventory of environmental information because the Pompeston Creek is one of Riverton's last natural, undeveloped areas. http://www.pompestoncreek.org/pcei/index.htm.

While it may seem unlikely, an ERI for a developed borough like Riverton can be more important to a built up community than it is in less developed towns. Since there is so little natural environment remaining in Riverton, an ERI quantifies the last remaining vestiges of natural resources. The few remaining resources that exist are of greater value because they are rare. It is important to understand what resources remain so the Town can plan in concert with them rather than against them. Hopefully, the little that is left in the environment will not be lost.

In a town as built up as Riverton, the *'environment'* to be inventoried appropriately includes the built environment. For instance, street trees, although planted by people, not nature, are just as important to the quality of life as the natural environment of the Pompeston Creek. Therefore, street trees should play just as important a role in planning decisions as anything pertaining to the Pompeston Creek.

Likewise, the Borough's historic character is not *'natural'*, but it is certainly part of the *'environment'* that defines Riverton. Planners in Riverton could do just as much damage to the quality of life in Riverton by ignoring the historic character of the town as they might if they ignored the environmental sensitivity of the Pompeston Creek watershed.

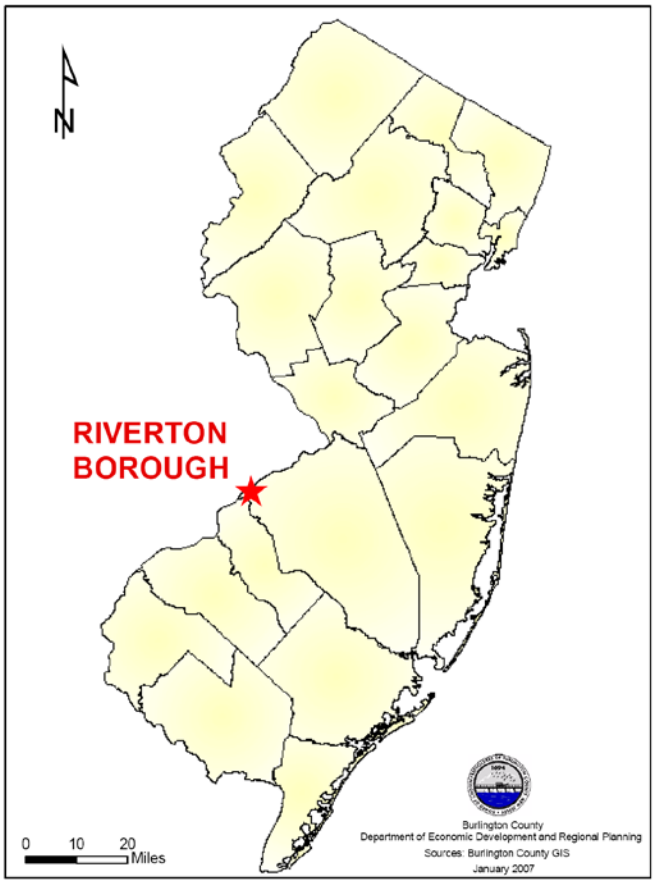
Therefore, this Environmental Resource Inventory for Riverton includes an assemblage of information, both the natural and man-made. It is a resource that should be updated periodically. If new open space is created, that information should be added to the inventory. If water quality within the Pompeston Creek improves, that information, and the factors that led to the improvements should be added to the inventory. This report is a picture of Riverton at this moment. With it, planning policies, like a new Open Space and Recreation Plan Element, can be developed to improve all the environmental resources.

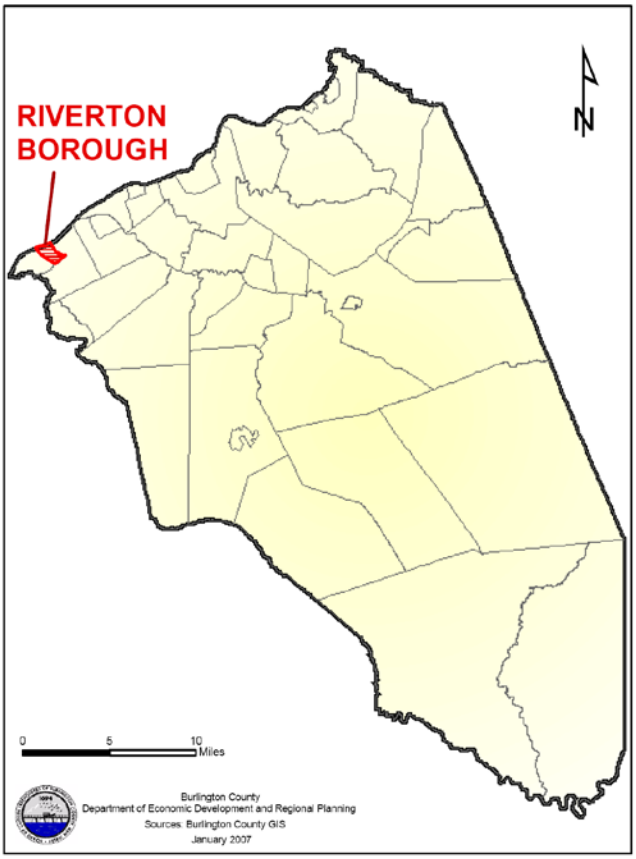
This ERI is divided into seven (7) sections. The section on Land Resources describes the nature of the land on which the Borough resides. Water Resources explains the realm of water that is in the ground and on it, like wetlands and creeks. The section on Air Resources describes the climate of the area and the general air quality. Biological Resources summarizes the local flora and fauna. Natural Resources refer to the undeveloped areas of town, and lastly the sections on Historic and Community Resources summarize the nature of the built environment.

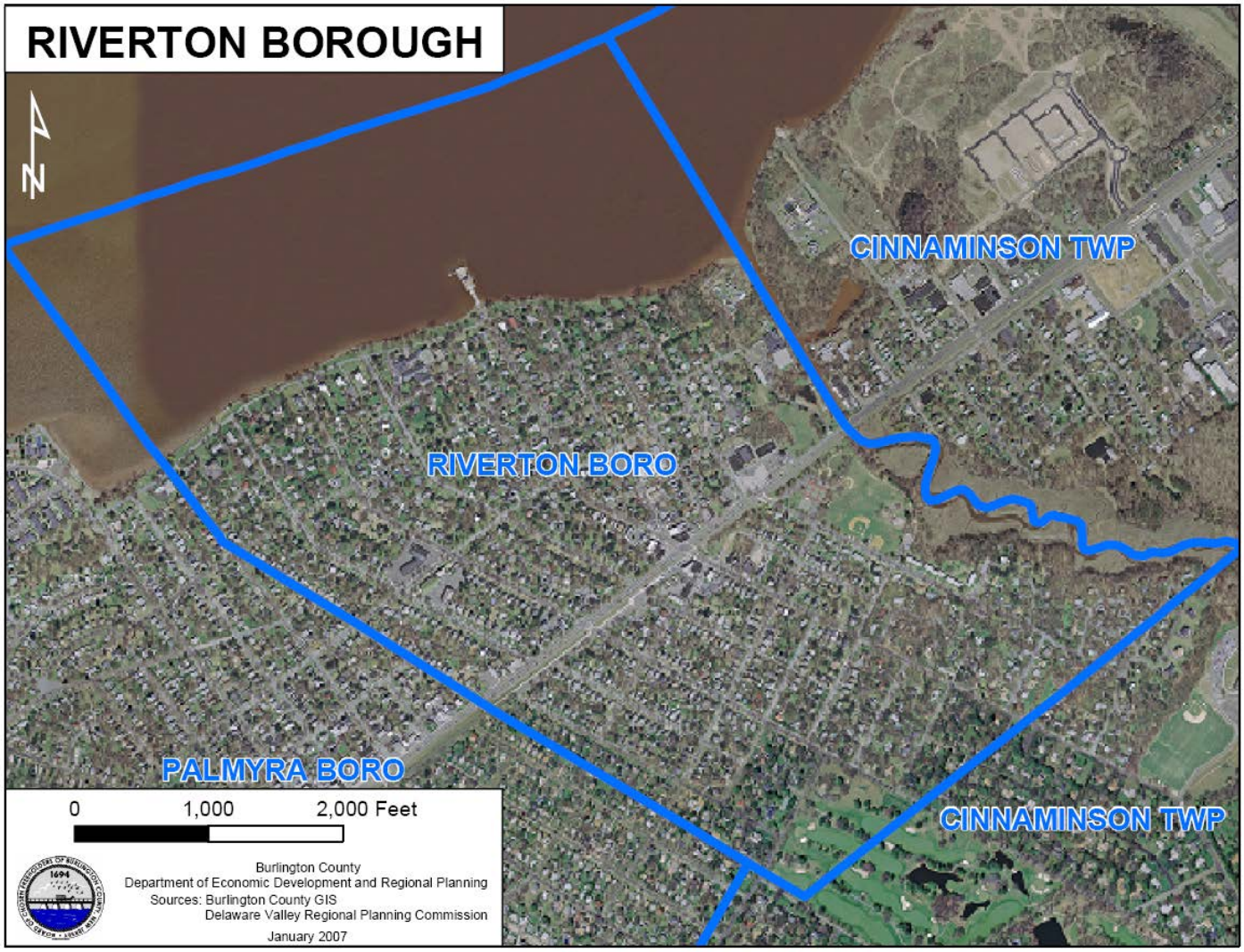
This document draws no conclusions. That is not its purpose. It is intended to be simply an inventory. The later phases of the larger project, the Open Space and Recreation Plan Element and the proposed ordinance and riverbank guidelines, will draw upon this inventory to develop conclusions and establish planning policies. This document should continue to be used as a foundation for planning policies in the future.

Riverton Yacht Club seen from Bank Ave

The Borough of Riverton is located in the western corner of Burlington County, where the southern edge of the County touches the Delaware River. The Township of Cinnaminson wraps around Riverton in an 'L' to the Borough's east and Palmyra borders the Borough to the west. The Tacony and Holmesburg sections of Philadelphia lie across the Delaware River to the north.






RIVERTON BOROUGH
N
CINNAMINSON TWP
RIVERTON BORO
PALMYRA BORO
CINNAMINSON TWP
0
1,000
2,000 Feet
Burlington County
Department of Economic Development and Regional Planning
Sources: Burlington County GIS
Delaware Valley Regional Planning Commission
January 2007

LAND RESOURCES

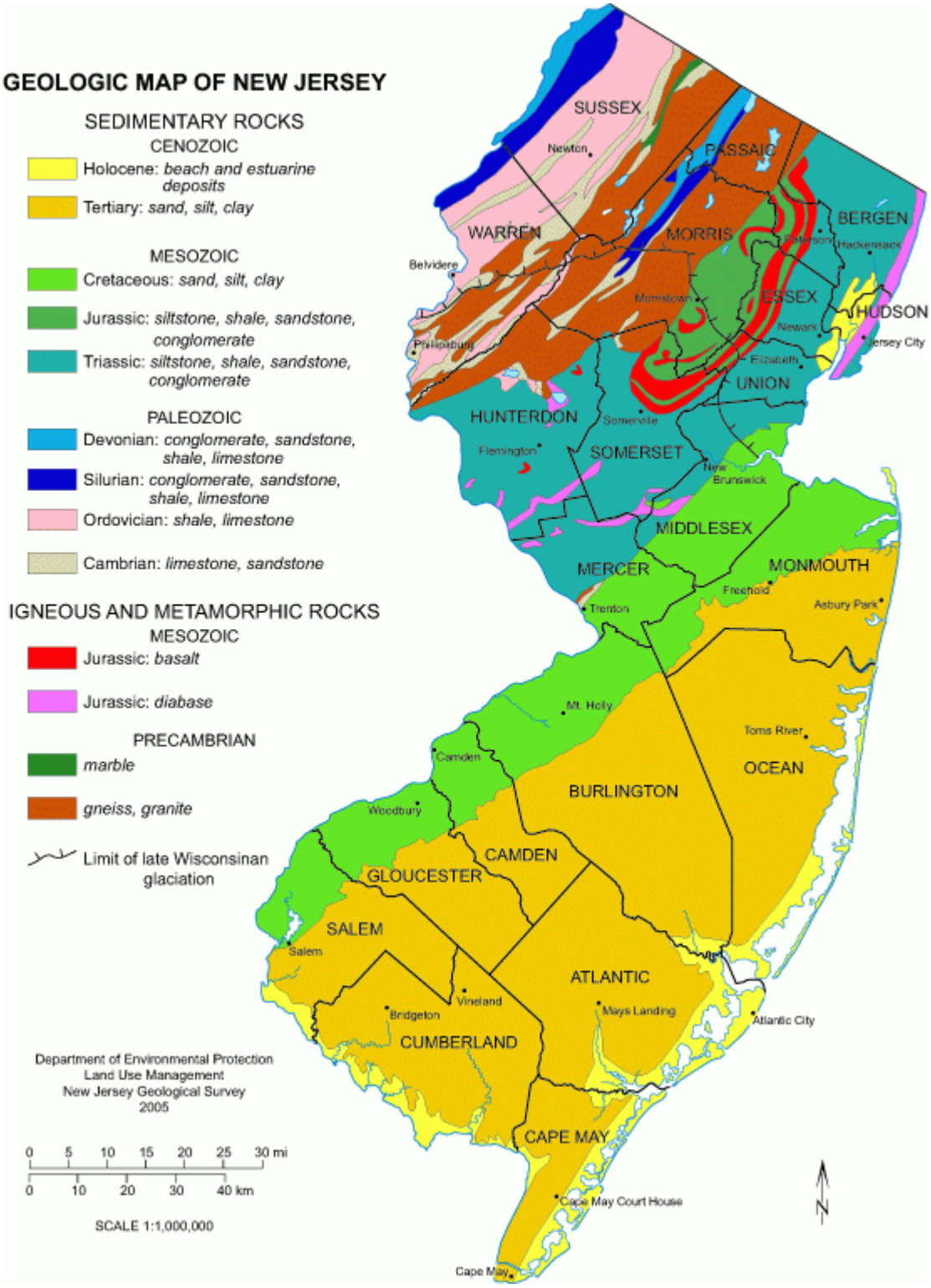
A. Geology

A good place to begin any environmental resource inventory is to review the geology of the area. The geology is the oldest part of the environment. It is the science that studies the structure of the Earth, which is estimated to be 4.6 billions years old. Earth's history is divided into four *eras*, including (from oldest to newest) the Precambrian, Paleozoic, Mesozoic and Cenozoic.

The geological map of New Jersey illustrates how the State is underlain by bedrock formed during different geological eras. Much of the southern part of the State was formed during the Cenozoic Era, a time that began 65 million years ago after dinosaurs had become extinct.

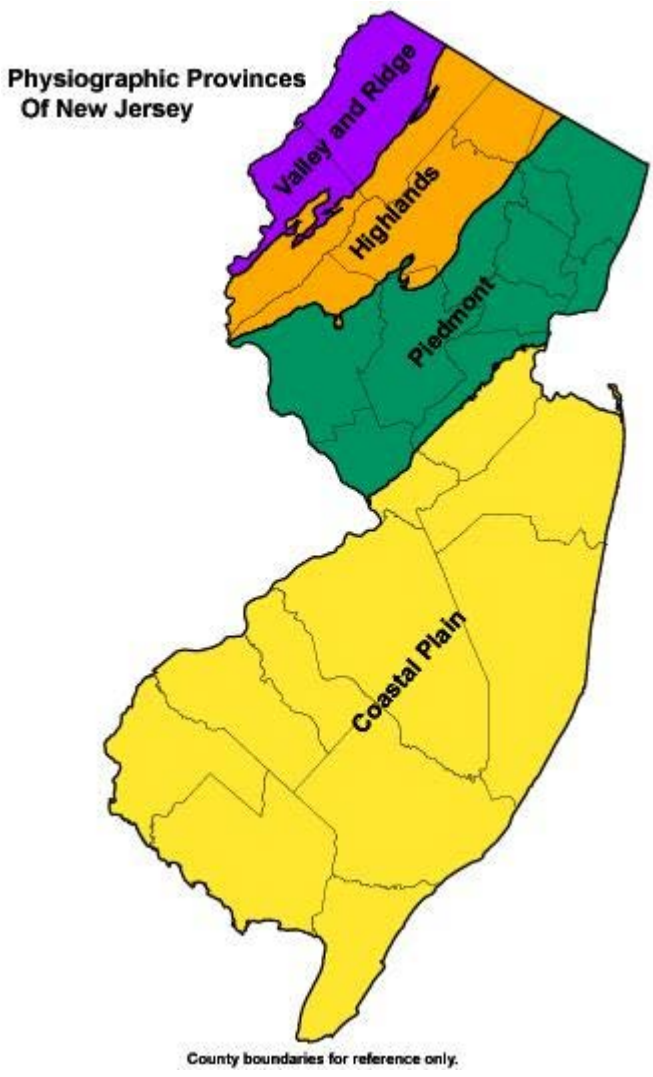
But Riverton is located in a part of the State underlain by Mesozoic formations. The Mesozoic era lasted from 248 million years ago to 65 million years ago. It is often referred to as the 'Age of the Reptiles.' The climate was mild, even warmer than it is today. There were no polar ice caps and the sea level was higher than it is now. At the beginning of the Mesozoic era, continents as we know them had not yet broken apart. Land on Earth was still consolidated in a single super-continent known as Pangaea.

Throughout the Mesozoic era, Pangaea began to drift apart and form the continents that we know today. The climate changed from very hot and dry to much more temperate and mild. The Mesozoic era, this second youngest era in geological time, is itself divided into *periods*. Again from oldest to youngest they include the Triassic Period, the Jurassic Period and the Cretaceous Period. During the Triassic Period (the first period), animals and plants began to appear, and they were flourishing by the end of the Cretaceous Period (the last period). The geology which underlies Riverton was formed during this most prolific time in Earth's history – the Cretaceous Period.


GEOLOGIC MAP OF NEW JERSEY
SEDIMENTARY ROCKS
CENOZOIC
Holocene: beach and estuarine deposits
Tertiary: sand, silt, clay
MESOZOIC
Cretaceous: sand, silt, clay
Jurassic: siltstone, shale, sandstone, conglomerate
Triassic: siltstone, shale, sandstone, conglomerate
PALEOZOIC
Devonian: conglomerate, sandstone, shale, limestone
Silurian: conglomerate, sandstone, shale, limestone
Ordovician: shale, limestone
Cambrian: limestone, sandstone
IGNEOUS AND METAMORPHIC ROCKS
MESOZOIC
Jurassic: basalt
Jurassic: diabase
PRECAMBRIAN
marble
gneiss, granite
Limit of late Wisconsinan glaciation
Department of Environmental Protection
Land Use Management
New Jersey Geological Survey
2005
0 5 10 15 20 25 30 mi
0 10 20 30 40 km
SCALE 1:1,000,000
SUSSEX
Newton
PASSAIC
WARREN
MORRIS
BERGEN
Belvidere
Paterson
Hackensack
Morristown
ESSEX
HUDSON
Newark
Phillipsburg
Jersey City
Elizabeth
UNION
HUNTERDON
Somerville
Flemington
SOMERSET
New Brunswick
MIDDLESEX
MERCER
MONMOUTH
Freehold
Trenton
Asbury Park
Mt. Holly
Toms River
Camden
OCEAN
BURLINGTON
Woodbury
CAMDEN
GLOUCESTER
SALEM
Salem
ATLANTIC
Vineland
Bridgeton
Mays Landing
Atlantic City
CUMBERLAND
CAPE MAY
Cape May Court House
Cape May
N

While geological time is divided in eras and periods, geologists divide New Jersey into four areas or zones, called *provinces* depending on the geological formations that dominate the areas. From north to south, these provinces include the Valley and Ridge Province, the Highlands Province, the Piedmont Province and the Coastal Plain Province. The Coastal Plain Province, in which Riverton is located, is by far the largest of the four. It includes 4,667 square miles of southern New Jersey or 60% of the State.

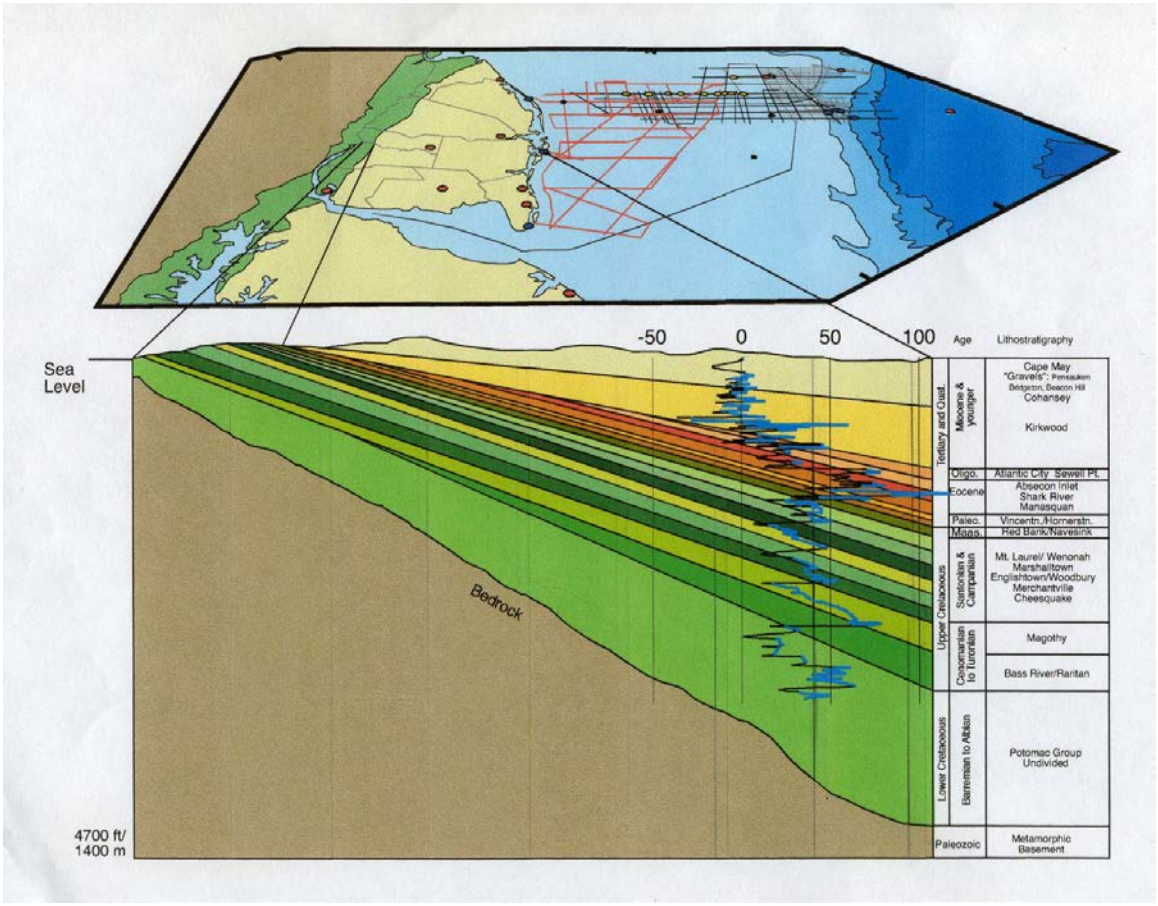
The Coastal Plain is further divided into two parts, the Inner and Outer Coastal Plains. They are distinctly different. The Outer Coastal Plain is the younger formation, created by a series of unconsolidated deposits laid down when the southern half of New Jersey was inundated by the sea. This formation includes sand, silt, clay and gravel. It is extremely porous and not at all fertile. A geological profile of the Outer Coastal Plain would show that it is a wedge shaped formation which is very thin on the western side of the State and thickens to approximately six thousand feet (6,000') along the Atlantic coast.



The Inner Coastal Plain, on which Riverton is located, was created when the land was alternately inundated by the sea and then exposed to the air and dried and then inundated again and so on. The sea would recede periodically. When it did, earth from what was the newly formed Appalachian Mountains eroded. The eroded soil washed down hill with the rains and settled on the Inner Coastal Plain area. In time, the sea level rose again and the newly deposited mountain sediment was flooded with sea water and marine sediments, until the sea receded again and another period of continental erosion would occur, bringing a fresh layer of continental sediment to the region. In this way, multiple, alternating layers of continental and marine sediment were deposited to create the Inner Coastal Plain.

Like the sediments of the Outer Coastal Plain, the periods when marine sediments were deposited create fairly porous, unconsolidated layers of sand and silt. The continental deposits are harder and more consolidated. They form confining layers, so the geology of the Inner Coastal Plain is a series of alternating layers of confining layers and unconsolidated material.

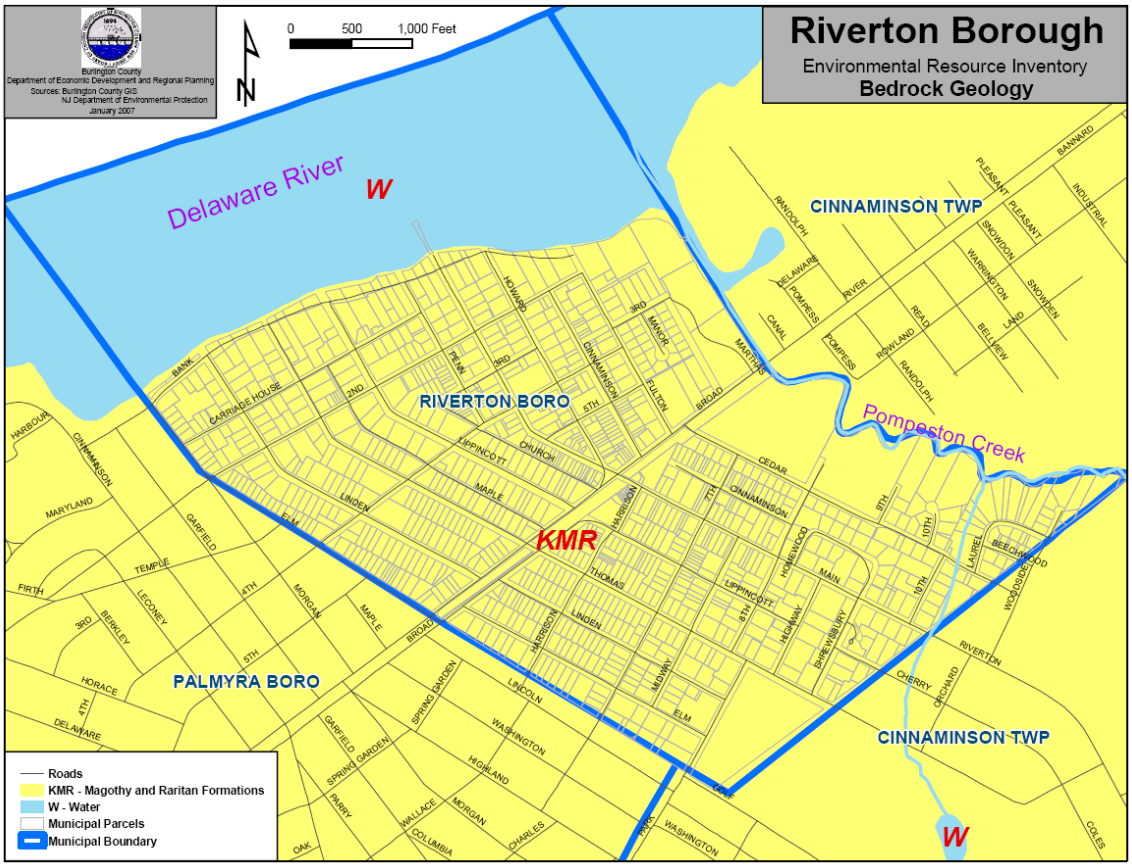
This series of alternating layers, something like a stack of pancakes, is tilted. It is exposed at the Delaware River and extends deep into the earth, underlying the wedge-shaped Outer Coastal Plain as it extends eastward.

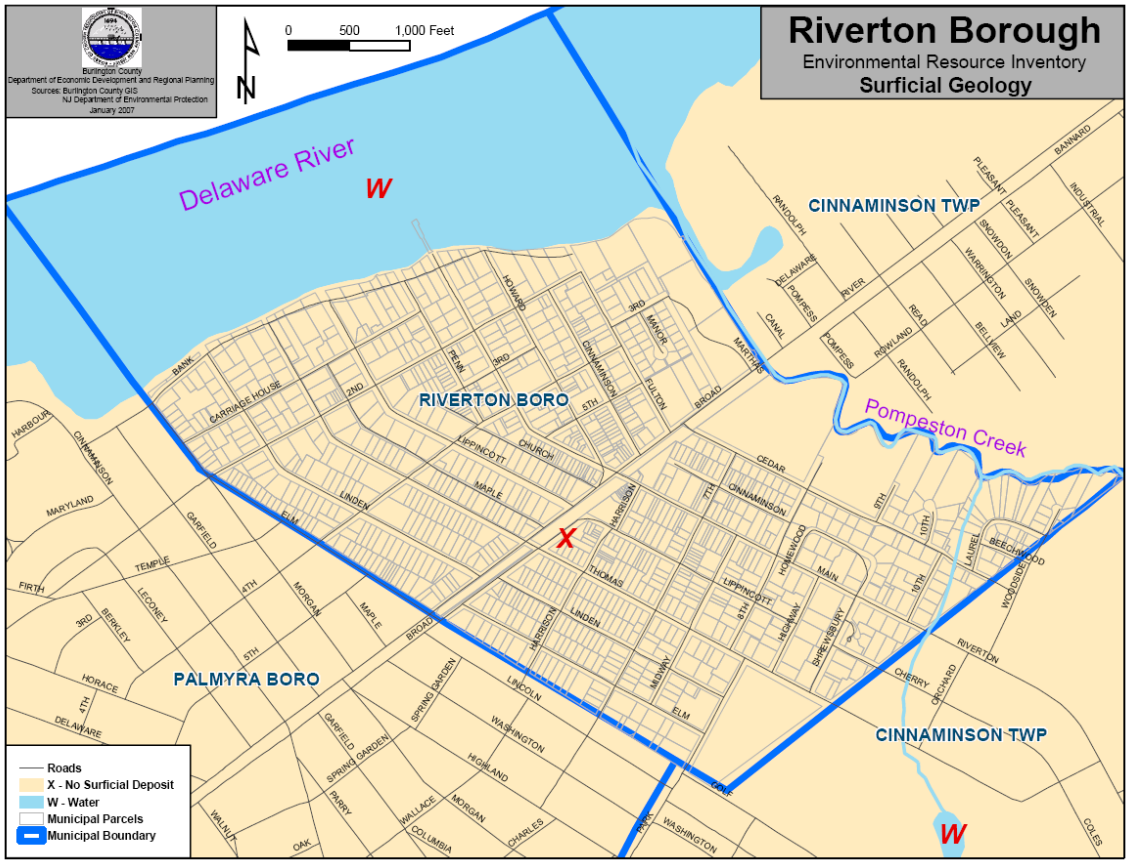


Cross section of Inner and Outer Coastal Plain Geological formations through Burlington County

Riverton's Inner Coastal Plain 'stack of pancakes' is a formation of *bedrock* geology with no overlying *surficial* geology. Surface geology is comprised of sediment that has been laid down by years of action from rivers, glaciers, wind and erosion. These deposits are typically less than five million years old and up to four hundred feet (400') thick. On the other hand, bedrock geology is much older. It includes both sedimentary rocks and metamorphic rocks. Sedimentary rocks were deposited by ancient rivers and marine deposits and they have been compacted and cemented over time. The metamorphic rocks were formed by intense heat and pressure of the earth which folded all kinds of rocks – sedimentary, igneous and even other metamorphic layers – into bedrock formations. Bedrock formations can be millions or billions of years old and they extend deep into the Earth's crust.

The Inner Coastal Plain is a bedrock geological formation which is exposed at the surface. Because the geological 'stack of pancakes' is tilted, the alternating layers of confining and more porous formations that make up the Inner Coastal Plain are exposed. This has significant planning implications because the unconsolidated layers hold the underlying aquifer, or groundwater resources. The exposure of these layers at the surface means that the groundwater can be replenished and/or contaminated, depending on how people treat the environment.





There were two notable incidents of groundwater contamination in and around Riverton. The first stems from a local business, Erin Cleaners, on the corner of Broad and Fulton Streets. The cleaners has operated at the site since 1949 and disposed of filter material at the rear of the property. That material contained tetrachloroethylene also known as perchloroethlene (PCE). An April, 2004 assessment from NJDEP, Bureau of Environmental Measurements and Site Assessment notes that this contaminant was first identified in January of 1988 as a pollutant of New Jersey American Water Company Wells 13 and 27. The original concentrate of the contaminants found was significant; 13 times the permissible Impact to Ground Water Soil Cleanup Criteria and 230 times the Ground Water Quality Standard criteria. By 2000, the concentration of the contaminants had dropped significantly; from 240 parts per billion of PCE at Well 13 to 6 parts per billion, and from 88 parts per billion of PCE at Well 27 to 6.7 parts per billion at Well 27. The maximum permissible concentration of PCE is 1 part per billion. Presently, the contamination appears to be contained, but on-going monitoring of the groundwater is still warranted.

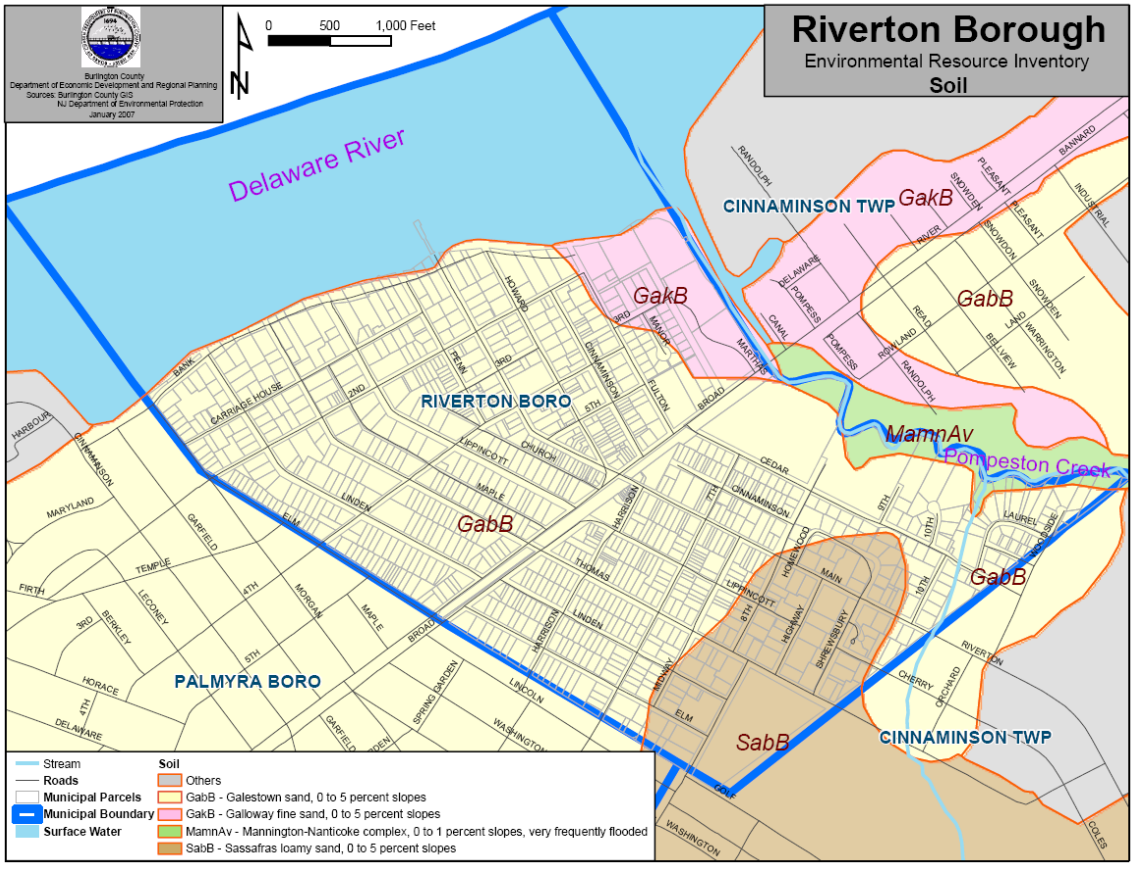
The other groundwater incident of note originates in Cinnaminson. The Cinnaminson Landfill has been identified as the source of the pollutants that have cause the New Jersey American Water Company to take Wells 14 and 26 off line. The contamination spread in a plume in the groundwater that runs from the landfill, down gradient and through Riverton. Remediation and monitoring is on-going.

In both these incidents, the ability of the contaminants to pass through the soil and reach the groundwater is a function the close proximity of bedrock geology to the surface and local soil types. To better understand the impact of development on Riverton's geology and the underlying aquifer, it helpful to understand the soils that lie overtop of the geology. The topography, or slope of the soil, plays an important role in directing stormwater runoff to some areas and away from others. Under the best circumstances, clean stormwater would be directed to areas where it can filter back into the aquifer through the soil.

LAND RESOURCES

B. Soils

Soils are a product of the weathering of geologic material, commonly referred to as the parent material. There are four (4) different types of soils in Riverton. They include Galestown sand (GabB), Galloway fine sand (GakB), Mannington-Nanticoke complex (MamnAv) and Sassafras loamy sand (SabB). Most of the Town is covered with Galestown sand. Its parent material, that is the geological formation from which the soil was created, is a combination of sandy marine deposits and sandy wind-blown (or eolian) deposits. It is very permeable and drains very easily. Water moves through this soil fairly rapidly. The seasonal high water table, that is the depth to which the groundwater rises to its highest point during the rainy season, is usually greater than sixty inches (60”). Without a lot of water in the soil, and with a high sand content, there isn’t much potential for a lot of shrinking and swelling of the soil due to a freeze-thaw action in the winter. Organic content in the surface layer of this soil is about one percent (1%). Organic material tends to hold water, which results in a shrink/swell effect in the winter, but with very little organic material in Riverton’s soils, this is not a serious issue in this area.



The southeast corner of the town is comprised of Sassafras loamy sand. Its parent material is loamy and/or gravelly marine deposits. Its permeability (the rate at which water passes through the soil) is relatively rapid, though a little less than Galestown soils because the Sassafras soils have more clay. Clay particles are very fine and tend to inhibit water movement. The clay content makes the Sassafras soils a little less well drained than the Galestown soils, however, it's all relative and the permeability is still fairly quick. The shrink-swell potential of this soil is still very low even though the organic content is a little higher, about two percent (2%).

Across town, where the Pompeston Creek meets the Delaware, there's a pocket of Galloway fine sand. This soil comes from unconsolidated marine deposits. It has a high permeability rate, similar to Galestown soils, but the seasonal high water table is generally closer to the surface, approximately twenty-one inches (21") down into the soil. It's still very sandy, with only about two percent (2%) organic content, so the shrink-swell factor is minimal.

The last soil mapping unit in Riverton is Mannington-Nanticoke complex and it extends along the edge of the Pompeston Creek, east of Broad Street. It's a combination of Mannington soils and Nanticoke soils. Both have silty estuarine deposits as their parent material, but Mannington soils come from marine deposits that were on top of organic, herbaceous materials. The soil complex includes mucky silt loams and peat, which are extremely fine and full of organic material. Permeability is moderately slow and the seasonal high water table is at the surface. This area is prone to frequent flooding and ponding. The organic content is fifteen percent (15%) and it is the only soil type in Riverton that is considered hydric; in other words, the soil meets the criteria for a wetlands soil. A wetlands soil is one that is so continuously saturated with water that air cannot aerate the soil. Lacking air, the soil becomes *anaerobic* (to be in a state that lacks air), rather than *aerobic* (to be in a state that includes air).

Typical clayey soils along the banks of the Pompeston Creek.

Different types of soil have different soil structures and different properties that make them good for some uses and bad for others. All of Riverton's soil types are fairly similar. They are all sandy, well drained and fairly stable. Except for the Mannington-Nanticoke complex, they are low in organic content and the seasonal high water table is deep below the surface of the ground. The Mannington-Nanticoke soils erode more easily from wind action because the silty particles of the soil are finer than the sandy particles of the other three soil types. Finer soil particles will blow away more easily.

On the other hand, erosion due to stormwater runoff is slightly higher in the Galestown, Sassafras and Galloway soils than it is in the Mannington-Nanticoke complex. The sandier soils are drier because they're more well drained. This is something to consider since man-made circumstances can increase the runoff and therefore erode the soil.

All in all, the four soil types are not substantially different from each other. They all tend to drain water better than they hold it, so they have limited natural capabilities for things like ponds, embankments and reservoirs. Because they drain so easily, they have limited use when it comes to sustaining the construction of landfills and anything that requires shallow excavations. Pollutants from landfills would filter easily through the soil and eventually contaminate the groundwater. Shallow excavation projects are susceptible to saturation, since water moves so easily through these soils and a phenomenon known as 'cutbanks cave' might occur. Cutbanks caving describes a tendency in the soil for the walls of excavated construction to cave in easily or slough off in sheets or blocks of soil; again, something to consider carefully when undertaking excavation in Riverton.

Somewhat surprisingly, the Natural Resource Conservation Service of the United States Department of Agricultural classifies Riverton soils as being very limited in terms of their ability to sustain paths, trails, golf fairways, camp areas, picnic areas and playgrounds. The classification is based on a couple of general observations. For instance, the Mannington-Nanticoke soils are so close to the Pompeston Creek, they're saturated and they tend to flood, which is not good for paths, etc. The other soils are considered 'very limited' for paths and trails because they are too sandy, and therefore easily eroded. Of course, engineering can overcome many natural obstacles and the historic success of Riverton at maintaining recreation facilities throughout the Borough demonstrates our ability to overcome the limitations of the underlying soils. Nonetheless, it's important to be aware of these limitations whenever considering new development.

With the exception of the Mannington-Nanticoke soils, Riverton soil is classified as not limited at all for dwelling and commercial buildings with or without basements. Reinforced concrete spread footings on undisturbed subgrade allow the soils to sustain buildings. The fact that water drains through the soils easily and freeze-thaw action is minimal makes the soil very stable for construction.

Different soils also sustain different types of vegetation. In New Jersey, the 'Garden State,' soils of the greatest importance for farming are classified as 'Prime Farmland.' They tend to be the most productive. Another farming classification is 'Unique Farmland' soils. These soils have a special quality to them; for instance, unique farmland soils in California have created vineyards that are particularly good for wine because the soils, combined with the microclimate of the Napa Valley, make wine development easier. In Riverton, the Mannington-Nanticoke soils have no significance in terms of their farmland productivity, and the other local soils are marginally significant.

The Galestown soils, which cover most of the Town, are classified as 'Farmland of Unique Importance' though the USDA does not specifically identify the reason for the classification. Riverton's history as a rich farming area before it was developed, and its easy access to the river and markets in Philadelphia, probably contribute to the designation.

The other soils, Galloway and Sassafras are classified as 'Farmland of Statewide Importance,' which means there's nothing prime or unique about them, but farming can be economical and crop yields can be high. Again, this reflects Riverton's long lost farming traditions.

Since the Town is fully developed, most of the trees in town are purposefully managed. Nonetheless, if Nature had its way, the soils would sustain the following 'forestland productivity':

Soil Type	**Common Trees**
Galestown	Black Oak, Shortleaf Pine, Virginia Pine
Sassafras	Black Oak, Northern Red Oak, Scarlet Oak, White Oak, Yellow Poplar
Galloway	Loblolly Pine, Sweetgum, Virginia Pine, White Oak
Mannington-Nanticoke	None

No inventory of Riverton's soils would be complete without a discussion of the Town's past history with a bit of soil contamination. There have been a couple noteworthy incidents. These are distinct from the local aquifer contamination previously mentioned.

Two houses on the east side of Tenth Street were contaminated by coal tar leachate from an old fuel provider, Riverton Coal Gas. Public Service Electric and Gas, the subsequent owner of the site, demolished the homes, excavated the contaminated soil, remediated the remaining soil and built new homes on the two affected lots. The process was conducted in accordance with NJDEP regulations.

Another incident in Riverton occurred in the early 1900's. It began at the Dreer Nursery, which once occupied 300 acres in and around Riverton. The operation was centered where National Casein is located today, on Broad Street. Exotic plants from around the world were shipped up the Delaware River to the Dreer Nursery dock on the Pompeston Creek. In August of 1916 an unidentified beetle was discovered in the nursery's fields about a half mile east of Riverton. It wasn't until 1917 that the beetle was identified as one of Japanese origin. We now refer to this beetle as simply the Japanese beetle. It is believed that the beetle arrived at the nursery in a grub stage in a shipment of iris bulbs in 1911 or 1912. Once identified, efforts to contain its spread began.

The beetle population spread from a small area in the Dreer Nursery in 1917 to over 500 square miles by 1924. By 1938, the entire State of New Jersey and parts of surrounding states were infested. During that time multiple insecticides were used by Federal and State authorities in attempts to eradicate, and later contain the beetle. Each year, the area over which the chemicals were applied became larger as the beetle population spread. The chemicals included powdered arsenate of lead, cyanide, lime-sulphur, carbon bisulphide, and paradichlorobenzene. Some of these chemicals were applied to the soil to attack the grubs. Others were dusted on foliage to combat the adult beetles, but to no avail. When the beetle infestation spread beyond the state line, the government ultimately abandoned its efforts. It is likely that some of the applied chemicals still exist in the soil today.

LAND RESOURCES

C. Topography and Slopes

Local geology establishes the foundation for the area. Soils are created over time from the weathering of the geology. Over the ages rivers scour the land and the ground shifts imperceptibly, but it all works to shape of the land and create topography.

To some, Riverton may seem fairly flat. There are no pronounced hills or valleys that punctuate the landscape. Sometimes it's difficult to see passed development that has been built and visualize just the shape of the land, but if we could strip away all the buildings and roads for just a moment, it would become obvious that part of Riverton is not as flat as it might first appear.

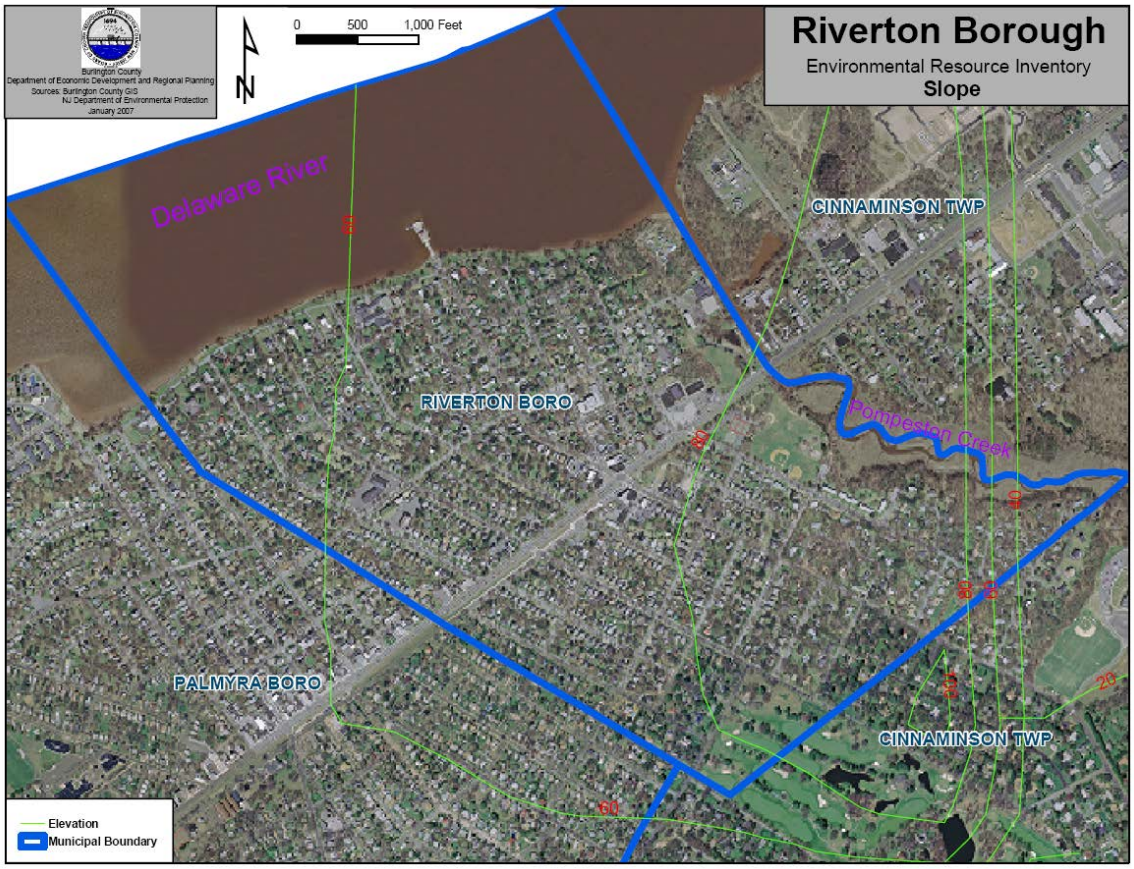
The southeastern half of Riverton includes a ridge that's approximately forty feet (40') high. The eastern half of the ridge flows into the Pompeston Creek and the western side flows directly to the Delaware River. At the eastern base of this minor ridge is a low point somewhere in the area between what is now Tenth Street and the Cinnaminson Township line. Beyond this low point to the east, the land rises again to another high point in Cinnaminson near the high school. Admittedly, the relief of the land is so slight, one hesitates to call this low point a valley, though it behaves like a small valley, collecting stormwater runoff and directing it northward to the Pompeston Creek.

The other side of town, north of Broad Street is virtually flat. There is a slight and fairly uniform down slope of the land to the west as the topography follows the gradient of the Delaware River corridor. Looking beyond Riverton's borders it quickly becomes obvious that this flat range in Riverton also exists in other towns. Broad Street is the modern day demarcation between the flat land along the river's edge and the hillier land that's farther from the Delaware. But in topographic terms this flat area is the functional floodplain of the Delaware River.

It's not a floodplain as defined by New Jersey Department of Environmental Protection – an area prone to flooding and on which building should not occur. But rather it is a floodplain in the sense that almost all rivers have an associated floodplain. In physiography, the study of land forms, all rivers carve out a channel in which the water flows. The height of the water within that channel changes over time with changes in weather and sometimes longer changes in climate. During periods of high water volume and deep water flows, river water can overtop the banks of the river channel and flood the land on one or both sides. The depth of the overtopping waterflow is not as great as the depth of water in the channel, but if it lasts long enough, or occurs frequently enough, the overtopping flows can erode the land beside the channel and flatten it out. This flattened area becomes the physiographic floodplain, the *plain* into which the river *floods* when the weather or climate increases the water volume in the river.

Clearly history created a floodplain for the Delaware River. There were times when the Delaware overtopped its banks and flooded the land currently located between the riverbank and Broad Street. Broad Street was probably constructed after the earliest settlers in the area had developed a path along the edge of the floodplain. They would have wanted to avoid a potential flooding of the river as much as possible.

Modern bulkheading of the river contains the flow of water now, but in the larger scheme of time, the flatter side of Riverton served a very important role in the life of the Delaware River.



WATER RESOURCES

A. Aquifer and Groundwater

Groundwater and aquifers are related but different. Groundwater is the water within the ground that saturates the tiny spaces between particles of soil or cracks and crevices of rock. (Groundwater: A Hidden Resource) It's already been explained that the seasonal high water table is the highest point in the soil to which groundwater will rise seasonally. The water table in general (not the *seasonal high* water table, but just the plain water table) is the highest point in the soil at which the soil *is always and completely saturated.* It's not seasonal. It does not change. The soil is always saturated with water at and below the water table. Above the water table, soil is either unsaturated or saturated depending on the seasons.

When the groundwater rises to its seasonal high levels it is still considered groundwater. Moreover, there is a type of groundwater called *capillary water*. This is water that moves upward through the soil, traveling from wet soil particles to dry ones, getting drawn up into the unsaturated zone of soil. Capillary water often feeds the roots of plants, along with surface water that percolates down through the soil.

Aquifers are the places in which groundwater resides and from which many people draw their drinking water. Private wells may tap into aquifers or water companies may tap into aquifers to supply water to entire communities. But to be clear, the aquifer is the structure and the groundwater is the resource in, around and above the aquifer.

Generally speaking, there are two types of aquifers – confined and unconfined aquifers. Confined aquifers are places where groundwater has collected in fairly rigid and impermeable pockets of hard rock. Sometimes they are formed between layers of impermeable clay formations. These aquifers are usually very old, millions of years. They are sometimes called artesian aquifers.

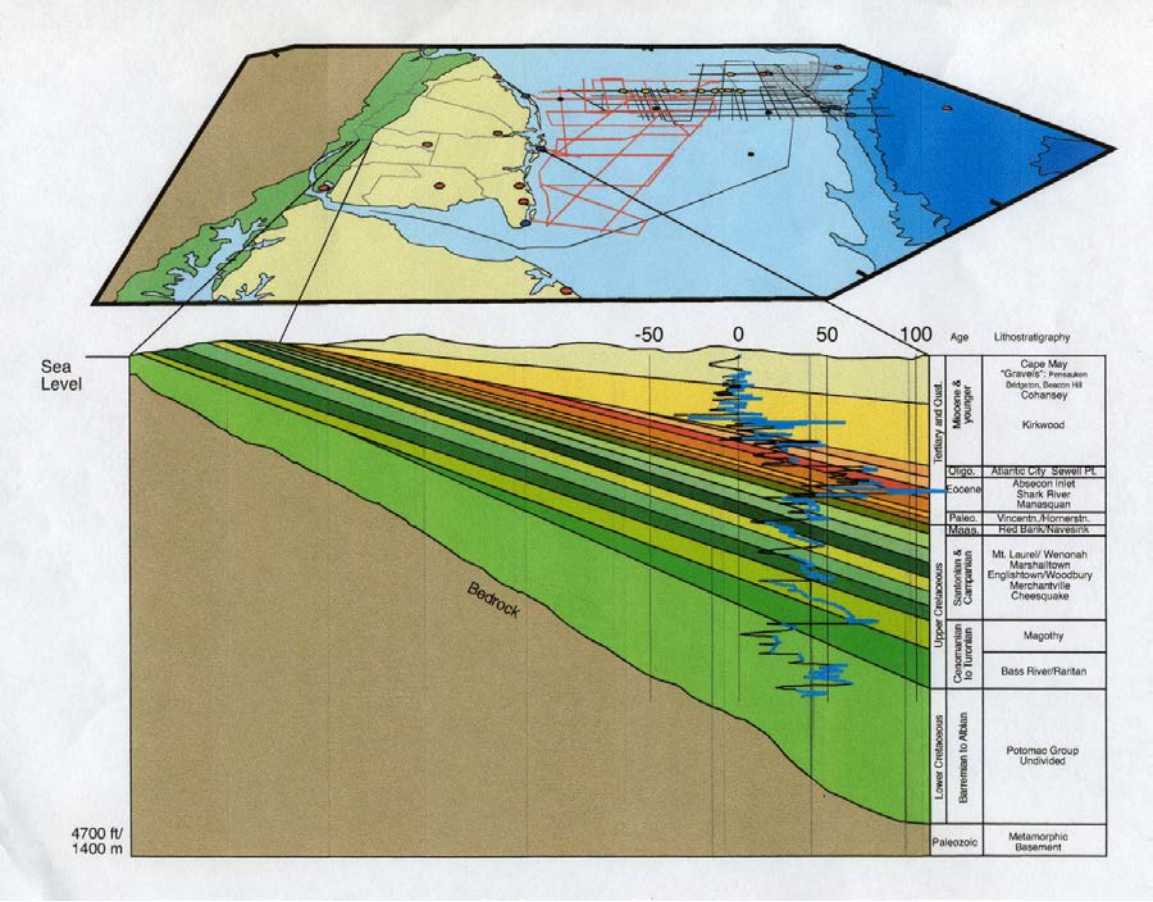
Unconfined aquifers are pockets of unconsolidated geological material that is very porous. They have lots of spaces between the particles of sand, gravel or silt that make up the bedrock geology. Because of the spaces in the material, this unconsolidated material can hold a lot of water. Because the water is not contained in a definable pocket, these areas are called unconfined aquifers. Usually the groundwater that exists in these aquifers has percolated through the soil above and collected in the aquifer below – this process is called *groundwater recharge.* Groundwater can also migrate from below, through cracks in the underlying geology and settle in unconfined aquifers.

Riverton, we've already noted, is underlain by alternating layers of porous marine deposits and denser layers of more confining continental sediment. The porous layers under Riverton, and most of southern New Jersey, create one of the State's most important aquifers, the PRM or Potomac-Raritan-Magothy Aquifer. The porous layers are sandwiched between non-porous clay layers. Because they are confined by non-porous layers, the US Geological Service considers the PRM a confined aquifer.

The PRM is part of the Inner Coastal Plain; that tilted geological formation discussed in the previous section. The formation is exposed on the western side of the State at the Delaware River and dips down below the Outer Coastal Plain formation in an easterly direction. Water recharges back into the aquifer in those areas where the aquifer is exposed, as it is in Riverton.

The PRM formation is up to 4,100 feet thick in some places. It is one of five principle aquifers in the Coastal Plain, and by far the largest of the five. By way of illustration, the rate of aquifer withdrawals from the other four aquifers in 1980 ranged from five million gallons (5 Mgal/d) per day to seventy million gallons per day (70 Mgal/d) in 1980. But the PRM was pumping 243 million gallons per day. It's a big aquifer.

Aquifer	**Aquifer withdrawals in 1980 (Mgal.day)**
Kirkwood-Cohansey Aquifer	70
Atlantic City 800-foot Sand Aquifer	20
Wenonah-Mount Laurel Aquifer	5
Englishtown Aquifer	12
Potomac-Raritan-Magothy Aquifer	243



Potomac-Raritan-Magothy aquifer make up the lowest three layers of the Coastal Plain geological formation.

The PRM makes up the lower reaches of the tilted 'stack of pancakes' that define the Inner Coastal Plain. It is divided into the Upper, Middle and Lower aquifers. But the confining layers that help define the three parts of the PRM are incomplete in some places and fractured in others. This makes it possible for water from one pocket of unconsolidated material to pass through confining layers to other pockets of unconsolidated material. In this way the three parts of the PRM are interconnected.

When wells draw water from an aquifer, such as the PRM, they temporarily lower the groundwater level around the well while the water is being drawn. If the wells are shut off, groundwater levels eventually return to their normal position. In southern New Jersey, so much development has occurred, and so many wells, both public and private, have been constructed, piercing into the PRM Aquifer, that the groundwater levels of the aquifer have dropped dramatically and cannot return to their original levels. In areas of very high concentrations of wells, the constant pumping for water usage has created a significant *'cone of depression.'* A cone of depression is an area around a well or group of wells where the groundwater levels have dropped. In the case of the PRM, they dropped so low that groundwater flows have reversed direction.

Reversed groundwater flows can be described this way. Normally the PRM should feed the Delaware River; that is, groundwater from the PRM should flow steadily into the Delaware where the PRM outcrops the earth's surface as it does in Riverton. But, by the 1980's the groundwater levels had dropped so low, and the cone of depression was so great, that the groundwater flow reversed and water from the Delaware River began to recharge into the aquifer. This could have serious consequences because the Delaware is fed by runoff water which is not pristine and contaminants can flow into the aquifer from the river. On the east side of the Coastal Plain, the upper aquifers are similarly in danger of sustaining saltwater intrusion from ocean waters because the cone of depression is drawing salt water from the ocean into the aquifer.

In 1993 the New Jersey Department of Environmental Protection designated a substantial part of the Coastal Plain to be "Water Supply Critical Area #2." ("Water Supply Critical Area #1" which spans Middlesex, Monmouth and Ocean Counties had already been designated in 1986.) In this Critical Area, NJDEP mandated that water usage of the PRM aquifer had to be reduced.

On a local level, some towns changed their zoning to curtail development. Some industries began to reduce water usage, and the New Jersey American Water Company developed a pipeline to deliver treated Delaware River water as an alternative water supply source. By 1997 usage withdrawals from the PRM had dropped to 125 million gallons per day, down from 1980 levels of 243 million gallons per day.

Nonetheless, the PRM remains a fragile groundwater resource. In Riverton, where the aquifer outcrops at the Delaware, land use decision can either positively or negatively affect the quality and quantity of the water within the aquifer. This is why the management of surface water as the aquifer's source of recharge is important.

WATER RESOURCES

B. Surface Water

Surface water resources include ponds and lakes, rivers and streams, all the water bodies that people can see on the surface of the ground, compared to groundwater resources which people can't see below ground. The principle surface water bodies in Riverton are the Pompeston Creek and the Delaware River.

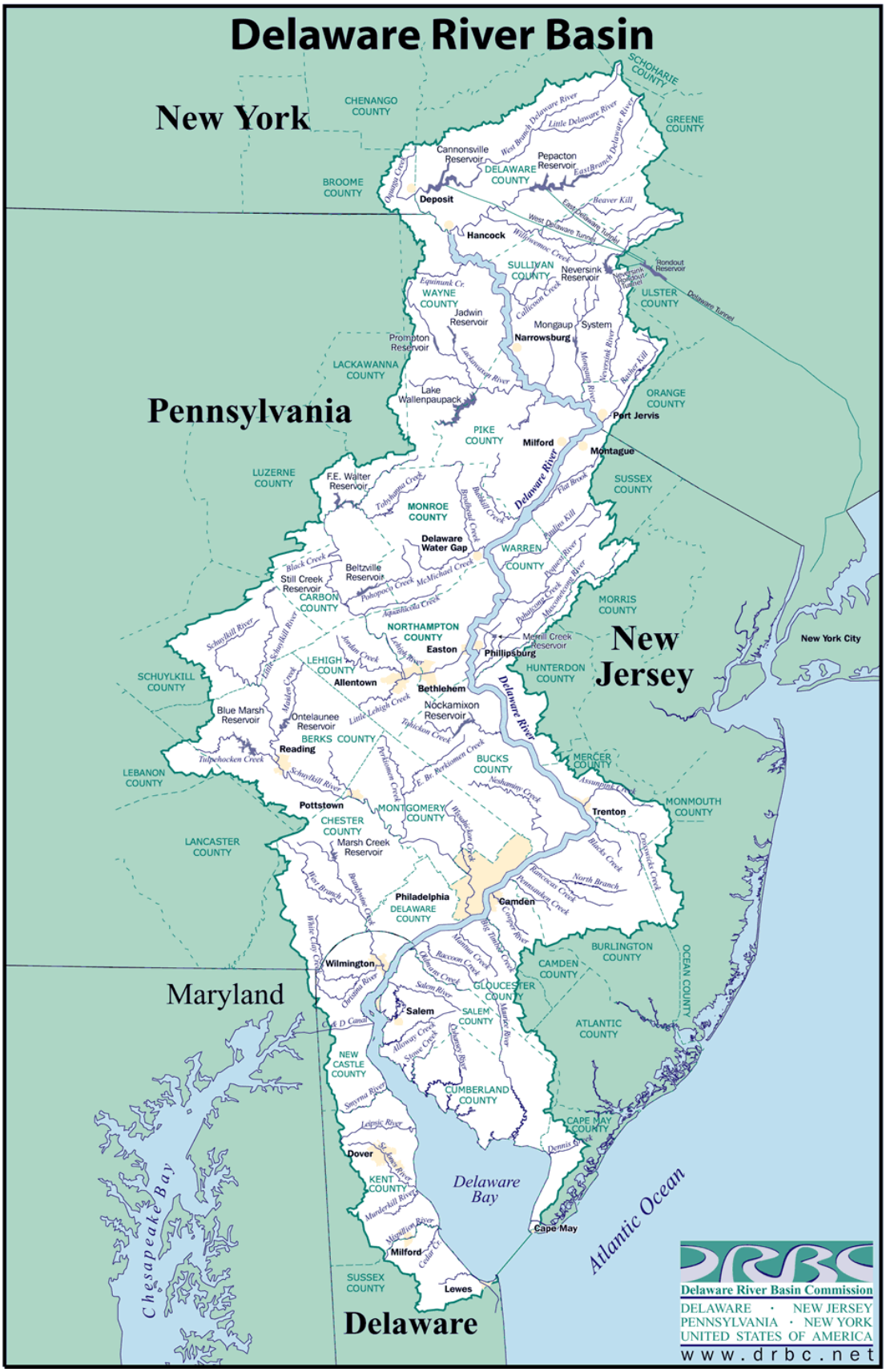
Delaware River Watershed.
From the Delaware River Basin Commission Watershed Association

The Borough is situated within the Delaware River Watershed. A *watershed* is an area of land that drains to a river or stream. Within a watershed, there may be many *subwatersheds*, smaller areas of land that flow into creeks, which in turn flow into larger streams and rivers.

Most of Riverton flows directly into the Delaware River. However, the eastern corner of the Borough lies within the subwatershed of the Pompeston Creek. The large size of the Delaware River relative to the smaller size of the Pompeston Creek creates some interesting variations in the Borough's two surface water resources.

<u>The Delaware River</u>

The Delaware River watershed extends into New York, New Jersey, Pennsylvania and Delaware, covering 13,539 square miles. The spine of the watershed, the River itself, is 330 miles long. It is the longest un-dammed river east of the Mississippi. Approximately 15 million people rely on the Delaware for drinking water and that includes people outside the watershed in northern New Jersey and the City of New York.

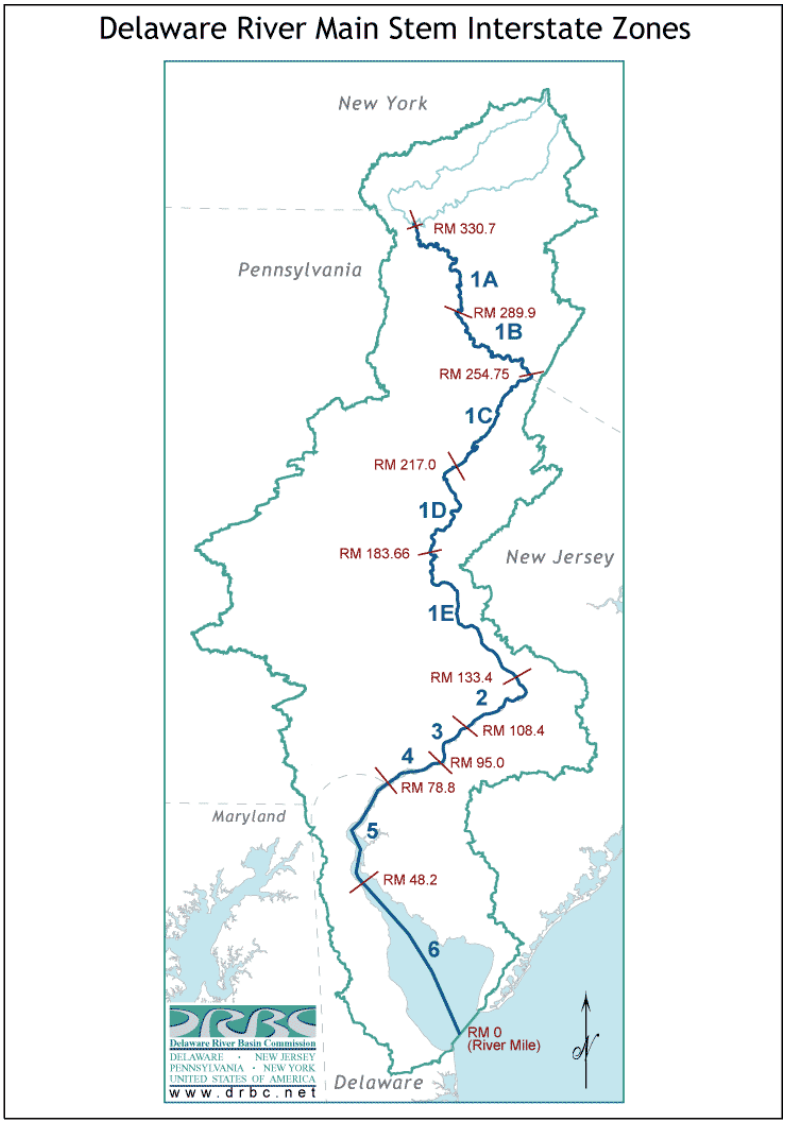


Map of the counties and states within the Delaware River Watershed.
Delaware River Basin Commission

Before 1961 there were forty-three (43) state agencies, fourteen (14) interstate agencies and nineteen (19) federal agencies that had regulatory jurisdiction and responsibilities with the watershed. In 1961, President Kennedy and the governors of New York, New Jersey, Pennsylvania and Delaware signed concurrent compact legislation, creating a regional authority to oversee regulation of the watershed. That legislation created the Delaware River Basin Commission (DRBC). Its members include the four governors of the States and a federal representative appointed by the President of the United States. (DRBC; http://www.state.nj.us/drbc/over.htm)

The Commission is responsible for regulating water quality, water supply, development permitting that affects the water resource, water conservation, drought management, flood control and recreation.

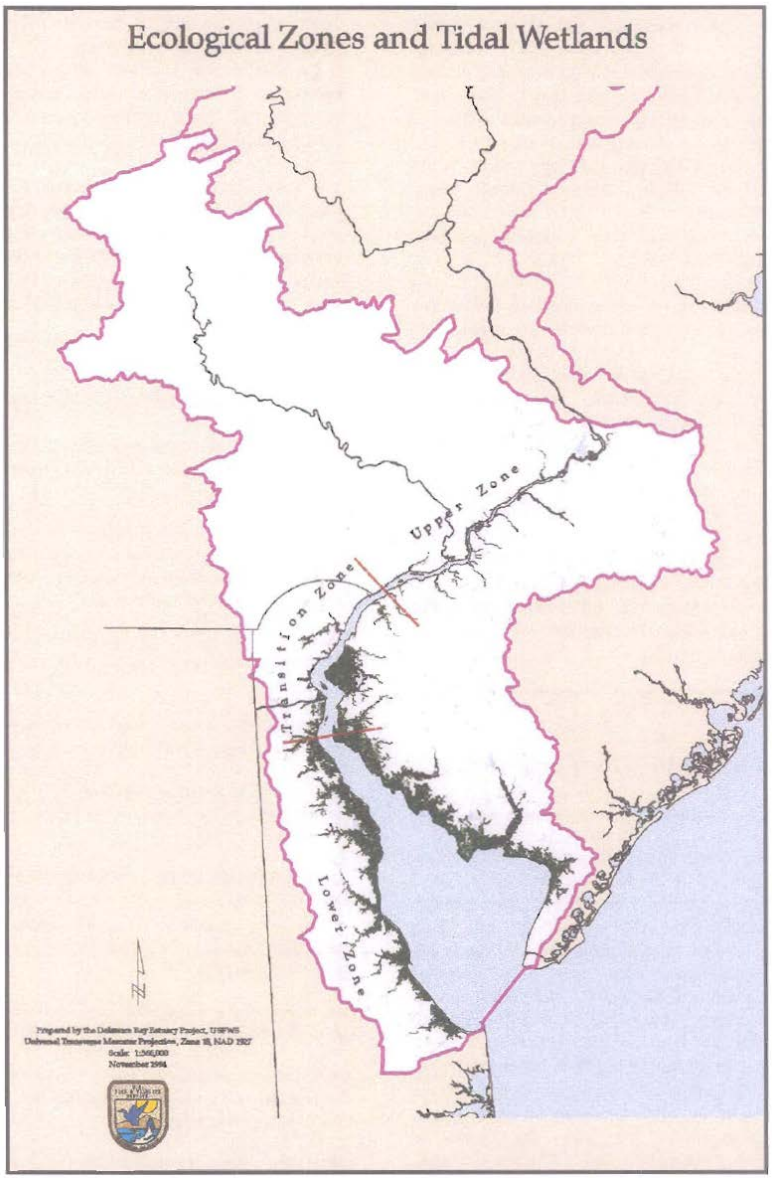
The river can be divided into a number of sections based on different characteristics. Probably the most prominent characteristic is the tidal behavior of the lower reaches of the river. The river is non-tidal upstream of the falls at Trenton. Below the falls, the river is tidal.



Delaware River Main Stem Interstate Zones.

Zones 1A - 1E represent the non-tidal portion of the river, and zones 2 - 6 represent the tidal, or estuarine, portions of the river. (DRBC)

Riverton is located within the tidal region which is further divided into three zones, based on variations in the river water's salinity, turbidity and biological productivity. These zones are called the Upper Zone, the Transitional Zone and the Lower Zone. (Sutton. The Delaware Estuary Program.) Riverton is in the Upper Zone of the tidal portion of the Delaware River.



The Upper Zone is 53 miles long from the Trenton Falls to the Pennsylvania/Delaware state line. Though tidal, it is still considered freshwater, with a salinity factor of less than 0.3 parts per thousand. Turbidity is low at the higher reaches, becoming moderate closer to Philadelphia.

The Transition Zone is 26 miles long and has moderate salinity and high turbidity. The Lower Zone, nearest to the ocean, includes the Delaware Bay. It has the highest salinity of the three zones, but relatively low turbidity.

These three zones make up the Delaware Estuary. An *estuary* is an area, partially surrounded by land, where a river meets the sea. (Partnership for the Delaware Estuary, Inc.) It's a place where the freshwater from upland areas meets salt water from the ocean and the waters begin to mix. The Delaware Estuary has been recognized as one of the largest freshwater tidal estuaries in world. The freshwater part of the estuary is the part that graces Riverton's shores.

Fifty-eight percent (58%) of the freshwater that flows in the estuary comes from the Delaware River. Rain, stormwater runoff and snow melt contribute the rest. The Delaware River Basin receives an average of forty-five inches (45") of rainfall a year. This equates to 10 trillion gallons of water in the Delaware watershed. Though the water is not salty, it is still tidal because water from the ocean and the lower zones of the estuary fill up the river valley as the tide rises in the ocean. Subsequently, water in the

Riverton area 'backs up' in the river channel so the freshwater that would normally flow downstream cannot drain from the area as it would otherwise during low tide. The salty parts of the estuary do not reach or mix with the freshwater parts in the Upper Zone near Riverton.

The Delaware Estuary was formed after the last glacial age melted, flooding the Earth's oceans and raising the sea levels. The rising sea drowned the river valley. Sediments from the Appalachian Mountains, which were much taller and steeper, continued to erode and wash sediments onto the Coastal Plain and the continental shelf. The Delaware River was forced to cut a new path for itself through the deposited sediments, and that's how the Delaware Estuary was created about 100,000 years ago.

Depending on storm events and seasonal changes, the average tide rises and falls about four feet (4') in the bay, six feet (6') near Philadelphia and Riverton and almost seven feet (7') by the Trenton Falls. The tide difference gets higher upstream because the river channel gets increasingly narrow. A narrower streambed means a larger volume of water has to increase in depth. A wide open bay will rise less, since the additional tidal volume can be spread over so much more area.

When stormwater flows increase the volume of freshwater flowing into the river, the limits of the estuary's salinity are pushed downstream. Conversely, during times of drought, the salinity limits reach further upstream, though, Riverton is far enough upstream in the Upper Zone that increases in salinity in this area are very rare.

Many people and industries use the water in the Delaware River. Significant amounts of freshwater are taken out of the Delaware each year. Seventy-seven percent (77%) of the water usage is used for cooling operations in power generation stations. Another twenty-two percent (22%) goes to domestic and industrial water consumption. Extracting freshwater from the Delaware can increase its salinity.

Water Use in the Estuary

The top five water using industries in the Delaware Estuary are Public Service Electric and Gas (PSE&G) in Salem, the PSE&G Mercer Generating Station, PECO Eddystone, Star Enterprises and Delmarva Power and Light. There are thirteen electric generating stations in the estuary, owned by five utilities and in 1990 they accounted for 80.1% of the water withdrawals or 1,653,085,000,000 gallons per year. At the same time, municipalities used about 4.5% or 93,075,000,000 gallons per year.

(Delaware River Basin Commission records for areas below Trenton.)

In the 1980's and 1990's regulations changed substantially and significant improvements were made to treatment plants up and down the Delaware. Water quality in the Delaware improved between 1977 and 1991. Phosphorus, nitrogen compounds and dissolved oxygen levels dropped. These pollutants tend to contribute to high levels of bacteria in the water, so lower levels of these elements translate to better water quality and improved biological health.

The Delaware River Basin Commission assesses segments of the Delaware in terms of their fishability and swimability. Ninety-nine percent (99%) of the estuary is swimmable and ninety-three percent (93%) is fishable. In 1990, water quality from Trenton to

northeast Philadelphia was considered by the DRBC to be “good to fair’ (Sutton) and the quality of the water continues to improve.

This doesn’t mean the river is pristine. Nutrient levels are still high, but the turbidity of the water reduces the amount of sunlight that shines through it. Bacterial growth is limited because bacteria can’t grow well without sunlight. The turbidity also causes the river water to look brown. The suspended sediment colors the water brown. Most of these sediments, sixty-eight percent (68%), come from rivers upstream. There are trace metals in the water, elements that are rarely found in nature. They come from human activity.

These metals, including iron, manganese, cobalt, nickel, copper, cadmium, mercury, lead, zinc and arsenic are found in both the suspended sediments in the water, as well as in the water itself as dissolved elements. The metals come from stormwater runoff, groundwater flows that have been polluted by stormwater runoff, wastewater effluent, non-point source pollution and precipitation, as pollution in the air gets washed into the river with rainstorms.

The Delaware Estuary’s wetlands and marsh areas help to filter out trace metal pollutants. However, along with DDT’s, PCB’s and chlorinated pesticides, these trace metals contaminate the sediment in the river. Dredged material from the river should always be analyzed and managed carefully.

Another unfortunate complication is that the trace metals affect wildlife habitat. Studies show that trace metals have been found in some fish, mussels and oysters. For fish caught in the Upper Estuary near Riverton, the New Jersey Department of Environmental Protection maintains a ‘fish consumption advisory.’ Currently, the advisory is as follows:

- Sharks — No more than 7 oz per week
- American eel — Do not eat
- White catfish — Do not eat
- Channel catfish — Do not eat
- Chain pickerel — One meal per week
- White perch — Do not eat
- Blue Fish (over 6 pounds) — One meal per week

Toxins have also shown up in the eggshells of some local raptors. The shells are consequentially thinner than they should be and this threatens to curtail the viability of such birds as the osprey, peregrine falcons and bald eagle.

The conclusions to be drawn from this is that, while gross organic pollution levels in the Delaware have improved, other toxins from human activities still need to be reduced. Simultaneously, wetlands and marshes are not limitless in their ability to protect us or the environmental. The toxins are already finding their way into the food chain and this trend needs to be reversed if the natural environment is to be preserved.

The Pompeston Creek

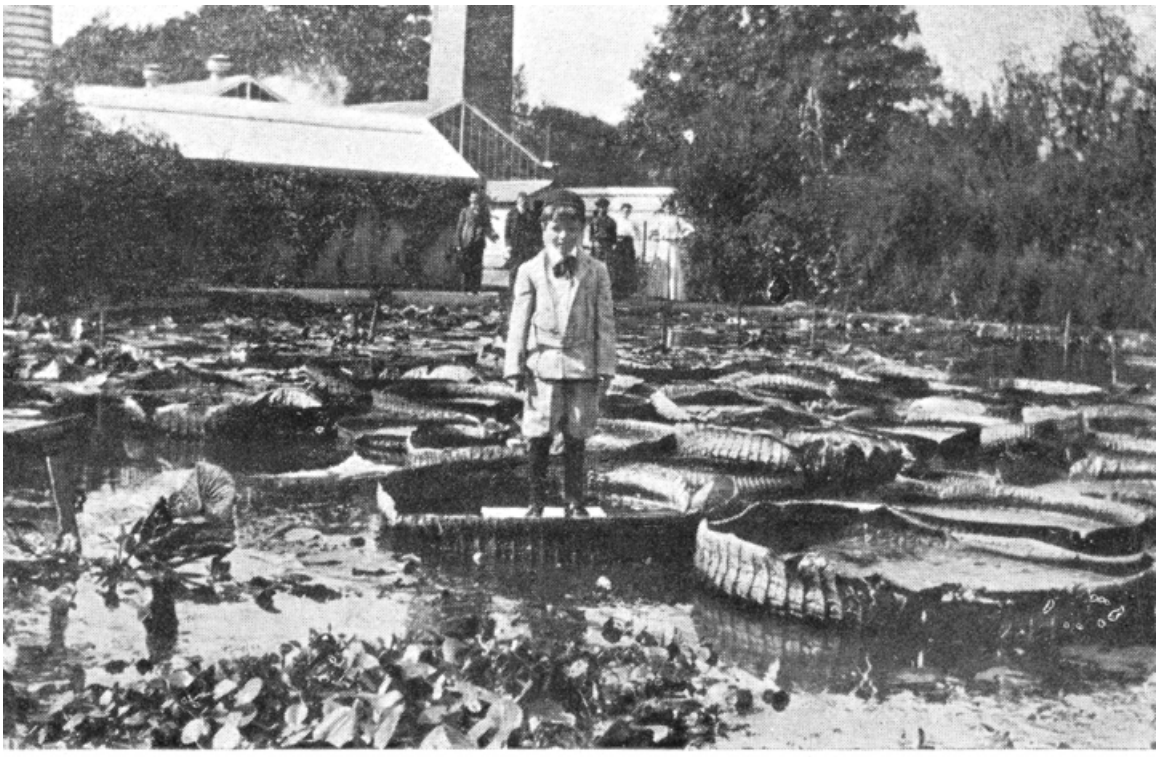
Within the 13,539 square mile watershed of the Delaware River, there are 216 subwatersheds. These are the drainage areas of the river's tributaries. One of the subwatersheds is the 11.33 square mile watershed of the Pompeston Creek. Beginning in nearby Moorestown, the creek flows northwest to the Delaware. The last three-quarters of a mile form the municipal boundary between Riverton and neighboring Cinnaminson Township.

In 2002, the Rutgers Cooperative Extension prepared a preliminary Environmental Resource Inventory of the Pompeston Creek through Riverton. (http://www.pompestoncreek.org/envstudybyrutgers.pdf) This was followed in 2004 by a more thorough inventory based on a Rutgers study and written by Riverton's Environmental Commission. (http://www.pompestoncreek.org/pcei/notes/pompeston_bklt_lo-res.pdf) Both studies focused on the lower end of Pompeston Creek, where the creek forms the northeastern border of the Borough.

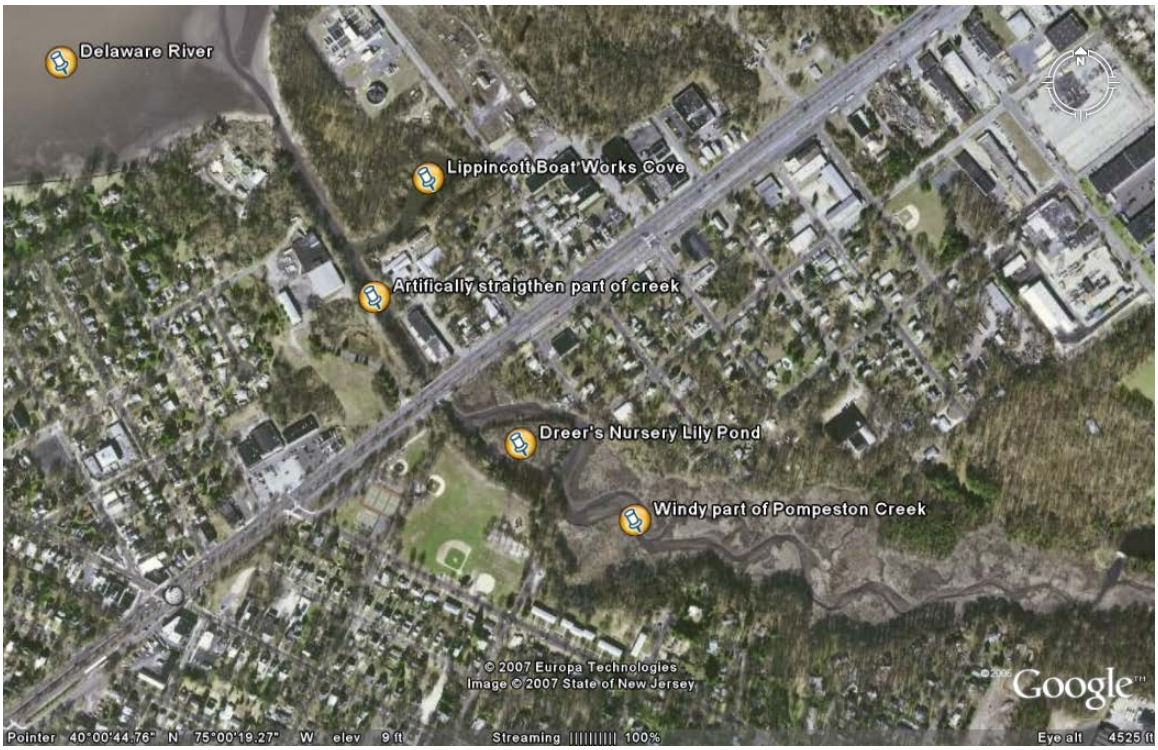
The Pompeston Creek Watershed includes part of Cinnaminson, Moorestown, Riverton, Delran and Palmyra. The studies noted that the watershed shows signs of environmental stress, due to increased development within it. More development leads to increase stormwater flows and a moderately small creek like the Pompeston is unable to withstand the increased volumes of stormwater. The banks of the creek are eroding in places and sedimentation is increasing. All of this puts a strain on the stream corridor, its native plants and animals.

Through Riverton, the creek is often considered in two parts, the part downstream of Broad Street, between Broad Street and the Delaware and the part upstream of Broad Street to the Borough's eastern corner. Understandably, the section of the creek that's closest to the Delaware is wider than the rest. It is sixty feet across where it meets the Delaware River. In this section there is a man-made cove on the Cinnaminson side, a remnant of the Lippincott Boat Works operation that once flourished there. The creek bed here is unnaturally straight because the former Dreer Nursery operation straightened the creek; probably to make it easier for delivery boats carrying imported plants to reach the company's pier on the Riverton side.

The creek is narrower in Riverton's upper section, but it is flanked by wide freshwater tidal marshlands covered with dense vegetation (Riverton Environmental Commission, Inventory.) An artificial lily pond is another remnant of the Dreer Nursery. It was created along the creek to house a stock of lily plants. Upstream of the lily pond the stream channel is windy, cutting a swath through the freshwater tidal marsh that forms lush habitat for a diverse collection of plants and animals. The edges of the marsh are delineated by steep banks that rise to the uplands on either side. The banks on the Riverton side are generally higher than those on the Cinnaminson side. In many places, the heavy stormwater flows continue to erode the streambanks dramatically.



VICTORIA TRICKERI " LILY POND, DREER'S NURSERIES, RIVERTON, N. J.
(The leaves of these lilies average 5 feet in diameter.)



Annotated Google Earth Image.

The upper portion of the stream was recently classified by the State of New Jersey as a Category One Stream. Category One streams are significant for one or more of the following reasons: they include threaten or endangered species, exceptional aquatic significance, exceptional fishery or water supply resources or trout producing capabilities. All Category One Streams and their immediate tributaries, like Jack's Run off the Pompeston Creek, are subject to a 300 foot protective buffer zone imposed by the State. Within that zone, nothing can be constructed without prior approval from the New Jersey Department of Environmental Protection.

There are a couple of ways to assess the health of the Pompeston. Before 2001, the water quality was assessed by New Jersey Department of Environmental Protection as 'moderately impaired' but that dropped to 'severely impaired in 2001, a finding that was reinforced by the 2002 Environmental Resource inventory study conducted by the Borough. (Pompeston Creek Environmental Inventory) These analyses were based on a finding that there are a limited number of macroinvertebrates living in the creek water. Macroinvertebrates are tiny, spineless organisms that can be seen with the naked eye. They are the bottom of the food chain. When their numbers show signs of stress, there's reason to be concerned that the ecosystem of the creek basin is threatened.

Some of the stress may be due to tidal action and the close proximity of this portion of the creek to the Delaware River. But, the toxins and trace metals in the larger Delaware River Watershed are also a source of concern. It is very probable that upstream development and contamination are contributing to the low number of marcoinvertebrates found in Riverton.

Even though the *water quality* is impaired, the *habitat quality* of the Pompeston Creek is quite rich. A stream with a healthy habitat is one that is very windy, includes areas of both swift moving water and quieter pools, a variety of vegetation, and places of both sun and shade. The more diverse a streambed is, the more viable habitat it holds for a broader range of plants and animals. The Pompeston Creek ecosystem is very diverse, particularly in the section between Broad Street and the Borough line. One factor that compromises the creek's habitat quality is the fair condition of its banks, which tend to erode easily. Of course, the Riverton soils are the types that erode easily, so, when faced with the pressures of increased stormwater volumes from more development, it's understandable that the banks of the creek will suffer. The erosion, in turn, leads to increased sedimentation, which affects the water quality. It's the water quality that reduces resident fish population. Habitat quality of the creek is good, so if the impaired water quality can be improved, fish populations might rebound.

There is little the Borough can do to change development patterns or trends in the upstream reaches of the Pompeston Watershed, but the last line of defense for the creek's viability is its associated wetlands and floodplains.

The Pompeston Creek wetlands

WATER RESOURCES

C. Wetlands and Floodplains

Wetlands and floodplains are areas of land that are often, but not always, wet. Floodplains are always associated with a body of surface water. A floodplain is the area which floods during a heavy rain, when a surface water body overtops its banks. If development encroaches so close to a stream that there is no open space into which the flood waters can flood, then property damage occurs. During a very large storm, floodwaters will rise and inundate whatever is in their way. Natural floodplains help to buffer development by holding the floodwaters within the plain until the storm passes.

If floodplains are the landform containers that hold floodwaters, then wetlands are the sponges that do the same thing. Wetlands are defined as areas where the seasonal high water table lies within eighteen inches (18") of the ground's surface. Some soils have the capacity to hold a lot of water. The plants within a wetland also have the capacity, and even the need, to utilize a lot of water. Wetlands are vegetated areas of wet soil that can store lots of water during a storm. When wetlands and floodplains are destroyed, or eliminated through development, these tools that nature has devised to help moderate the effects of large storms are lost. Without the moderation, the full impact of a large storm can bear down on the most vulnerable areas around streams and rivers. This concept clearly and unfortunately played out in New Orleans during the hurricanes of 2005.

Just to be clear, not all wetlands are associated directly with a stream. For instance, isolated soils may be saturated because the landform is bowl-shaped and the surface runoff in the 'bowl' collects in the lower elevations of the landform where the water saturates the soil. In such an instance, there may be no stream in the area, nonetheless an isolated wetland forms at the bottom of the 'bowl.' There are no isolated wetlands in Riverton. All of Riverton's wetlands are associated with the Pompeston Creek or a tributary that flows into creek called Jack's Run.

The Delaware River is bulkheaded along its banks in Riverton. Historically there may have been wetlands along the River's edge but they have been filled and the river's edge is upland now.

The Dreer Nursery operation changed the shape of the lower reaches of the Pompeston streambed so between

Broad Street and the Delaware, the wetlands along the creek are confined to a small band at the edge of the stream of this artificially straighten part of the creek. Between Broad Street and the Borough line, where the creek is very sinuous, the land on either side of the creek is completely saturated so in this area wide swaths of wetlands flank the Pompeston. Wetlands also cover the rear third of Memorial Park, where the old Dreer Nursery lily pond use to be. And they extend well into the site of the Cedar Lane Apartments on Cedar Street. Here the wetlands are confined by a steep slope that rises up to the apartment complex.

In addition to the wetlands that flank the creek, there's a narrow finger of wetlands that extend from the creek toward the south, between Tenth Street and Laurel Road. These wetlands follow Jack's Run and many of the property owner's that back up to the creek have confined the stream and its wetlands with makeshift bulkheads.

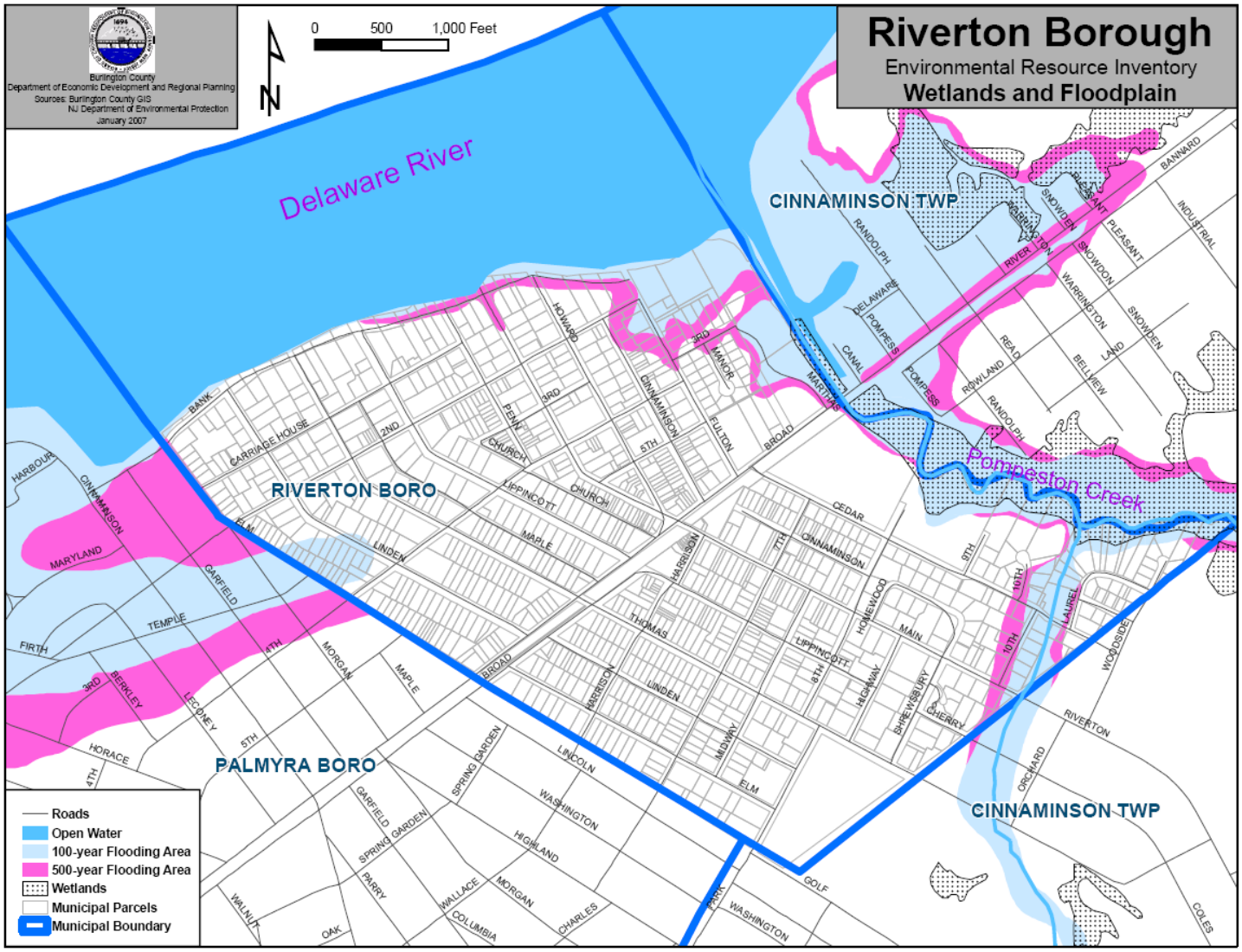
The floodplain in Riverton is very closely associated with the wetlands. This is not always the case. Floodplains are only inundated by large storms and when the flood waters rise, the edge of the flooded area conforms to the shape of the land. Commonly, municipal engineers consider the 100-year storm and the 500-year storm. These are theoretical storms that have a probability of occurring once every 100 years or 500 years. That doesn't preclude them from happening in rapid succession, like the huge storms of 2005 that pummeled New Orleans one after the other. But the size of the storm is the type that *normally* wouldn't happen more than once a century or once in 500 years.

Since Riverton is nearly fully developed, the areas that flood during a big storm are generally confined by the shape of the land that development has created. For instance, the floodplain along the Delaware is very much confined by Bank Avenue and the 100-year floodplain doesn't extend beyond the shore side of the street. The 500-year floodplain crosses Bank Avenue between Penn and Howard Streets, but it still doesn't extend too far inland.

Along the lower part of Pompeston Creek, between Broad Street and the Delaware, the floodplain is more expansive. This is an area where the creek is flowing into the river and, like all stream flows, the mouth of the creek is fairly wide. In this case, the creek bed has been artificially confined by development, but the natural landform, that which existed before Riverton was built, is still lower in elevation around the mouth of the creek, making it more susceptible to flooding. Much of the land bounded by Third and Fulton Streets between the Delaware River and Pompeston Creek is within the 100-year and five-hundred year floodplains. The floodplains even extend beyond this area in some directions. General FEMA studies show that a portion of the National Casein site may be in the floodplains too.

Upstream of Broad Street, the Pompeston creek bed narrows and the upland areas are substantially higher than the water, especially on the Riverton side of the creek. Steep bluffs to the creek help confine the floodplains so here the floodplains align more closely with the wetlands. There is a narrow spit of floodplains that correspondence with Jack's Run, too.

New Jersey regulates development within floodplains and wetlands. Riverton's wetlands must be respected with a fifty foot (50') buffer zone. Most construction is prohibited within floodplains. The wetlands and floodplains shown on this map are based on published regional studies by NJDEP. Site-specific study should be conducted to determine the actual limits of wetlands and floodplains on any specific site when development is contemplated.



AIR RESOURCES

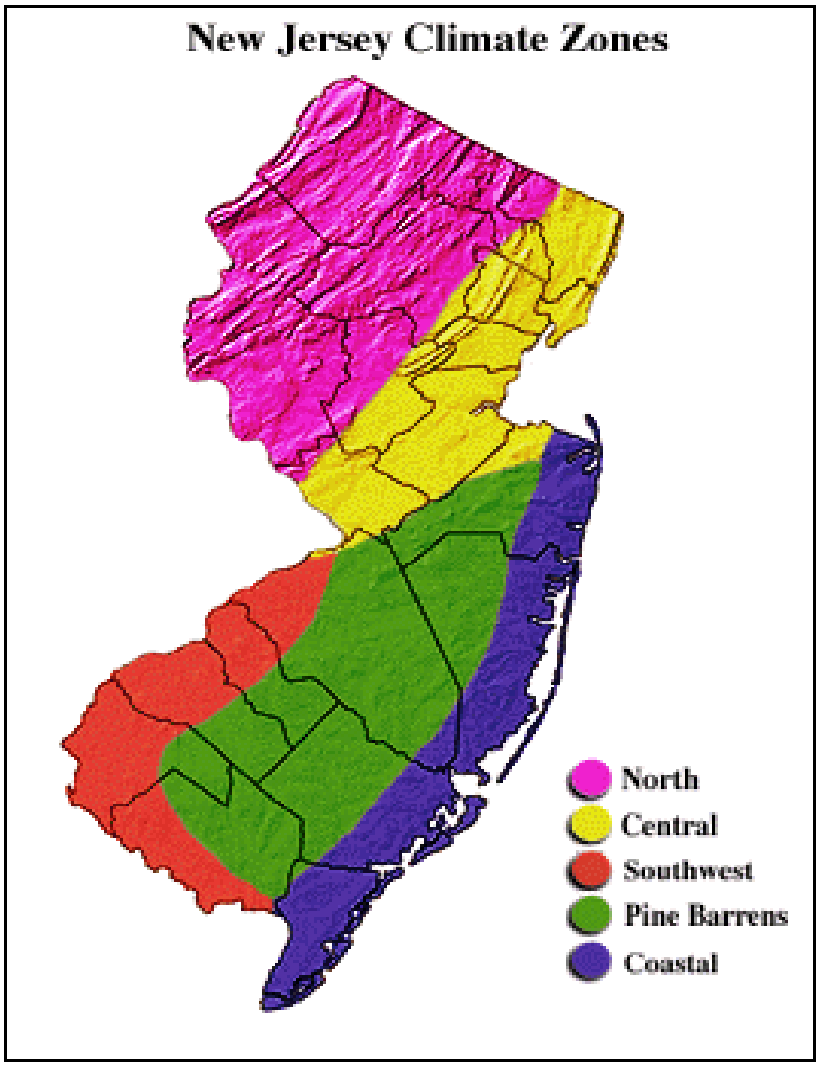
A. Climate

- The greatest snow storm to ever hit Philadelphia occurred on January 7th 1996, when 30.7" of snow fell and paralyzed the region for three days.
- The highest January temperature reading ever recorded happened on January 26, 1950, when the area was blanketed with a balmy 74 degrees.
- On January 17, 1982, the Riverton area suffered with the lowest temperatures ever recorded, dipping to -7 degrees below zero.
- July 19th, 1850 Burlington, New Jersey flooded when the Delaware River embankments broke during a rare summertime flood.
- August 12, 2000 : 3.08" of rain fall in Willingboro, New Jersey in 45 minutes.
- In 1879, lighting struck and burned the Atlantic Refining Company's plants at Point Breeze, New Jersey along with five vessels that were docked nearby. June 11th.
- August, 1955 Hurricane sisters Connie and Diane moved through the region within five days of each other, killing nearly 200 people.
- On December 19th, 1948 snow fell at a rate of two inches per hour, and accumulated to a total of 7.4 inches when the Philadelphia Eagles played the Chicago Cardinals in what came to be known as the 'Blizzard Bowl.'

Source: National Oceanic and Atmospheric Administration
http://www.erh.noaa.gov/er/phi/hist_phi.html

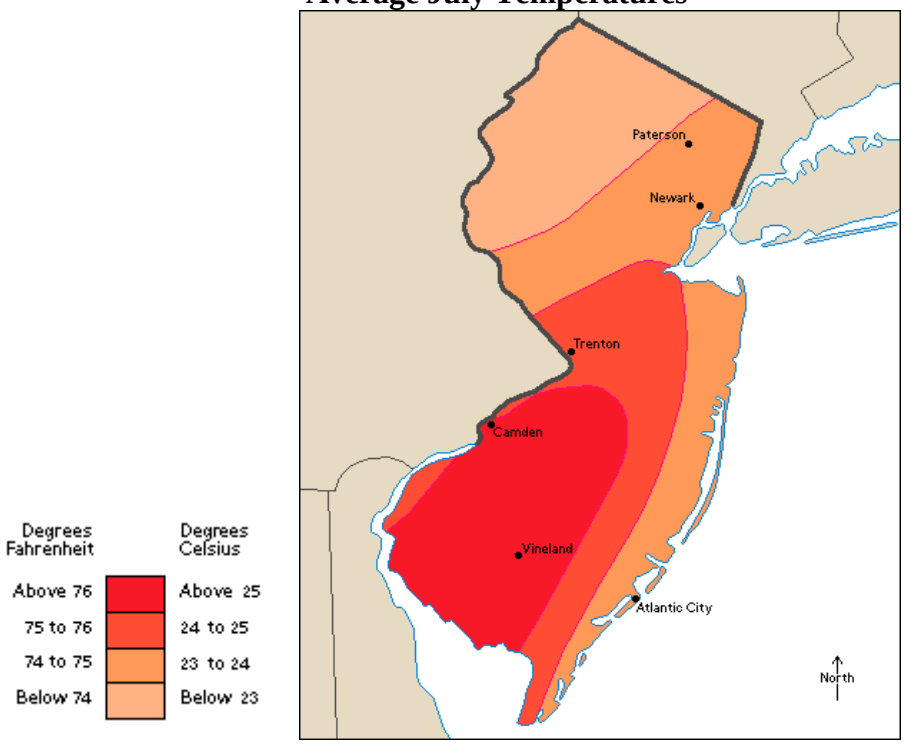
Rain, snow, lighting, hurricanes, and sunshine – New Jersey has it all. Native New Jerseyans often speak of the State's infamous humidity; however, New Jersey's State Climatologist, Dr. David Robinson says, "There is nothing special about New Jersey's humidity." The State is "…no more humid than any other middle latitude coastal state." (Source: Individual correspondence, 12/24/06)
Depending on the direction of the prevailing winds, the State is either blanketed by the moist winds from the ocean or the drier continental winds from the west.

For the purposes of understanding the local climate, the State was divided into five (5) zones by the late David Ludlum, an icon among climatologists. The zones are called the North, Central, Southwest, Pine Barrens and Coastal Zones. Each is influenced by its own set of physiographic characteristics and each exhibits distinct weather patterns. These zones help to explain the State's overall weather patterns.

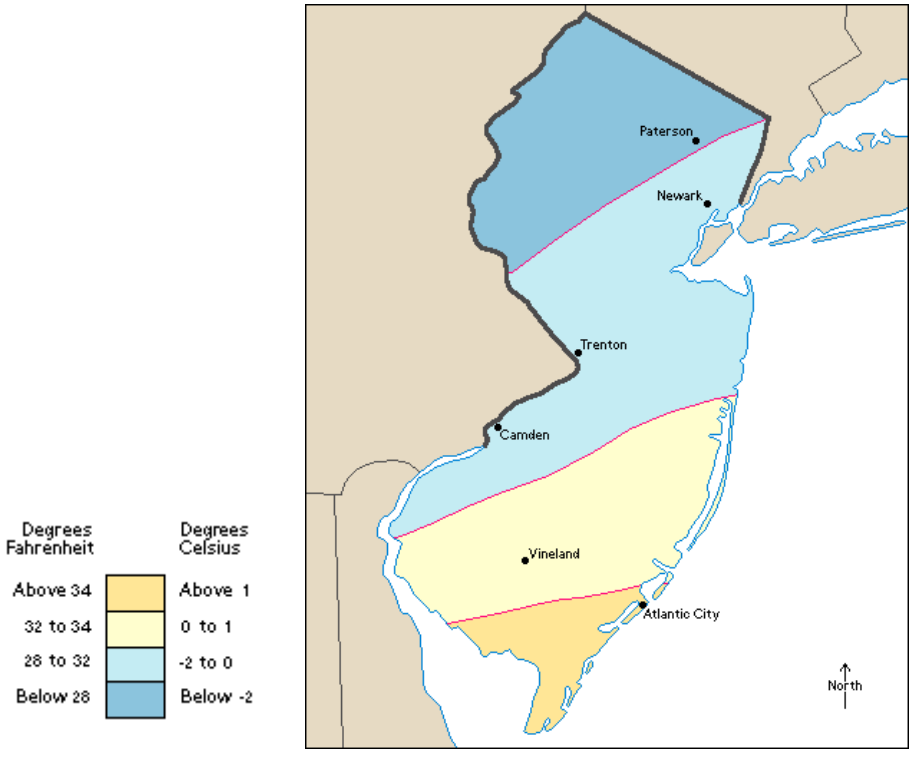


The following maps illustrate the pattern of the State's average temperatures. The patterns are somewhat reflective of the climate zones.

Average July Temperatures

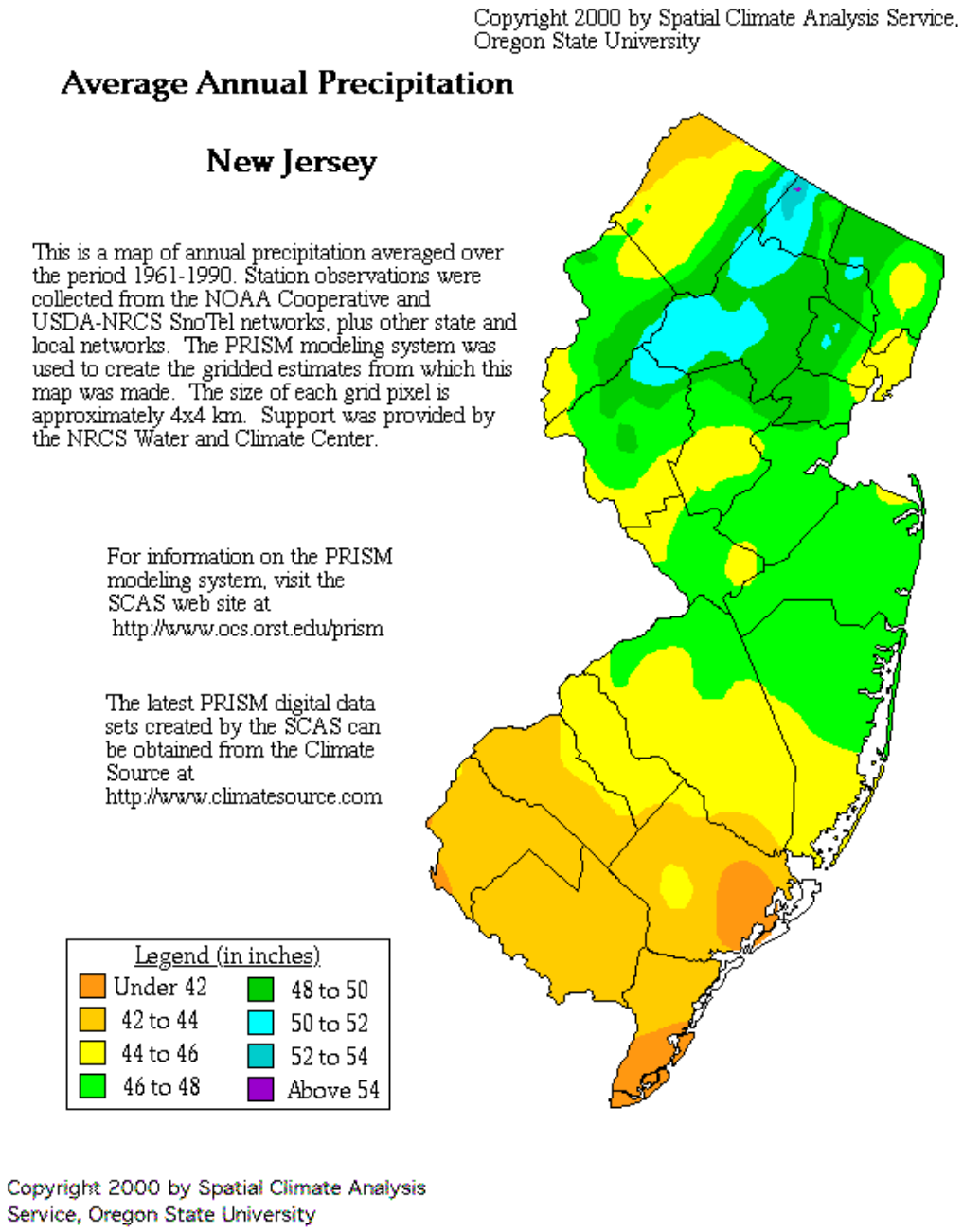


Average January Temperatures



Source:
http://www.worldbook.com/wb/Students?content_spotlight/climates/north_american_climate_new_jersey

The State's average precipitation patterns look more like this:



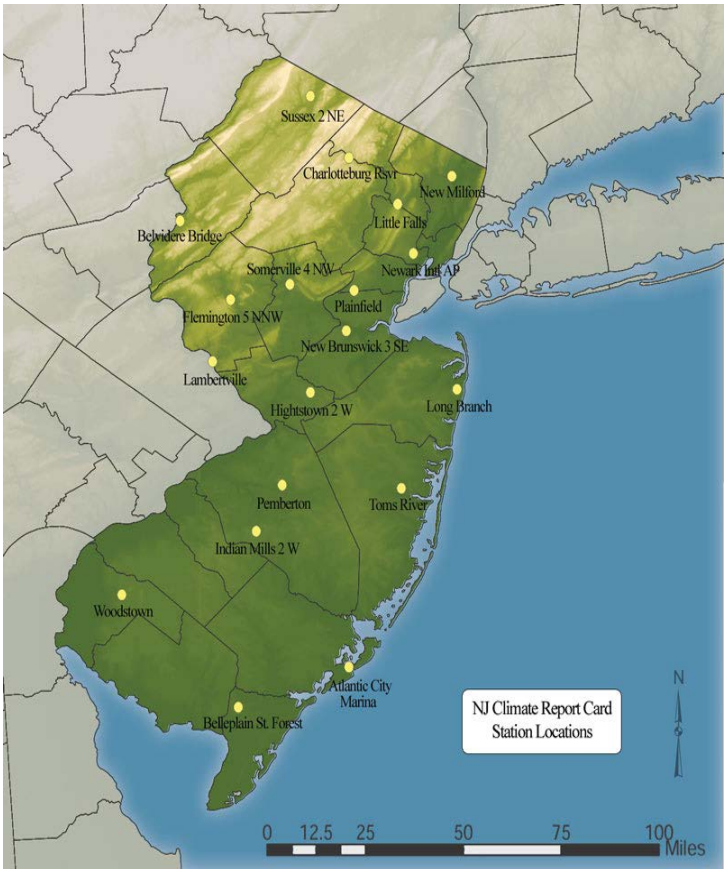
Source: Netstate. 'The Geography of New Jersey."
http://www.netstate.com/states/geography/nj_geography.htm

Riverton is located within Mr. Ludlum's Southwest Climate Zone. The area is influenced most by its proximity to the Delaware Bay, which tends to moderate temperatures. The zone receives less rain than the more mountainous Northern and Central Zones. Since it is on the inland side of New Jersey, it is less affected by coastal storms than the Coastal and Pine Zones.

The area has some of the highest average temperature in the State yet the nighttime temperatures don't drop as much from the daily highs as they do in the adjacent Pine Barrens Zone. This is because the soil of the Southwest Zone is more organic; not as sandy as the Pine Barren or Coastal Zones. Sandy soil stores heat during the day, but then reflect most of it back out into space at night. In the Southwest Zone, where the soil is less sandy, it holds heat longer and this helps to moderate the nighttime low temperatures.

Most of the year, the prevailing winds in Riverton are from the southwest. In the winter they come from the west and northwest. Winds from the west tend to be drier, since they are coming from over land. When the winds come from the south or east, they bring moisture from the bay and the ocean and the days feel humid. The moderating effects of the water bodies of the bay help create a longer growing season in the Southwest Zone. The last frost in the spring is about a month earlier than in zones to the north. The first frost in the fall is about a month later, ergo the longer growing season.

For more site specific information about the State's weather, data is collected from over 180 stations throughout the New Jersey, Pennsylvania, Delaware and New York area. The State Climatologist uses observations from nineteen (19) specifically outfitted stations, all part of the National Weather Service Cooperative, to generate ongoing 'climate report cards.' While the closest of these stations is in Pemberton, the relevant station to consider for Riverton is the one in Woodstown. It is the only station of the nineteen that is in the same climate zone as Riverton.



Source: Station map.
http://climate.rutgers.edu/stateclim_v1/stations/stationmap.html

The Woodstown Station's data is summarized in this chart and the seasonal data graphs that follow. Over the course of a year, there's more than a 46 degree difference in the average daily high temperatures. The average daily lows vary by about 41 degrees.

Woodstown Station Climate Data		
Data	*Range – Annual Lowest to Highest*	
Maximum Monthly Temperature	41.5 degrees (January)	88.1 degrees (July)
Minimum Monthly Temperature	24.3 degrees (January)	65.7 degrees (July)
Mean Temperature	32.9 degrees (January)	76.9 degrees (July)
Annual Mean Temperature	55.3 degrees	
Precipitation	2.89" (February)	4.41" (July)
Annual Total Precipitation	45.76"	

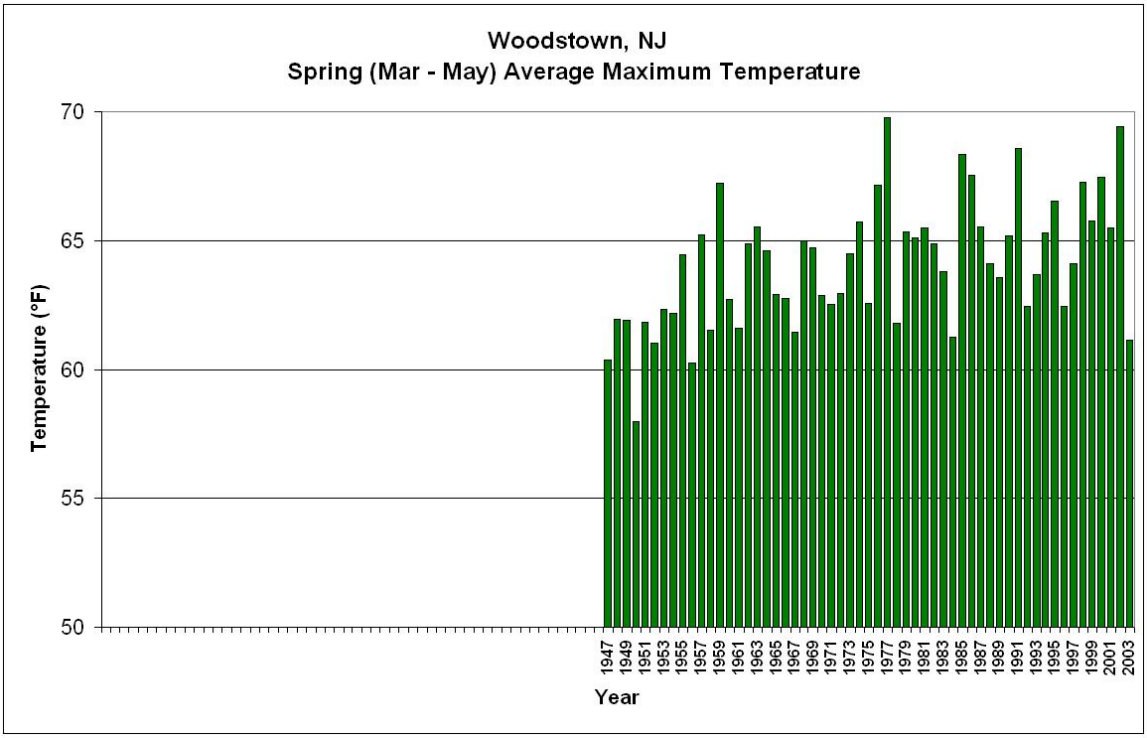
Source: NJ State Climatologist. http://climate.rutgers.edu/stateclim_v1/norms/monthly/index.html

It's interesting to note that the Woodstown Station has the highest annual mean temperature of all the report card stations, measuring 55.2 degrees. And yet, the average annual minimum temperature at the station is 44.5 degrees - between the lowest average annual of 36.8 degrees at the Sussex Station and the highest of 46.7 degrees in Newark. This statistic is an example of how the area's temperatures are moderated by the surface water bodies and the organic soils in the region.

Precipitation at the State's stations ranges from an annual total of 40.59 inches in Atlantic City to 52.94 inches in Charlotteburg. The Southwest Climate Zone is again right in the middle, with 45.76 inches of precipitation annually. In New Jersey, snowfall amounts are quite variable. There were eleven (11) winter storms in 2002-03, nine (9) in 2003-04 and thirteen (13) in 2004-05. A storm that comes from the northwest tends to drop a lot of its precipitation on the mountains of northern New Jersey. But winter storms that emanate from the south or east can bring much more snow to Riverton. The Borough is very susceptible to the classic New Jersey nor'easter.

The charts that follow illustrate an historic account of the region's temperatures and precipitation relative to the seasons.
(Source: **http://climate.rutgers.edu/stateclim_v1/climreportcard/station_pages.php?station=wdt)**

Some very useful websites for the latest weather in New Jersey are the New Jersey Weather and Climate Network at http://climate.rutgers.edu/njwxnet/, the Office of the State's Climatologist http://climate.rutgers.edu/stateclim/, and the National Weather Service forecast Office for Philadelphia and Mount Holly http://www.erh.noaa.gov/er/phi/index.php.


Woodstown, NJ
Spring (Mar - May) Average Maximum Temperature
Temperature (°F)
70
65
60
55
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1947
1949
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1961
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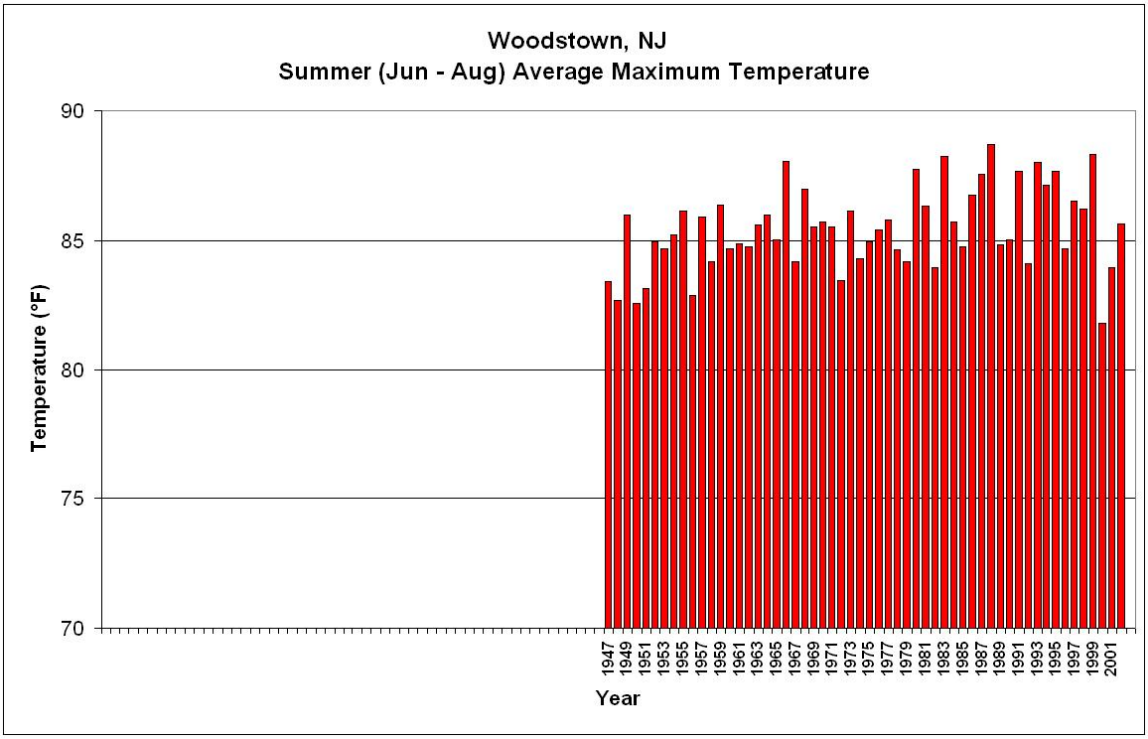
Year


Woodstown, NJ
Summer (Jun - Aug) Average Maximum Temperature
Temperature (°F)
90
85
80
75
70
1947
1949
1951
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1955
1957
1959
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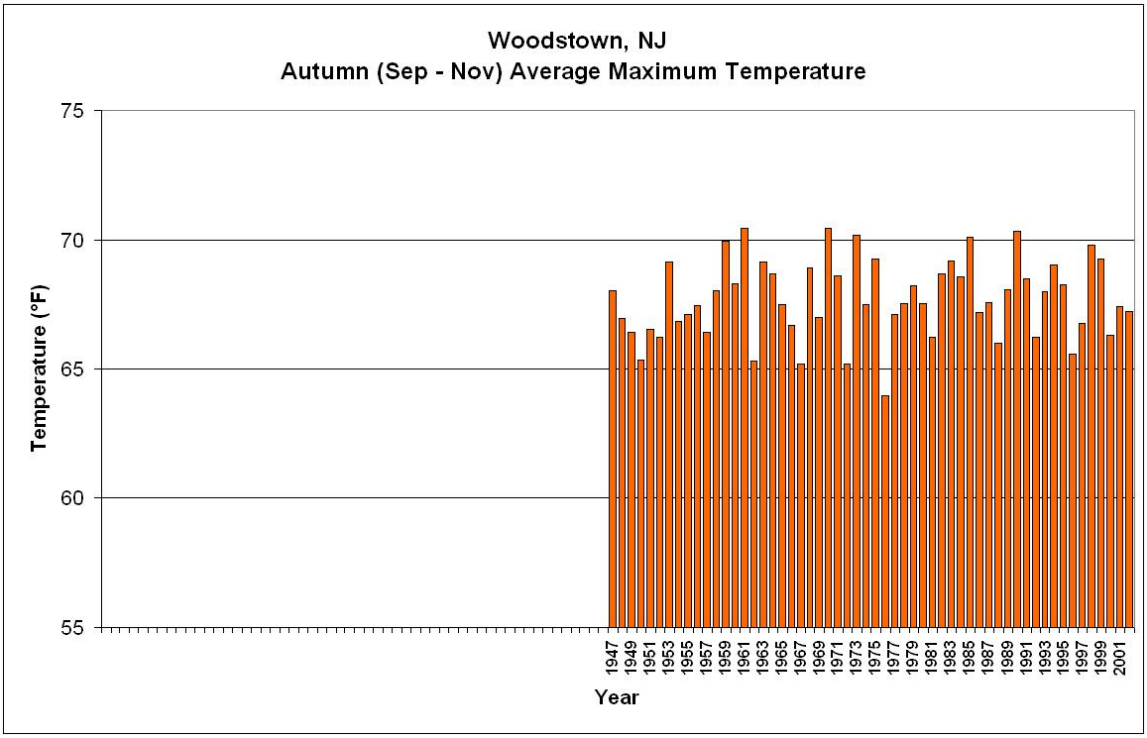
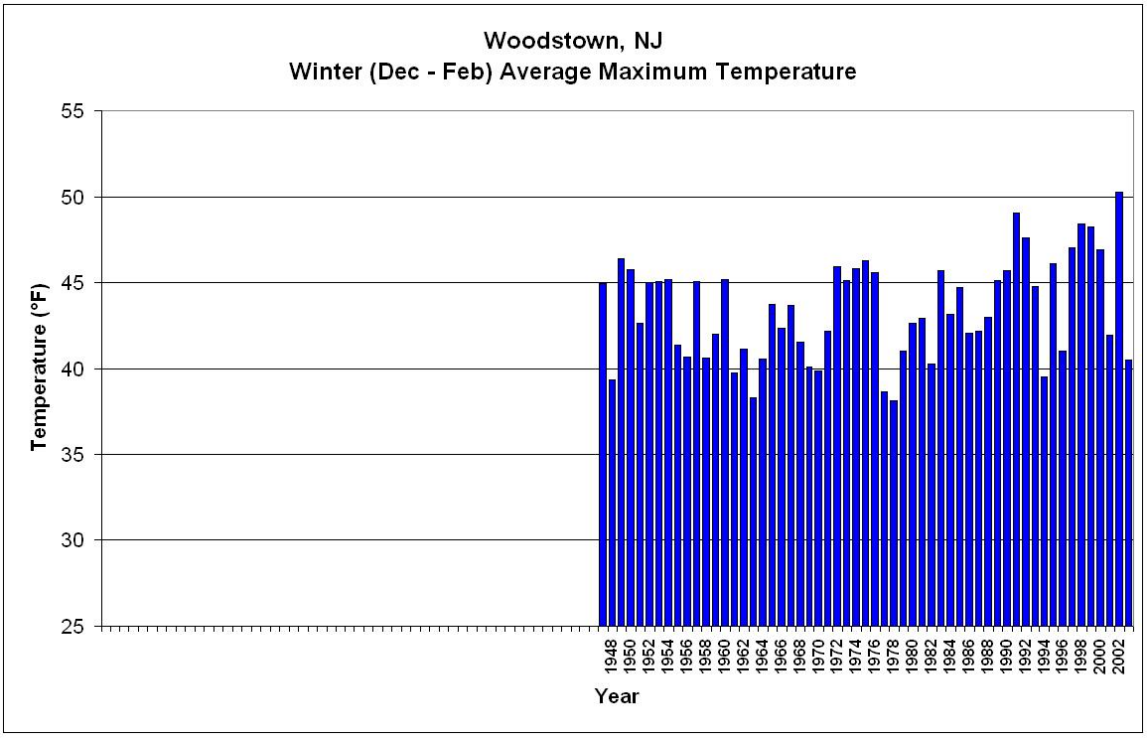
Year


Woodstown, NJ
Autumn (Sep - Nov) Average Maximum Temperature
Temperature (°F)
75
70
65
60
55
1947 1949 1951 1953 1955 1957 1959 1961 1963 1965 1967 1969 1971 1973 1975 1977 1979 1981 1983 1985 1987 1989 1991 1993 1995 1997 1999 2001
Year


Woodstown, NJ
Winter (Dec - Feb) Average Maximum Temperature
Temperature (°F)
55
50
45
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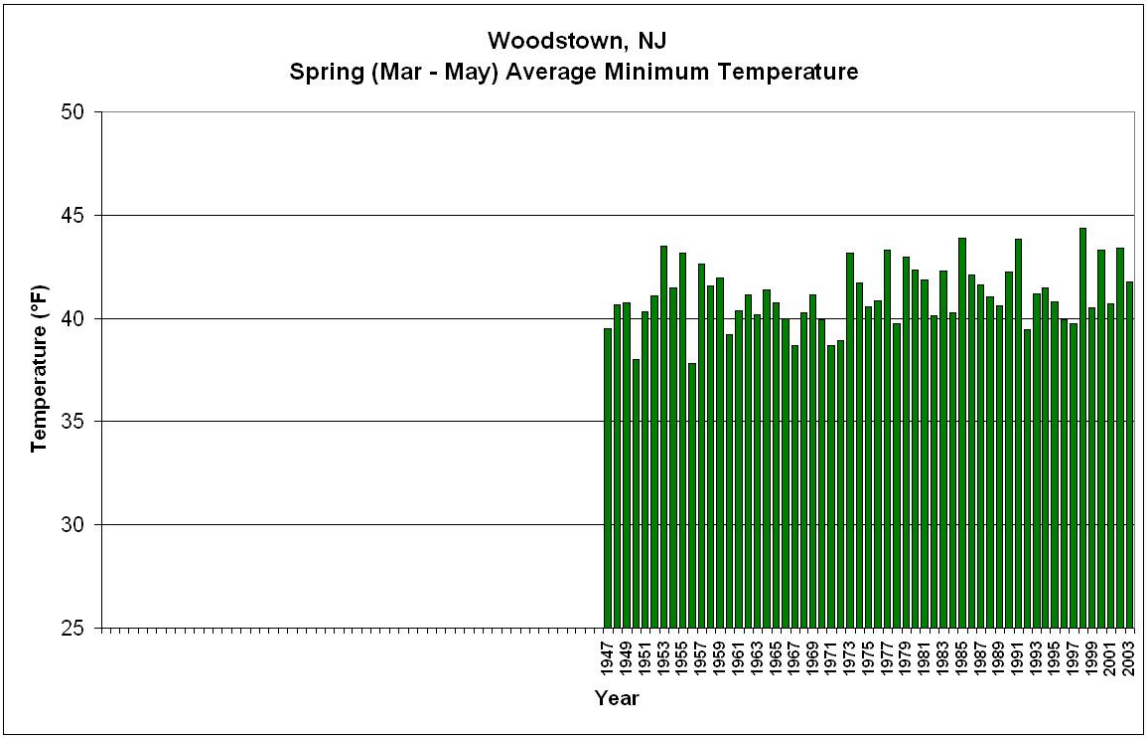
25
1948 1950 1952 1954 1956 1958 1960 1962 1964 1966 1968 1970 1972 1974 1976 1978 1980 1982 1984 1986 1988 1990 1992 1994 1996 1998 2000 2002
Year


Woodstown, NJ
Spring (Mar - May) Average Minimum Temperature
Temperature (°F)
50
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1957
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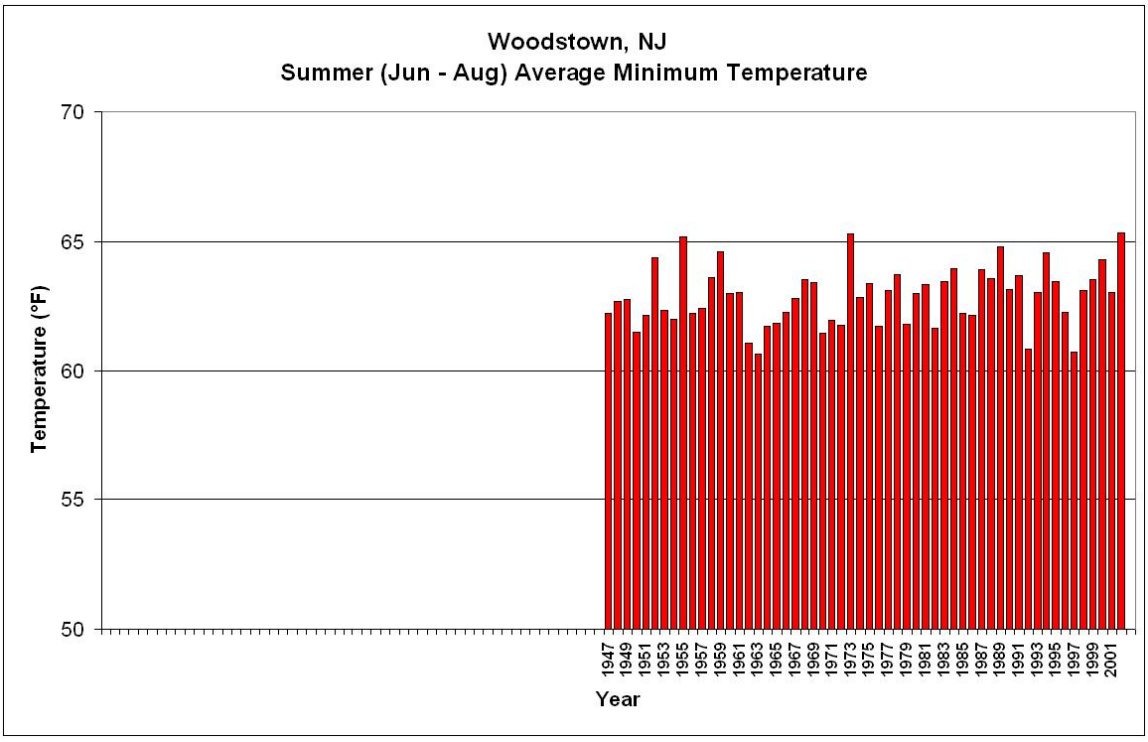
Year


Woodstown, NJ
Summer (Jun - Aug) Average Minimum Temperature
Temperature (°F)
70
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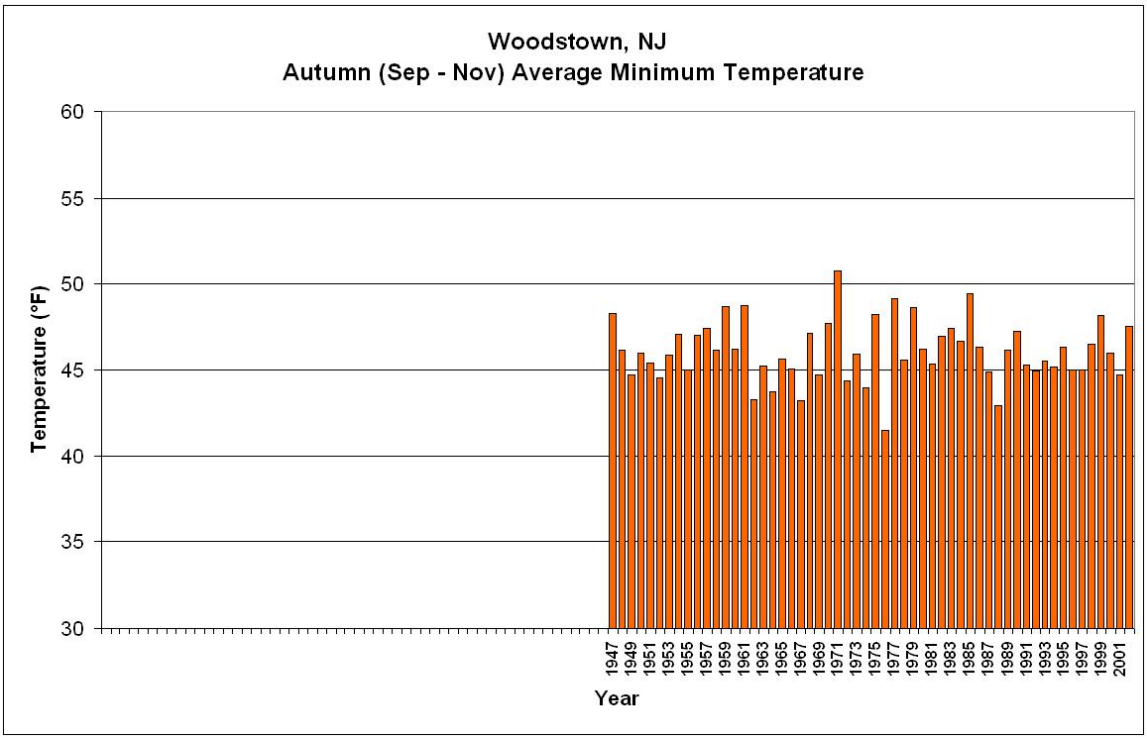
Woodstown, NJ
Autumn (Sep - Nov) Average Minimum Temperature
Temperature (°F)
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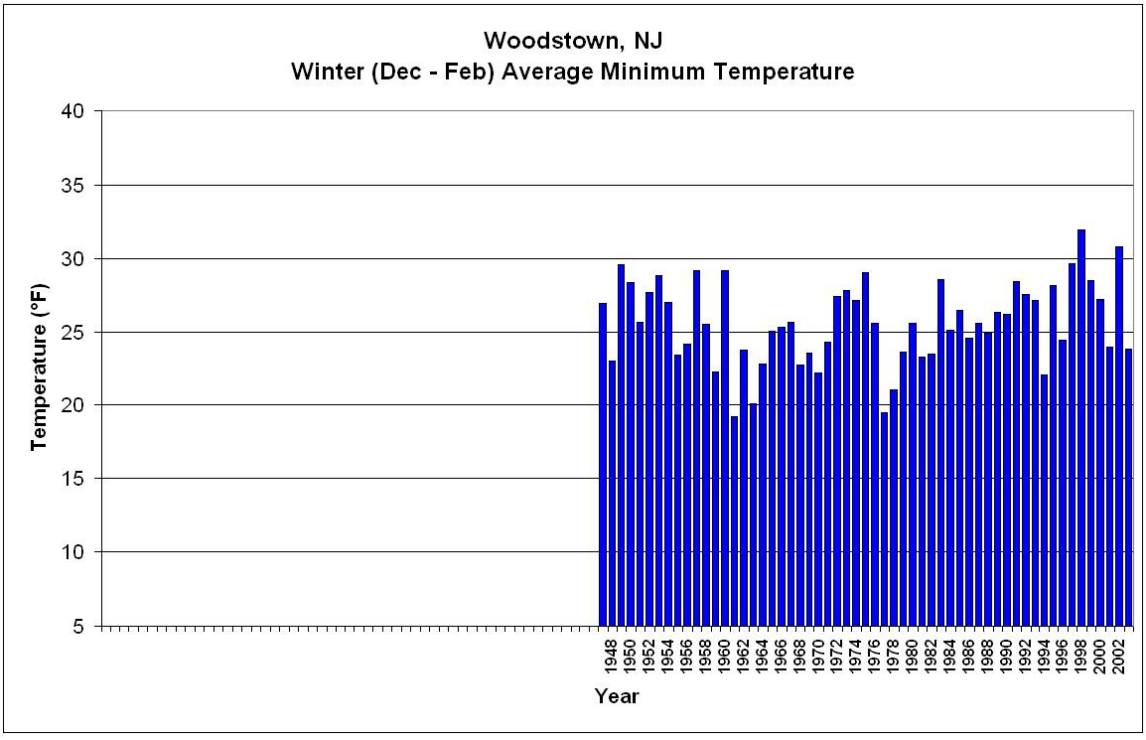
1947 1949 1951 1953 1955 1957 1959 1961 1963 1965 1967 1969 1971 1973 1975 1977 1979 1981 1983 1985 1987 1989 1991 1993 1995 1997 1999 2001
Year


Woodstown, NJ
Winter (Dec - Feb) Average Minimum Temperature
Temperature (°F)
40
35
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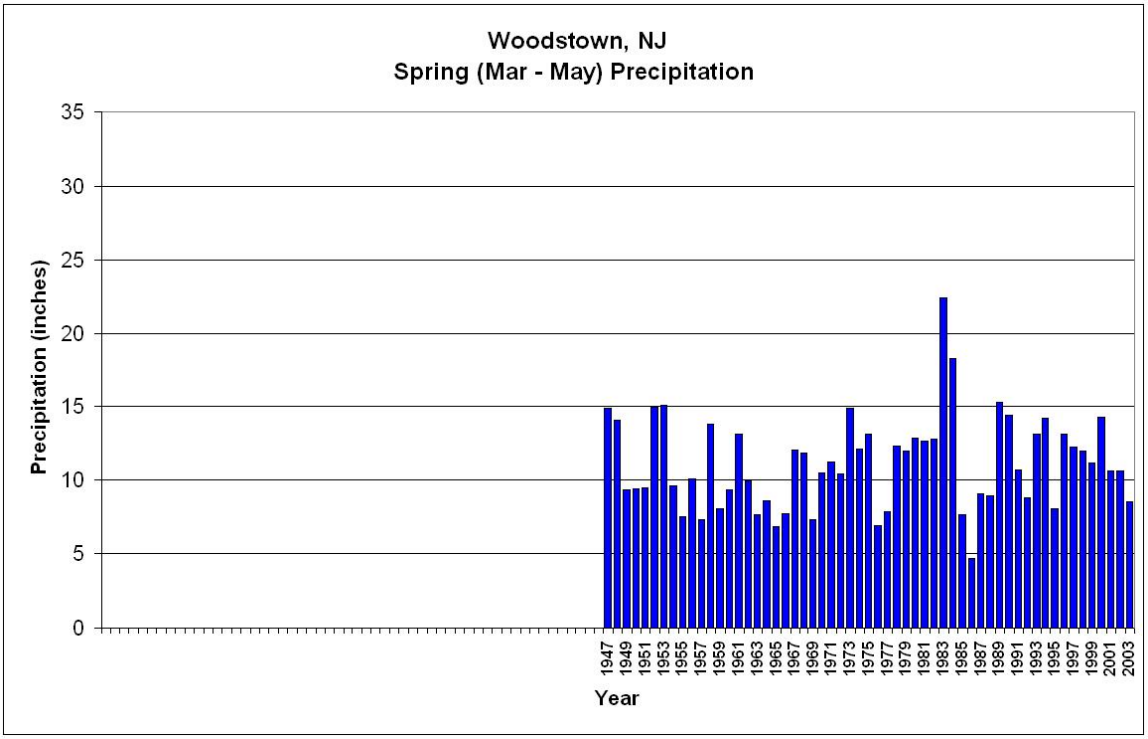
1948 1950 1952 1954 1956 1958 1960 1962 1964 1966 1968 1970 1972 1974 1976 1978 1980 1982 1984 1986 1988 1990 1992 1994 1996 1998 2000 2002
Year


Woodstown, NJ
Spring (Mar - May) Precipitation
Precipitation (inches)
0
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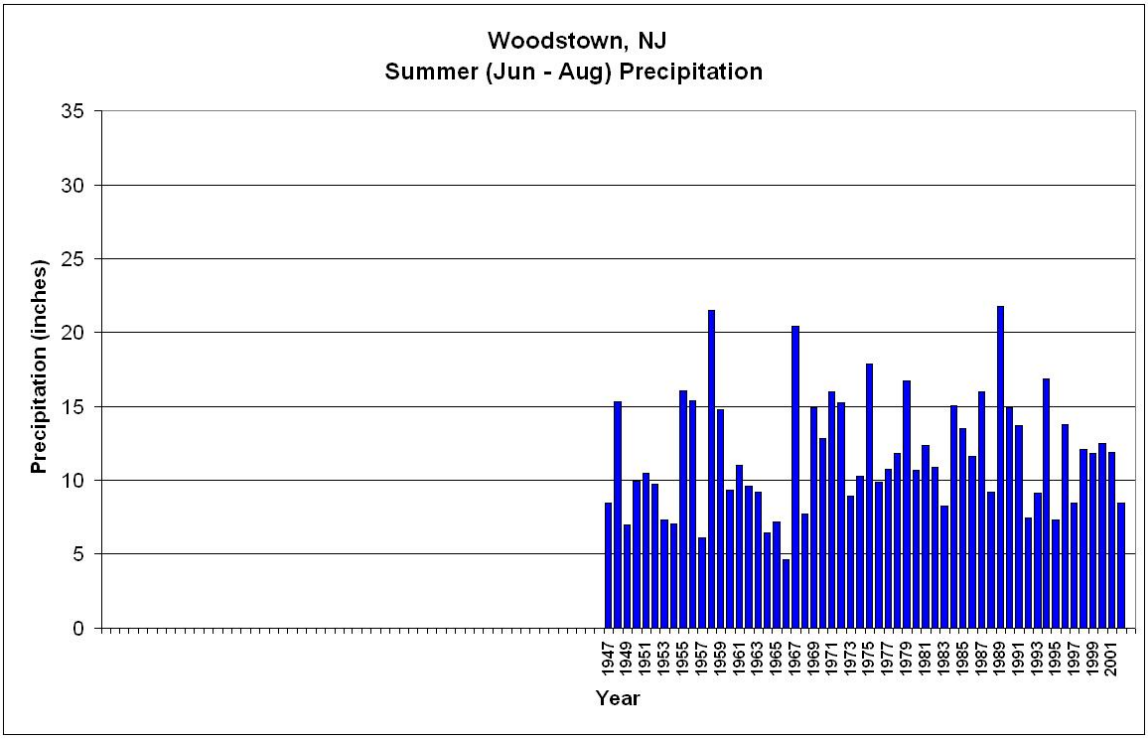
Woodstown, NJ
Summer (Jun - Aug) Precipitation
Precipitation (inches)
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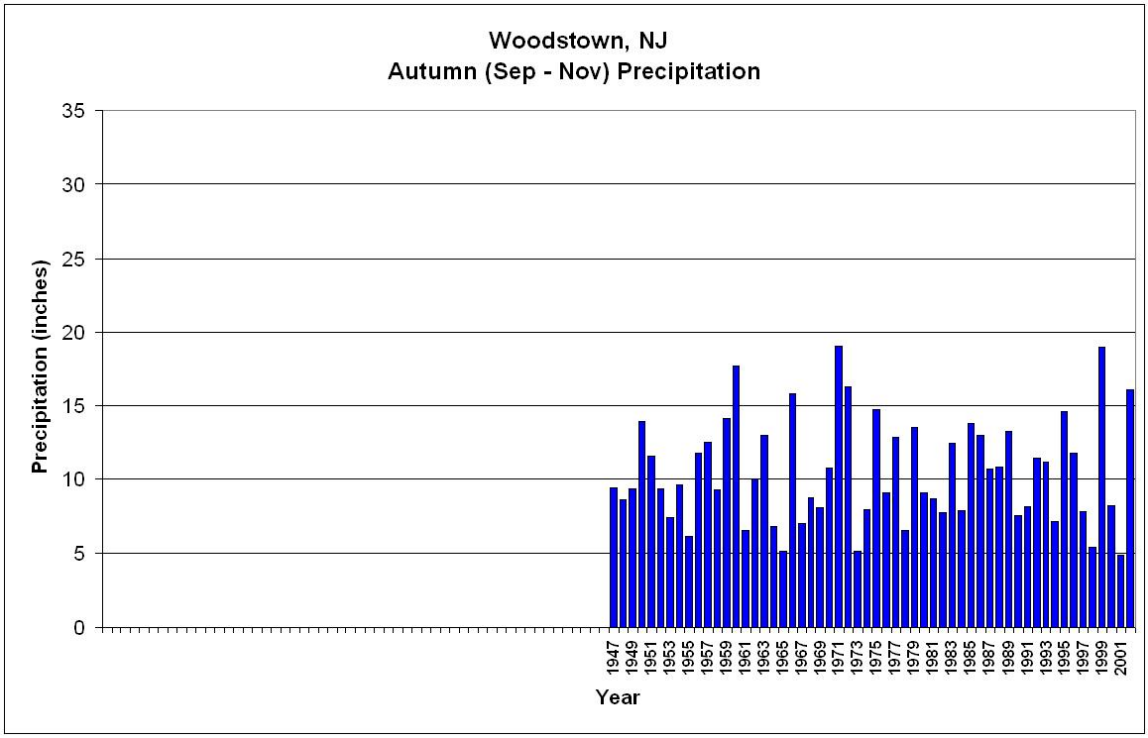
Woodstown, NJ
Autumn (Sep - Nov) Precipitation
Precipitation (inches)
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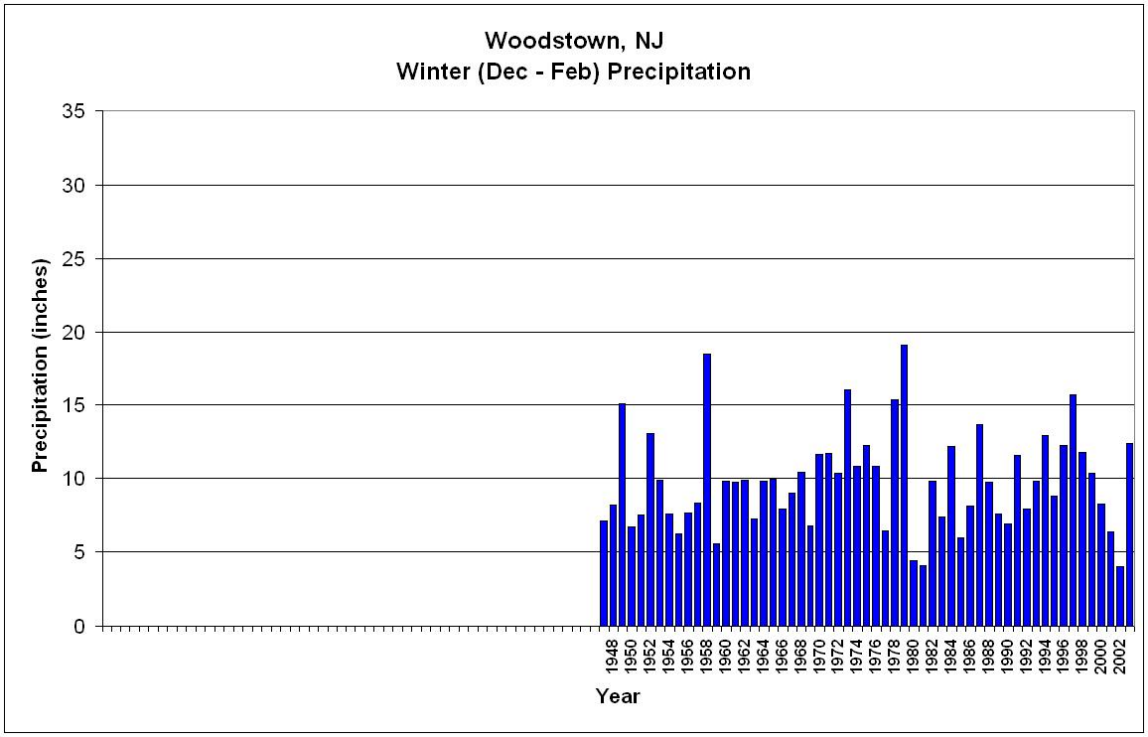
Woodstown, NJ
Winter (Dec - Feb) Precipitation
Precipitation (inches)
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AIR RESOURCES

B. Air Quality

In 1970 the Clean Air Act was established by Congress. Subsequently, the US Environmental Protection Agency (US EPA) was charged with the task of enforcing the Act. Regulations were written, called the National Ambient Air Quality Standards, to establish controls on air quality. The Office of Air Quality Planning and Standards was set up within the US EPA to enforce the standards. In New Jersey, the Bureau of Air Monitoring within the New Jersey Department of Environmental Protection monitors air quality at the state level.

Air quality is tracked using what the EPA calls *'criteria air pollutants.'* There are six (6) specific criteria air pollutants: carbon monoxide, nitrogen dioxide, sulfur dioxide, lead, particulate matter (very fine dust), and ground level ozone (the principal component of smog). There is a seventh element that the EPA monitors called volatile organic compounds, or VOCs. Volatile organic compounds help to generate smog, so if VOCs can be reduced, then smog can be reduced, hence the EPA targets some of its efforts at reducing VOCs.

These criteria air pollutants are measured based on primary standards and secondary standards. Primary standards assess the pollutants' risk to human health. Secondary standards assess their risk to the environment and people's property. Areas that meet the primary standards for a particular pollutant are called *'attainment areas.´* Areas that do not meet the primary standards are called, logically, *'non-attainment areas'*. Any area may be a non-attainment area for some pollutants, but an attainment area for others – each pollutant is measured individually.

The sources of the pollutants and their potential effects on health, the environment and property are summarized in the chart that follows:

THE US ENVIRONMENTAL PROTECTION AGENCY'S CRITERIA AIR POLLUTANTS			
Carbon Monoxide			
Source	**Health Effects**	**Environmental Effects**	**Property Damage**
Burning of gasoline, natural gas, coal, oil etc.	Reduces the ability of blood to bring oxygen to body cells and tissues; cells and tissues need oxygen to work. Carbon monoxide may be particularly hazardous to people who have heart or circulatory (blood vessel) problems and people who have damaged lungs or breathing passages.	--	--
Nitrogen Dioxide			
Source	**Health Effects**	**Environmental Effects**	**Property Damage**
Burning of gasoline, natural gas, coal, oil etc. Cars are an important source of NO2.	Lung damage, illnesses of breathing passages and lungs (respiratory system).	Nitrogen dioxide is an ingredient of acid rain, which can damage trees and lakes. Acid rain also can reduce visibility.	Acid rain can eat away stone used on buildings, statues, monuments, etc.
Sulfur Dioxide			
Source	**Health Effects**	**Environmental Effects**	**Property Damage**
Burning of coal and oil, especially high-sulfur coal from the Eastern United States; industrial processes like paper and metals.	Breathing problems may cause permanent damage to lungs.	Sulfur dioxide is an ingredient in acid rain which can damage trees and lakes. Acid rain also can reduce visibility.	Acid rain can eat away stone used in buildings, statues, monuments, etc.
Lead			
Source	**Health Effects**	**Environmental Effects**	**Property Damage**
Leaded gasoline (which is being phased out), paint (houses, cars), smelters (metal refineries); manufacture of lead storage batteries.	Brain and other nervous system damage; children are at special risk. Some lead-containing chemicals cause cancer in animals. Lead causes digestive and other health problems.	Lead can harm wildlife.	--

Particulate Matter			
Source	**Health Effects**	**Environmental Effects**	**Property Damage**
Burning of wood, diesel and other fuels; industrial plants; agricultural practices such as plowing and burning off fields; unpaved roads.	Nose and throat irritation, lung damage, bronchitis, early death.	Particulates are the main source of haze that reduces visibility.	Ashes, soot, smokes and dusts can dirty and discolor structures and other property, including clothes and furniture.
Ground Level Ozone (aka Smog)			
Source	**Health Effects**	**Environmental Effects**	**Property Damage**
Chemical reaction between volatile organic compounds and nitrogen dioxide.	Breathing problems, reduced lung function, asthma, irritates eyes, stuffy nose, reduced resistance to colds and other infections, may speed up aging of lung tissue	Ozone can damage plants and trees; smog can cause reduced visibility.	Damages rubber, fabrics, etc.
Volatile Organic Compounds (VOC's aka smog-formers)			
VOCs are released from burning fuel (gasoline, oil, wood coal, natural gas, etc.), solvents, paints glues and other products used at work or at home. Cars are an important source of VOCs. VOCs include chemicals such as benzene, toluene, methylene chloride and methyl chloroform.	Breathing problems, reduced lung function, asthma, irritates eyes, stuffy nose, reduced resistance to colds and other infections, may speed up aging of lung tissue. Many VOCs can also cause serious health problems such as cancer.	Reduced visibility. Some VOCs such as formaldehyde and ethylene may harm plants.	--
Source: US Environmental Protection Agency. http://epa.gov/climatechange/science/index.html			

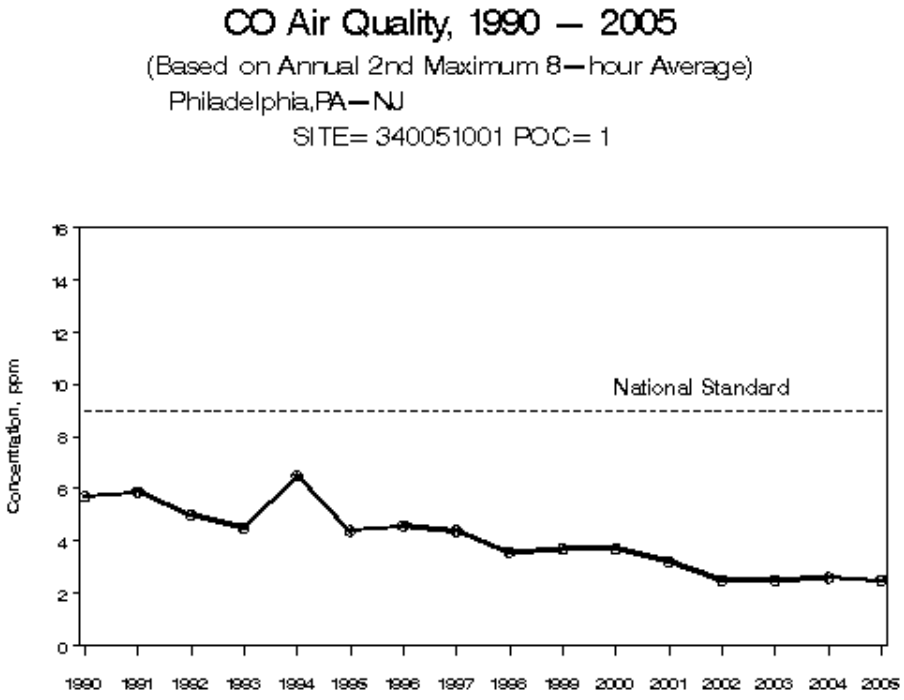
A word about smog or ground level ozone. Ozone in general is a good thing when it's in the stratosphere, high above the Earth. It filters out harmful rays and traps heat within the Earth's atmosphere; heat that would otherwise radiate back out into space. Without stratospheric ozone, the Earth would be approximately sixty degrees cooler than it is today and human life on Earth would not be possible.

But ground level ozone is man-made. It comes from the volatile organic compounds (VOCs) that are released into the air when things like fuel are burned. Once in the air, the VOCs combine with nitrogen oxide. Together, the mixture, or more specifically the chemical reaction that occurs within the mixture, creates heat. Unfortunately, smog, this chemical reaction between VOCs and nitrogen oxide, occurs more quickly when temperatures are hot. Therefore, as smog forms, temperatures rise, which leads to more and faster chemical reactions and more smog. Technically, VOCs are not a 'criteria air pollutant,' but they contribute to smog so they're worth monitoring.

Similarly, nitrogen oxide and sulphur dioxide combine in the area with precipitation to create acid rain. Acid rain increases the acidity of rivers and streams. It also damages plants, contaminates soils and decays buildings. Fortunately for Riverton, this area of the State does not have excessively high levels of either of these compounds in the air so there's not much acid rain.

The EPA, with assistance from the New Jersey Department of Environmental Protection and similar agencies in other states, monitors the criteria air pollutants. Near Riverton, there is no single station that monitors all six criteria air pollutants, but there are several stations along the river in the vicinity. Between them, they collect all the critical data.

The data shows that Riverton air quality has levels of carbon monoxide, nitrogen dioxide, sulfur dioxide and lead all well below the national standard. However, particulate matter hovers around the national standard and ground level ozone, though improving, has been historically well above the national standards. See the following charts.



NO2 Air Quality, 1990 – 2005

(Based on Annual Arithmetic Average)

Philadelphia,PA–NJ

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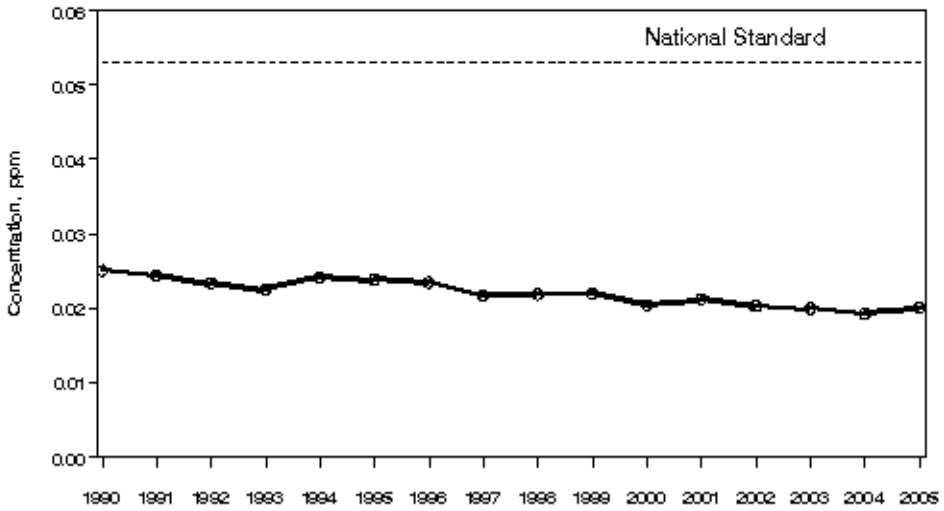

SO2 Air Quality, 1990 – 2005

(Based on Annual Arithmetic Average)

Philadelphia,PA–NJ

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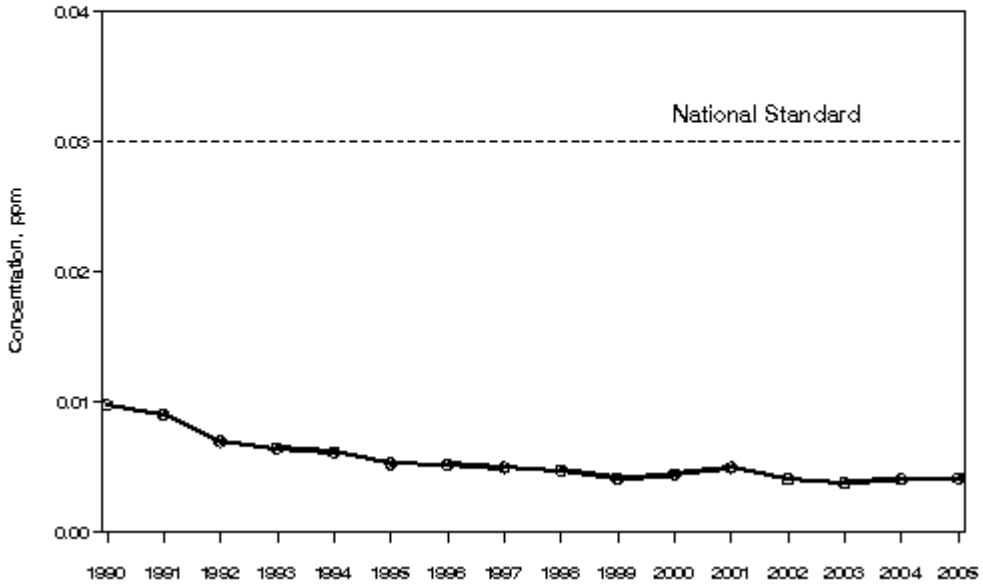

Lead Air Quality, 1990 – 2005

(Based on Annual Maximum Quarterly Average)
Philadelphia,PA–NJ
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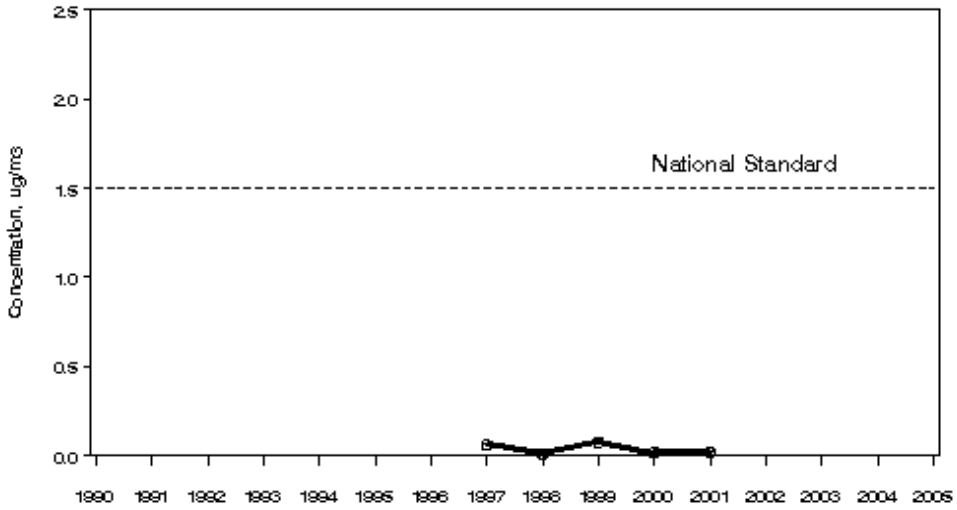

PM2.5 Air Quality, 1999 – 2005

(Based on Seasonally–Weighted Annual Average)
Philadelphia,PA–NJ
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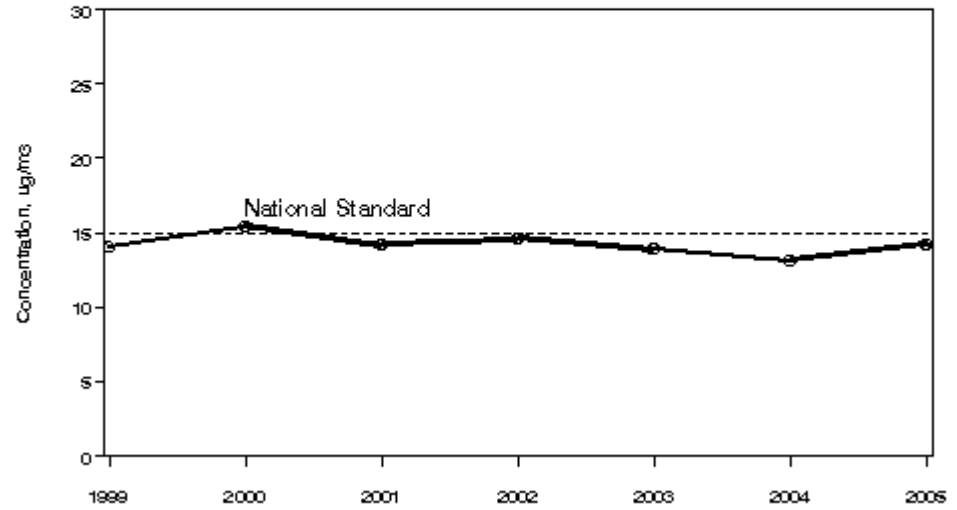
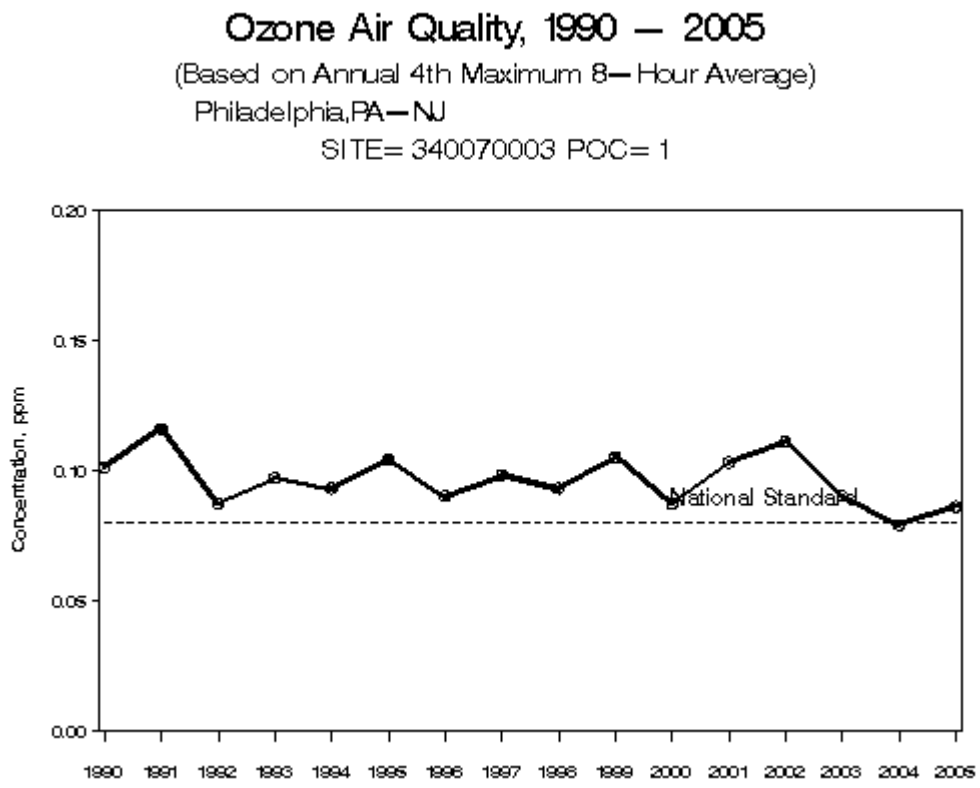


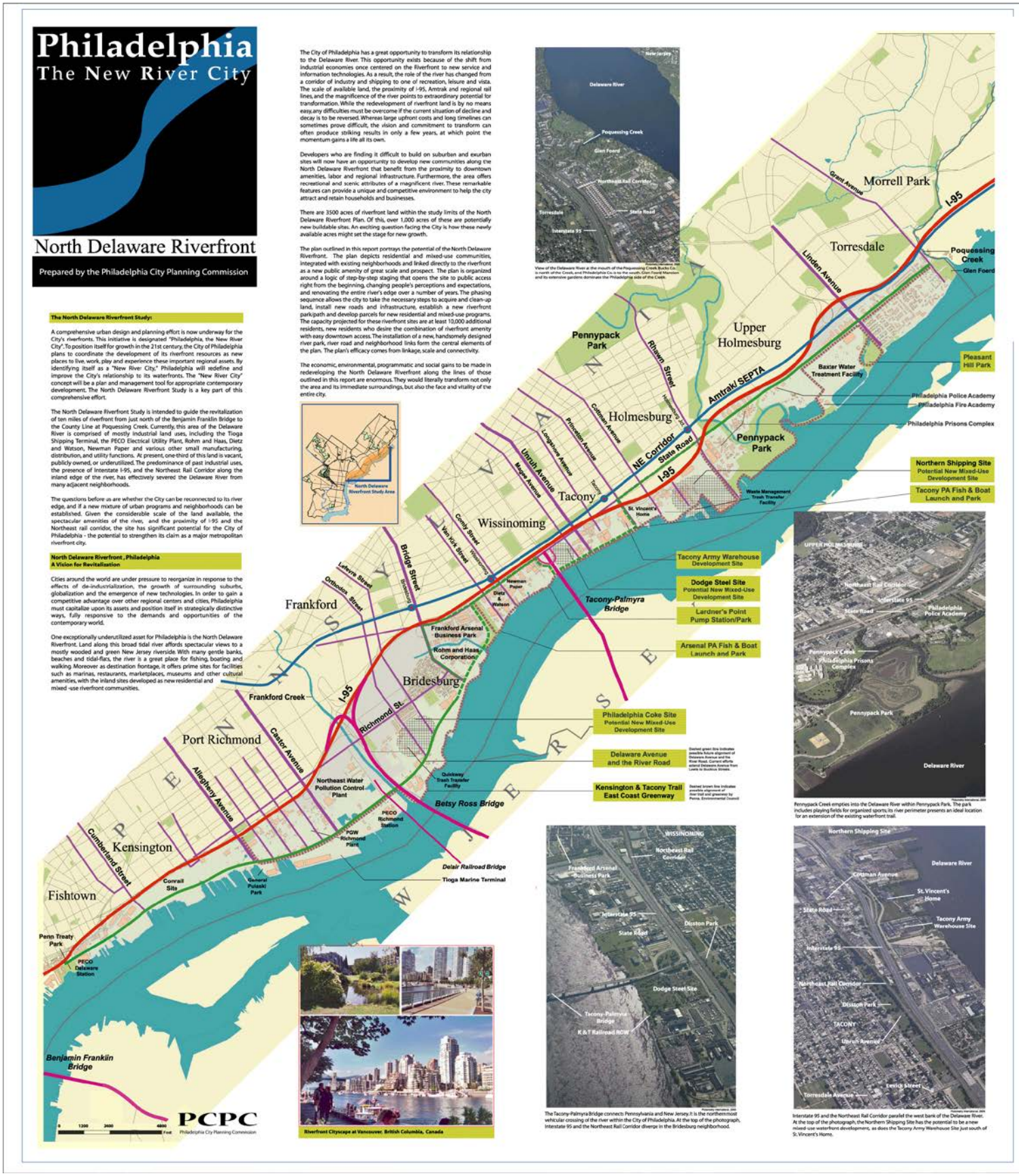


As of March 2, 2006, the EPA classified Burlington County as being an attainment area for carbon monoxide, nitrogen dioxide, sulfur dioxide, and lead. The County has 'moderate' to 'severe' problems with ozone and it's not meeting the standards with respect to fine particular matter. For the ozone, the federal and state air quality regulators have seven to fifteen years to continue reducing the ozone threats to avoid being designated as a non-attainment area. The entire County is already designated as a non-attainment area with respect to fine particulate matter.

One cannot consider air quality in Riverton without looking across the river at Philadelphia, and indeed, the EPA considers this region as part of the Philadelphia area in terms of air quality monitoring.

The Pennsylvania riverbank across from Riverton is peppered with industrial uses, including the Dodge Steel site, the Tacony Army Warehouse, the Waste Management Trash Transfer Facility, the Northern Shipping Site, the Baxter Water Treatment Facility and the Philadelphia Prison complex. Few of these sites do much to enhance the environment. Fortunately, the Philadelphia City Planning Commission initiated a redevelopment plan for this area, which the City calls the 'North Delaware Riverfront Study Area.'

Under a plan entitled *"Philadelphia: The New River City"* Philadelphia will convert many of these industrial sites into mixed use developments. Redeveloping the Dodge Steel Mill, the trash transfer facility and the Northern Shipping site will probably improve air quality for Riverton.



Source: Philadelphia City Planning Commission. Philadelphia: The New River City. 2004-05.

BIOLOGICAL RESOURCES

A. Vegetation

Admittedly, Riverton is a fully developed community with virtually no vacant or undeveloped land to be built upon. That does not mean that the vegetation in the Borough is of marginal importance. In fact, just the opposite is true. Some of the most significant local vegetation includes the Borough's magnificent street tree collection and the naturalized vegetation of the Pompeston Creek.

The Borough's Street Trees

Riverton was a 'planned suburban community.' It was designed by architect Samuel Sloan who was engaged by prospective residents who wanted a vacation spot for their families outside of Philadelphia. From its inception, the Borough was envisioned as a small community with a rectilinear pattern of *tree-lined* streets. The initial idea of a tree-lined community has survived and remains important to the identity of Riverton.

The Borough's first Shade Tree Commission was constituted in 1893. The current Shade Tree Commission is still very active. It maintains a catalogue of all of the trees on Borough property. This includes the town's street trees and trees within municipal parks. As of 2005, the catalogue included 2,575 trees and 118 different species. The Commission keeps track of the species, location, size and health of each of these trees. Combined with an abundance of trees that residents maintain on their own properties, mature trees in Riverton are an important element of the town's character.

Since 2000, the Shade Tree Commission has maintained an up-to-date Community Forestry Management Plan. It outlines the operational framework with which the Borough manages its tree inventory. The Plan describes how the Shade Tree Commission monitors the health of the trees, trains its volunteers, works with professionals to combat arbor diseases and reduces hazardous tree conditions, keeping Riverton's trees looking beautiful. The Commission has also written a 'Homeowner's Guide to Beautiful, Safe, and Healthy Trees in Riverton.' Residents can find it on the Shade Tree Commission's website. (http://www.riverton-nj.com/shade.html)

For the last 18 years, Riverton has been a designated Tree City USA. This is an impressive designation conferred by the National Arbor Day Foundation to qualified municipalities only. Tree City USA towns are required to meet and maintain four specific criteria:

1. Possess a Tree Board or Forestry Department. In Riverton, that entity is the all volunteer Shade Tree Commission. The Commission assumes responsibility for the management of all the Borough's shade trees and maintains a website with an abundance of interesting tree-related information.
2. Adopt a local tree ordinance. (See http://www.riverton-nj.com/code118.html) The ordinance regulates the care and protection of trees on Borough property – that is within road rights-of-way and in Borough parks and other municipal sites. Residents cannot do anything to public trees, including those located

between the sidewalk and the street without first obtaining a permit from the Borough.

3. Spend at least $2 per capita on trees within the Borough. The Shade Tree Commission has received over $50,000 in Community Stewardship Incentive Grants in the past six years for such activities as developing Urban Forestry Management Plans, training, public education and awareness, tree hazard identification, bacterial leaf scorch management plan (tree disease management), hazardous tree removals and tree plantings. The Borough also contributed at least another $7,000 worth of in-kind services from resident volunteers and municipal employees to assist in these endeavors.
4. Promote Arbor Day. The Borough celebrates Arbor Day each year with programs in the public schools, tree planting activities for school children and a tour of the Borough's trees on 'Tree Viewing Day'.

All the work that the Shade Tree Commission does, the Tree City USA activities and the Arbor Day activities demonstrate to importance the Borough places on shade trees in Riverton and the value these trees have to the local quality of life. The Shade Tree Commission is actively pursuing projects that will upgrade the computer data base of the Borough's trees and generate a location map of all the trees. The map will be integrated with the data base, making it possible to identify a particular street tree on the map and simultaneously isolate all the pertinent information about that tree. Once the projects are complete, this information should be incorporated into this inventory.

Reserved for
Riverton Borough Shade Tree Commission's
Database of Borough Trees
(to be added in the future)

Reserved for
Shade Tree Plan
(to be added in the future)

Pompeston Creek Vegetation

The vegetation of the Pompeston Creek plays a slightly different, though no less important role in Riverton. The Creek is the last remaining place where Nature has not been completely eclipsed by development. The vegetation provides important habitat for ecological niches for resident wildlife.

The Pompeston Creek Environmental Inventory catalogues the vegetation well. (http://www.pompestoncreek.org/pcei/index.htm) There are 112 different plants noted in the Inventory, ranging from trees and shrubs to grasses and other herbaceous plants. Understandably, the vast majority of them are wetland species; this reflects the hydrology of the creek. Thirty of the identified plants are non-native. This means they are plants which were imported to the country from elsewhere in the world and they are now thriving and propagating new plants season after season. Native plants, on the other hand, are plants that originated in the area and so they are recognized as 'the locals' within the plant community.

In recent years much has been made of the value or threat posed by non-native plants. There is a lot of worry these days that non-native plants threaten native plant populations.

The truth is, there was a time, about twenty-five years ago, when horticulturalists thought that native plants were the problem. At that time, Dutch Elm disease had just destroyed most of the majestic elms that lined America's suburban streets. Municipalities were devastated. The conventional wisdom back then was that there were too many native trees planted in close proximity to each other. Under those conditions, plant diseases and infestations spread rapidly, creating problems like the plight of the decimated American Elms.

Michael Robinson, Riverton Environmental Commission Chair, kayaking on the Pompeston

In response to that crisis 25 year ago, the horticultural industry promoted the introduction of plants that were called 'exotics.' We now call the plants 'non-native.' The exotics were less common and thought to be more disease resistant than common native plants. So for the last twenty-five years the landscape industry has been planting more and more non-native plants.

Well, now the pendulum has swung the other way. Too many non-native plants have been introduced into the environment and some of them are squeezing out native plant populations. The reality is that it is less important whether or not a plant is native or non-native, and more important whether or not the plant is *invasive or non-invasive.*

Of the thirty non-native plants identified in the Pompeston Creek Inventory, only eleven (11) are classified as invasive plants. The National Invasive Species Council defines invasive species as "… those that are not native to the ecosystem under consideration *and that cause or are likely to cause economic or environmental harm or harm to human, animal, or plant health*…. Furthermore for policy purposes, to be considered invasive, the negative impacts caused by a non-native species will be deemed to outweigh the beneficial effects it provides…" (emphasis added)

Some non-native plants are harmless. They are not likely to take over an area and prohibit other plants from establishing themselves. Non-invasive plants, both native and non-native, can share the environment and create a vegetatively-diverse ecosystem. Ecosystems with a lot of plant diversity are more likely to have a lot of habitat diversity, which leads to wildlife diversity. All tolled, it equals a healthy bio-diversity.

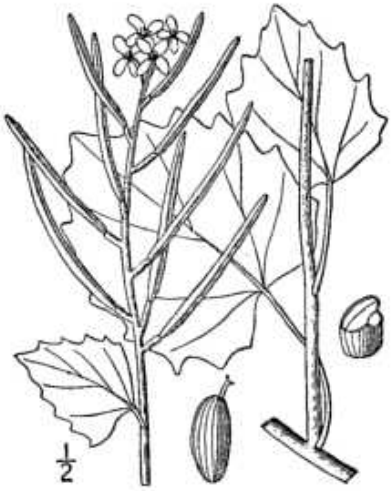
Invasive species, on the other hand, preclude bio-diversity and that's not healthy. In the Pompeston Creek the plants which are considered invasive include the following:

- Norway maple (tree)
- Tree-of-heaven (tree)
- Garlic mustard (herbaceous or weed-like, plant)
- Porcelian ampelosis (vine)
- Oriental bittersweet (shrub)
- Honeysuckle (vine)
- Common reed (tall grass)
- Kudzu (vine)
- Japanese knotweed (large herbaceous plant)
- Black locust (tree)
- Multiflora rose (shrub)

Photographs of these plants, along with some of their most identifiable features are included here. Removing invasive species from the environment will improve its biodiversity and the overall healthy of the Pompeston Creek. However, considering the susceptibility of the creek's banks to erosion, wholesale eradication of invasive species is not recommended without a carefully planned strategy to maintain the stability of the stream banks to minimize erosion and sedimentation in the creek bed.

Norway Maple (Acer platanoides) tree, leaves and seed pods. The seed pods can often be found on the tips of children's noses. USDA. Natural Resources Conservation Service. 'Plants Database.'

Tree-of-Heaven (Ailanthus altissima) sapling and its leaves and flowers. USDA. Natural Resource Conservation Service. 'Plants Database' and the Univ. of Connecticut. 'Plant Database of Trees, Shrubs and Vines.'



Sketch of Garlic Mustard (Allararia petiolata) plant. A tall herbaceous plant, with a photo of its flowers and leaves. USDA. Natural Resource Conservation Service. 'Plants Database.'

Porcelian Ampelosis (Ampelopsis brevipedunculata) vine with berries. Univ. of Connecticut. 'Plant Database of Trees, Shrubs and Vines.'

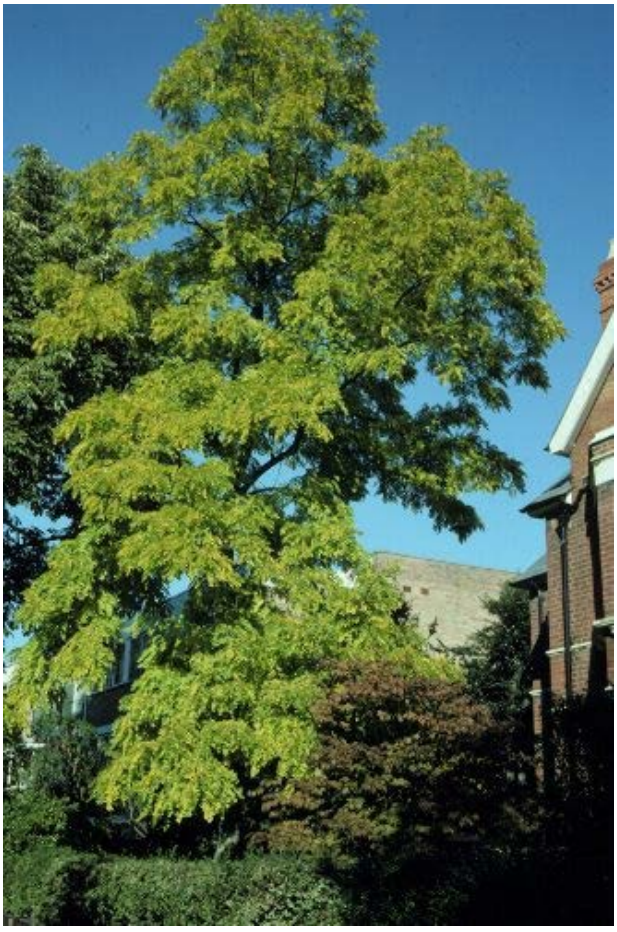
Oriental bittersweet (Celastrus orbiculatus) vine in spring and summer. Univ. of Connecticut. 'Plant Database of Trees, Shrubs and Vines.'

Honeysuckle (Lonicera japonica) vine. Very fragrant when in flower. USDA. Natural Resource Conservation Service. 'Plants Database.'

Common reed (Phragmites australis). USDA. Natural Resource Conservation Service. 'Plants Database.'

Kudzu vine (Pueraria montana). USDA. Natural Resource Conservation Service. 'Plants Database.'

Japanese knotweed (Polygonum cupsidatum). Large herbaceous plant, bordering on a shrub, sometimes called a 'subshrub.' USDA. Natural Resource Conservation Service. 'Plants Database' and the Burke Museum of Natural History and Culture.



Black locust (Robinia pseudooacacia) tree, with its leaves and flowers. USDA. Natural Resource Conservation Service. 'Plants Database' and the Univ. of Connecticut. 'Plant Database of Trees, Shrubs and Vines.'

Multiflora rose (Rosa multiflora) shrub. This shrub has wicked thorns. USDA. Natural Resource Conservation Service. 'Plants Database'
Shrub

Plants within the Pompeston Creek in Riverton

as noted in the Pompeston Creek Environmental Inventory

Common Name	Scientific name	Plant type	Origin
American Elm	Ulmus americana	tree	native
American Holly	Ilex opaca	tree	native
Arrow Arum	Peltandra virginica	herbaceous	native
Arrow-leaved Tearthumb	Polygonum sagittatum	vine	native
Arrowwood	Viburum dentatum	shrub	native
Aster	Aster spp.	herbaceous	native
Bamboo	Arundinaria sp.	shrub	non-native
Barberry	Berberis sp.	shrub	native
Barrenwort	Epimedium	herbaceous	native
Bastard Indigo	Amorpha fruticosa	shrub	native
Beech	Fagus grandifolia	tree	native
Black Cherry	Prunus serotina	tree	native
Black Gum	Nyssa sylvatica	tree	native
Black Locust	Robinia pseudoacacia	tree	non-native/ INVASIVE
Black Oak	Quercus velutina	tree	native
Black Willow	Salix nigra	tree	native
Blackberry	Rubus spp.	shrub	native
Bouncingbet	Saponaria officinalis	herbaceous	non-native
Box Elder	Acer negundo	tree	native
Broad-leaved Arrowhead	Sagittaria latifolia	herbaceous	native
Bugleweed	Lycopus sp.	herbaceous	native
Bunchberry Dogwood	Cornus canadensis	shrub	native
Bur Cucumber	Sicyos angulatus	vine	native
Camphorweed	Heterotheca subaxillaris	herbaceous	native
Catalpa	Catalpa bignonioides	tree	non-native
Cattail	Typha x glauca	grass	native
Chestnut Oak	Quercus Montana	tree	native
Cinnamon Fern	Osmunda cinnamonea	herbaceous	native
Clearweed	Pilea pumila	herbaceous	native
Common Greenbrier	Smilax rotundifolia	vine	native
Common Mugwort	Artemisia vulgaris	herbaceous	non-native
Common Mullein	Verbascum thapsus	herbaceous	non-native
Common Reed	Phragmites australis	grass	non-native/ INVASIVE
Coontail	Ceratophyllum demersum	herbaceous	native
Crabapple	Malus sp.	tree	non-native
Crabgrass	Digitaria sp.	grass	native
Crinkled Hairgrass	Dechampsia flexuosa	grass	native

Common Name	Scientific name	Plant type	Origin
Deer-Tongue Grass	Panicum clandestinum	grass	native
Dodder	Cuscata sp.	herbaceous	native
Dotted Smartweed	Polygonum punctatum	herbaceous	native
Elderberry	Sambucus Canadensis	shrub	native
English Ivy	Hedera helix	vine	non-native
Evening Primrose	Oenothera biennis	herbaceous	native
False Solomon's Seal	Smilacina racemosa	herbaceous	native
Field Garlic	Allium vineale	herbaceous	native
Flat-Topped Goldenrod	Euthamia graminifolia	herbaceous	native
Flowering Dogwood	Cornus florida	tree	native
Fox Grape	Vitis labrusca	vine	native
Fragrant Wormwood	Artemisia annua	herbaceous	non-native
Garlic Mustard	Allaria petiolata	herbaceous	non-native/ INVASIVE
Glaucous Greenbrier	Smilax glauca	vine	native
Goldenrod	Solidago spp.	herbaceous	native
Goosefoot	Chenopodium spp.	herbaceous	native
Hackberry	Celtis occidentalis	tree	native
Horseweed	Conyza canadensis	herbaceous	native
Japanese Clematis	Clematis ternifolia	vine	non-native
Japanese Honeysuckle	Lonicera japonica	vine	non-native/ INVASIVE
Japanese Hops	Humulus japonicus	vine	non-native
Japanese Knotweed	Polygonum cuspidatum	herbaceous	non-native/ INVASIVE
Japanese Yew	Taxus cuspidata	shrub	non-native
Jewelweed	Impatiens capensis	herbaceous	native
Kudzu	Pueraria Montana	vine	non-native/ INVASIVE
Lamb's Quarters	Chenopodium album	herbaceous	native
Large Bur-Marigold	Bidens laevis	herbaceous	native
Leafy-flowered Blackberry	Rubus pensilvanicus	shrub	native
Long-bristled Smartweed	Polygonum caespitosum var. longisetum	herbaceous	non-native
Mock Orange	Philadelphus coronaries	shrub	non-native
Mountain Laurel	Kalmia latifolia	shrub	native
Multiflora Rose	Rosa multiflora	shrub	non-native/ INVASIVE
New York Ironweed	Vernonia noveboracensis	herbaceous	native
Ninebark	Physocarpus opulifolius	shrub	native
Norway Maple	Acer platanoides	tree	non-native/ INVASIVE

Common Name	Scientific name	Plant type	Origin
Oriental Bittersweet	Celastrus orbiculatus	vine	non-native/ INVASIVE
Pickerelweed	Pontederia cordata	herbaceous	native
Pin Oak	Quercus palustris	tree	native
Poison Ivy	Toxicodendron radicans	vine	native
Pokeweed	Phytolacca americana	herbaceous	native
Porcelain Ampelosis	Ampelopsis brevipedunculata	vine	non-native/ INVASIVE
Princess Tree	Paulownia	tree	non-native
Prostrate Knapweed	Polygonum aviculare	herbaceous	non-native
Queen Anne's Lace	Daucus carota	herbaceous	non-native
Red Cedar	Juniperus virginiana	tree	native
Red Maple	Acer rubrum	tree	native
Rice Cutgrass	Leersia oryzoides	grass	native
Sassafras	Sassfras albidium	tree	native
Scentless Mock Orange	Philadelphus inodorus	shrub	native
Sensitive Fern	Onoclea sensibilis	herbaceous	native
Silky Dogwood	Cornus amomum	shrub	native
Spatterdock	Nuphar advena	herbaceous	native
Spicebush	Lindera benzoin	shrub	native
Spiderwort	Tradescantia	herbaceous	native
Stinging Nettle	Urtica dioica	herbaceous	native
Sugar Maple	Acer saccharum	tree	native
Swamp Loosestrife	Decodon verticillatus	grass	native
Sweet Flag	Acornus calamus	herbaceous	native
Sweet Pepperbush	Clethra alnifolia	shrub	native
Sycamore	Platanus occidentalis	tree	native
Tree-of-Heaven	Ailanthuis altissima	tree	non-native/ INVASIVE
Tulip Poplar	Liriodendron tulipifera	tree	native
Virginia Creeper	Parthenocissus quinquefolia	vine	native
Virginia Knotweed	Polygonum virginianum	herbaceous	native
Water Hemp	Acnida cannabina	herbaceous	native
Weeping Willow	Salix babylonica	tree	non-native
White Ash	Fraxinus americana	tree	native
White Mulberry	Morus alba	shrub	non-native
White Oak	Quercus alba	tree	native
White Snakeroot	Eupatorium rugosum	herbaceous	native
Wild Ginger	Asarum canadense	herbaceous	native
Wild Rice	Zizania aquatica	grass	native
Winterberry	Ilex verticillata	shrub	native
Yarrow	Achillea millefolium	herbaceous	native
Yellow Flag	Iris pseudacornus	herbaceous	non-native

BIOLOGICAL RESOURCES

B. Wildlife and Habitat

This section of the Environmental Resource Inventory examines the existing wildlife and natural habitat in Riverton. This is also the first section in which the environmental information explained in previous sections becomes increasingly relevant to an understanding of the information in this section. The environment is a web of interconnected ecological parameters that relate to each other and have consequences that affect the whole ecosystem as well as its individual parts. Understanding the parts, and how they relate to each other is essential.

The ERI has already noted a few relationships between various sections, for instance the explanation of the geological 'stack of pancakes' in the geology section helped to explain the function of the groundwater system and its related aquifers, which were described in the water resources sections. However, a discussion of wildlife and habitat relies heavily on and understanding of several environmental parameters, including soils, topography, water resource, climate and vegetation.

In less developed towns, Nature has room to compensate for losses due to development. In Riverton, most of the natural environment is disturbed already, so any new element of Nature that gets disturbed will have some impact on that which remains. There is less tolerance for change in Riverton's natural ecosystem because it is so confined.

Riverton's natural lands are also threatened by development outside the municipality. Almost all of the Borough's undeveloped land exists along the Pompeston Creek. Unfortunately development upstream contributes to the siltation and degradation of the creek in Riverton, as already noted in the water resources section of this ERI.

Since Riverton's existing natural environment hangs in a precarious balance, complicated even more by outside forces, it's going to take a special effort on the part of the Borough to protect the remaining local resources. Understanding the ecology, its wildlife and habitat, is a good first step.

Ecology *n.*
The science of the interaction and relationship between living organisms and their environments.
-Webster's Dictionary

The 'connectiveness' or the degree to which every aspect of the environment is connected to every other element of the environment, is often difficult to comprehend. Various aspects of nature relate to each other on many levels. They include vegetation, soil, water, light, elevation, seasons, air quality, noise, time of day, food sources, shelter, territories, and many more.

To illustrate this point, we might consider the local turtles. Some say that Cindy Pierson has made local turtle populations a community favorite. She notes with some concern that female snapping turtles need to survive the first 15 years of their lives before they can begin to lay eggs. To complicate matters, the female turtles only lay their eggs once a year - during a full moon - between April and May. If something happens to the turtles during those first 15 years, or if some activity disturbs their habitat during the full moon between April and May, Riverton can lose a whole generation of turtles. This example of Nature's complexity illustrates one element of Nature's sensitivity. Now try and think about every element of Nature and imagine that most of the valuable animals and plants in Riverton's environment depend on a similarly sensitivity set of prerequisites.

The connectivity of nature can work against a healthy environment, if the balance isn't just right. Human activity that draws rodents and raccoons to trash cans can increase the size of predator populations that excavate turtle nests and feed on turtle eggs. That's another way to lose a generation of turtles.

The few delicate areas of Nature that exist in Riverton are important to the Borough's overall character. As noted in the Borough's Master Plan, one of the things that is so special about this town is the fact that it is a microcosm of the larger world. It has commercial and residential areas, a variety of shops and a whole range of housing styles, as well as a valuable touch of Nature. Wildlife,

Snapping Turtle Eggs.
Cindy Pierson

and the habitat that supports it, is an important part of Riverton's unique character.

The Pompeston Creek Environmental Inventory summarizes much of the wildlife that live in the Pompeston watershed. http://www.pompestoncreek.org/pcei/index.htm. It also notes the kind of wildlife that could inhabit the watershed. Such species have not been seen in the watershed, but the habitat of the area could support them.

We know the quality of the creek has been degraded. A water resource analysis noted earlier showed that the water quality in the Pompeston Creek is polluted with sediments. But the habitat quality of the creek remains good. If the overall health of the natural environment could be restored, wildlife populations which could inhabit the ecosystem might become more abundant and the wildlife population would be more diverse.

The following information was taken from the Pompeston Creek Environmental Resource Inventory; however, for the purposes of this inventory, the species have been regrouped relative to those animals that we know exist in the area, and those that might. This helps us better understand the existing state of the natural environment and compare that to its potential.

For instance, under ideal conditions, Riverton could enjoy more than twice as many birds as currently exist, and almost three times as many mammals. Fish, reptiles and amphibians populations could increase by approximately 50%. These statistics tell us that the water environment in which the fish, amphibians and reptiles live, sustains a greater proportion of the total number of species that could live in that ecosystem than does the terrestrial environment. The number of different birds and mammals that might live in Riverton if we could improve the environment would increase more dramatically.

Animals *Found and Living* within the Pompeston Creek Watershed
as noted in the Pompeston Creek Environmental Inventory

Common Name	Scientific name
Birds	
American goldfinch	Carduelis tristis
Bald Eagle	Haliaeetus leucocephalus
Belted kingfisher	Ceryle alcyon
Bluejay	Cyanocitta cristata
Canadian goose	Branta canadensis
Common grackle	Quiscalus quiscula
Dark-eyed junco	Junco hyemalis
Great blue heron	Ardea herodias
Great or American egret	Casmerodius albus
Grey catbird	Dumetella carolinensis
Mallard duck	Anas platyrhynchos
Marsh wren	Cistothorus palustris
Osprey	Pandion haliaetus
Red-tailed hawk	Buteo jamaicensis
Red-winged blackbird	Agelaius phoeniceus
Ruby-crowned kinglet	Regulus calendula

Snowy egret	Egretta thula
Song sparrow	Melospiza melodia
Tree swallow	Tachycineta bicolor
White-breasted nuthatch	Sitta carolinensis
White-throated sparrow	Zonotrichia albaicollis
Woodpeckers	Unidentified species
Mammals	
Big brown bat	Eptesicus fuscus
Eastern chipmunk	Tamias striatus
Gray squirrel	Sciurus carolinensis
Little brown bat	Myotis lucifugus
Muskrat	Ondatra zibethica
Opossum	Didelphis marsupialis
Raccoon	Procyon lotor
Red bat	Lasiurus borealis
Striped skunk	Mephitis mephitis
Woodchuck	Marmota monax
Fish	
Alewife	Alosa pseudoharengus
American Eel	Anguilla rostrata
American shad	Alosa sapidissima
Banded killifish	Fundulus diaphanous
Brown bullhead catfish	Ameriurus nebulosus
Carp	Cyprinus carpio
Channel catfish	Ictalurus punctatus
Herring	Clupea species
Hickory shad	Alosa medirocris
Largemouth bass	Micropterus dalmoides
Mummichog	Fundulus heteroclitus
Pumpkinseed sunfish	Lepomis gibbosus
Sea lamprey	Petromyzon marinus
Shiners	Various species
Striped bass	Morone saxatilis
Tesselated darter	Etheostoma olmstedi
White catfish	Ameiurus catus
White perch	Morone americana
Yellow perch	Perca flavescens
Reptiles and Amphibians	
Black rat snake	Elaphe obsolete
Bullfrog	Rana catesbeiana
Eastern garter snake	Thamnophis sirtalis
Eastern painted turtle	Chrysemys picta
Esastern box turtle	Terrapene carolina Carolina
Fowler’s toad	Bufo woodhousi fowleri
Green frog	Rana clamitans melanota
Musk turtle (Stinkpot)	Sternotherus odoratus
Northern black racer (last seen in 1901)	Coluber constrictor

Northern brown snake	Storeria dakayi
Northern water snake	Nerodia sipedon
Redback salamander	Pletodon cinereus
Red-bellied turtle	Pseudemys species
Snapping turtle	Chelydra serpentina

Snowy Egret

Striped Bass

American Egret

American Goldfinch

Eastern Chipmunk

Based on the environment of the existing habitat, the following animals could live and thrive in the Pompeston Creek Watershed.

Animals That ***Could Live*** within the Pompeston Creek Watershed

as noted in the Pompeston Creek Environmental Inventory

Common Name	Scientific name
Birds	
American bittern	Botaurus lentiginosus
American black duck	Anas rubripes
American coot	Fulica americana
American kestrel	Falco sparverius
American robin	Turdus migratorius
American wigeon	Anas amerciana
Baltimore oriole	Icterus galbula
Bank swallow	Riparia riparia
Barn swallow	Hirundo rustica
Black-crowned night heron	Nycticorax nycticorax
Blue-winged teal	Anas discors
Bobolink	Dolichonyx oryzivorus
Bobwhite quail	Colinus virginianus
Bufflehead	Bucephalavalbeola
Cattle egret	Bubulcus ibis
Common gallinule (Morrhen)	Gallinula chloropus
Common merganser	Mergus merganser
Cooper's hawk	Accipiter cooperii
Double-crested cormorant	Phalacrocorax auritus
Gadwall	Anas strepera
Great cormorant	Phalacrocorax carbo
Great horned owl	Bubo virginianus
Great-crested flycatcher	Myiarchus crinitus
Greater scaup	Aythya marila
Green heron	Butorides striatus
Green-winged teal	Anas crecca
Killdeer	Charadrius vociferous
King rail	Rallus elegans
Least bittern	Ixobrychus exilis
Lesser scaup	Aythya affinis
Long-eared owl	Asio otus
Northern cardinal	Cardinalis cardinalis
Northern harrier	Circus cyaneus
Northern pintail	Anas acuta
Northern shoveler	Anas clypeata
Pied-billed grebe	Podilymbus podiceps
Red-bellied woodpecker	Melanerpes carolinus
Redhead	Aythya americana

Red-shouldered hawk	Buteo lineatus
Ringed-necked duck	Aythya collaris
Ringed-necked pheasant	Phasianus colchicus
Rough-legged hawk	Buteo lagopus
Ruddy duck	Oxyura jamaicensise
Rufous-sided towhee	Pipilo chlorurus
Sharp-shinned hawk	Accipiter striatus
Short-eared owl	Asio flammeus
Sora rail	Porzana Carolina
Spotted sandpiper	Actitis macularia
Swamp sparrow	Melospiza georgiana
Virginia rail	Rallus limicola
Willow flycatcher	Empidonax trailii
Wood duck	Aix sponsa
Woodcock	Scolopax minor
Woodthrush	Hylocichla mustelina
Yellow rail	Coturnicops noveboracensis
Yellow warbler	Dendroica petechia
Yellow-shafted flicker	Colaptes auratus
Mammals	
Beaver	Castor canadensis
Bobcat	Lynx rufus
Coyote	Canis latrans
Eastern cottontail	Sylvilagus nuttalli
Eastern mole	Scalopus aquaticus
Eastern pipistrel	Pipistrelius hesperus
Feral cat	Felis catus
Feral dog	Canis familiaris
Gray fox	Urocyon cinereoargenteus
Hoary bat	Lasiurus cinereus
House mouse	Mus musculus
Keen myotis	Myotis keeni
Least shrew	Cryptotis parva
Longtail weasel	Mustela frenata
Masked shrew	Sorex cinereus
Meadow vole	Microtus pennsylvanicus
Mink	Mustela vison
Norway rat	Rattus norvegicus
Red fox	Volpes fulva
Rice rat	Oryzomys palustris
River otter	Lutra Canadensis
Shorttail shrew	Blarina brevicauda
Silver-haired bat	Lasionycteris noctivagans
Smalled-footed myotis	Myotis subulatus
Southern flying squirrel	Glaucomys volans
Starnose mole	Condylura cristata
White-footed mouse	Peromyscus leucopus

Woodland jumping mouse	Napaeozapus insignis
Fish	
Atlantic sturgeon	Acipinser oxrinchus
Atlantic tomcod	Microgadus tomcod
Blueback herring	Alosa aestivalis
Shortnose sturgeon	Acipenser brevirostrum
Smallmouth bass	Micropterus dolomieu
Spottail shiner	Notropois hudsonius
White sucker	Catostomus commerconi
Reptiles and Amphibians	
American toad	Bufo americanus
Black racer	Coluber constrictor
Eastern mud turtle	Kinosternon subrubum
Eastern ribbon snake	Thamnophis sauritus
Eastern tiger salamander	Ambystoma tigrinum
Five-lined kinks	Eumeces fasciatus
Gray treefrog	Hyla versicolor and chrysoscelis
Map turtle	Graptemys geographica
Marbled salamander	Ambystoma opacum
Milk snake	Lampropeltis triangulum
Northern cricket frog	Acris crepitans
Northern ringneck snake	Diadophis punctatus edwardsii
Pickerel frog	Rana palustris
Redbelly turtle	Pseudemys rubriventris
Red-spotted newt	Notophthalmus viridescens
Rough green snake	Opheodrys aestivus
Southern leopard frog	Rana utricularia
Spotted salamander	Ambystoma maculatum
Spotted turtle	Clemmys guttata
Upland chorus frog	Pseudacris triseriata feriarum
Wood frog	Rana sylvatica
Wood turtle	Clemmys insculpta

The following photos illustrate animals that could live in Riverton if the quality of the existing habitat areas was improved through enhancement projects and protective planning.

Long Eared Owl

Yellow Warbler

River Otter

Black Racer

Southern Flying Squirrel

Southern Leopard Frog

NATURAL RESOURCES

A. Parks and Open Space

Parks and open space in Riverton include a collection of public and private properties. Memorial Park is a 13.86 acre park bounded by the Pompeston Creek and Cedar, Broad and 10th Streets. It's a mix of open fields and shady areas with places for gathering together or being quietly alone.

It's a favorite local community spot with a variety of recreational facilities, including:

- three (3) tennis courts
- two (2) basketball courts
- one (1) hard surface hockey court
- two (2) little league baseball fields
- two (2) regular-sized baseball fields
- one (1) soccer field (overlapping the baseball fields)
- two (2) wallball courts
- one (1) tot lot
- numerous picnic tables and grills
- jogging/walking trails along the creek.

The larger ball field has a covered grandstand with restroom facilities.

The park is used regularly by local organized sports teams for both children and adults. The teams include residents from Riverton as well as surrounding communities. Local schools visit the park as part of the after school program and occassional class trips.

Parking at the park is unstructured but generally adequate. While located close to the center of the Borough, pedestrians find it more difficult to reach from their neighborhoods on the river side of heavily trafficked Broad Street.

The park is maintained by the Borough with additional support from the Friends of Riverton Park, a group of resident volunteers who raise money for occasional enhancements. Memorial Park is the largest active recreational open space in Riverton and a valuable resource for the Borough.

The Pompeston Creek borders Memorial Park on the northeast side. The creek flows at the base of a significant bluff and provides a passive open space resource for Borough residents. It is wide and an excellent venue for non-motorized boating. Unfortunately, there is no convenient location to launch canoes, kayaks or rowboats and people are left to find their own way down to the water. This practice has undesirable consequences. Some people are reluctant use the creek and this valuable resource is under-appreciated. Others who try to enjoy the creek often trample valuable wildlife habitat because there's no controlled pathway to get to the water.

If one or two controlled access points were created away from places like turtle nesting sites and other critical habitat areas, existing habitats would be protected more effectively. This, in turn, would make the creek a more valuable eco-environment with greater biodiversity, which boaters could enjoy. As the community's enthusiasm for the creek increased, so would the community's respect for this sensitive ecosystem. This could lead to more efforts to improve the creek's ecology and hence a positive spiral could be generated to produce future enhancements of Pompeston Creek, making it an even more valuable open space resource for the Borough.

The Park and the creek are the largest expanses of open space in the Borough, except for the Delaware River. There are a number of smaller, isolated open space lots that are also noteworthy.

The Riverton County Club is a property that spans the Riverton/Cinnaminson municipal line in the southeast corner of the Borough. It is bound by municipal lines on two sides and Park and Thomas Avenues on the other two sides. The member-owned club is privately held, and the Riverton portion includes 10.77 acres. Though the Country Club has many facilities, the portion of the club which resides in Riverton is completely landscaped and includes only golf course fairways. There are no structures or other facilities in the Borough.

The Borough's current Affordable Housing Plan (COAH) established a planning caveat for the 10.77 acres of the club property. According to the Plan, if the club ever develops this site, it can only be developed with housing that includes affordable housing units. As long as the site remains in private ownership *and* continues as a golf course, it will remain a privately-held open space resource in the Borough.

Other open space lots are maintained by the Riverton School at Fifth and Howard Streets. The school system has a fenced-in set of basketball courts at the intersection of Fourth and Howard Streets and a tot lot and swings in another fenced-in lot at Fourth and Cinnaminson Streets. These are not municipally owned properties, but they are the only source of active recreation for children on publicly owned property on the river side of Broad Street. When school is not in session, local residents often use the school's playgrounds.

Riverton School Playground

Another open space lot that is often mentioned, though it is not publicly or quasi-publicly owned is the three acre site on the Delaware River west of the sewer plant. It is undeveloped and owned by National Casein. Published wetlands and floodplain maps indicate that a significant portion of the site is not developable. Access to the site is very constrained, if it is not accessed directly from the Borough's sewer plant site. Nonetheless, the site has valuable wetlands habitat, beautiful views of the Delaware River and potential access for un-motorized watercraft, if it could be utilized in conjunction

with the undeveloped portions of the sewer plant site. Presently, National Casein has no plans for the use of this lot.

The above mentioned open space areas, Memorial Park, Pompeston Creek, the Riverton Golf Course, the Riverton School playgrounds and the National Casein riverfront lot, constitute the most notable areas of open space within the Borough, both publicly and privately held. But in a built-up community like Riverton, the town shouldn't ignore other open space opportunities, unique to small town life.

Downtown Riverton, with its historic-looking storefronts and casual plaza spaces, is another open space resource that the community can enjoy. It's a place where people gather to meet, talk, and enjoy the recreation of the downtown. This may include eating out, shopping, visiting a coffee shop or relaxing on a sidewalk bench to watch passersby. Recent enhancements to the business district, and still others yet to be constructed, make this area a valuable part of Riverton open space system.

Also, the Borough's tree-lined streets are corridors of picturesque open space that traverse the town and create room for walking and biking. The Borough has undertaken a

bicycle and pedestrian planning project that identified ways to capitalize on and enhance these open space corridors. The quantitative results of the study should be coupled to this report and integrated into the Borough's Open Space and Recreation Plan Element.

NATURAL RESOURCES

B. River's Edge

The other significant location of natural open space in the Borough is the Delaware River. The view is beautiful and the activity of boats and water sports along the River is exciting. The Pennsylvania side is fairly industrial, but Philadelphia is generating plans to redevelop the waterfront with a mix of residential and commercial uses. Many of the existing and abandoned industrial spaces will be positively transformed. The river will continue to be an increasingly valuable resource for Riverton for many years to come.

Most of the water's edge is privately owned by residents who live along the river. Bank Avenue divides local residents' homes from the water. An unspecified number of the riverfront lots (it might be all of the riverfront lots) identify Bank Avenue as an easement given by previous land owners to the public for access along Bank Avenue. This street is not a right of way, although it is maintained by the Borough. The general public routinely walk, jog and ride their bikes along Bank Avenue.

The strip of land between Bank Avenue and the river is predominantly grass, maintained by the landowners, with isolated shade trees and some shrubbery. The bulkhead is fairly continuous from Howard Street to Morgan Avenue, although it is in various states of disrepair – seemingly sound in some places and completely destroyed in others.

Riverton's Delaware River Bulkhead, in good shape in some places and in disrepair in others.

There are isolated spots of public land at the River's edge, where the end of local streets abut the river. The end of Main Street is owned by the Yacht Club, with a long-standing deed restriction for public access. The end of Fulton Street is publicly owned, although it is developed in a manner that suggests it is privately held. And the end of Penn Street seems to be fairly well established as a public street to the water's edge, according to the original map of the founders' summer resort town in 1860.

However, there is some dispute within the community over contradictions between the tax map and the deeds of some local residents who live along the river. Historical deed research is necessary to definitively determine the ownership of the waterfront at the ends of Morgan, Linden, Thomas, Lippincott and Howard Streets.

The community in general has debated the best use of the Delaware riverfront for years. There is a public interest to be served by allowing the public to enjoy the riverfront but the public's interest must be balanced with the rights of the property owners. The degree to which the public is permitted to utilize the riverfront has never been formalized, but the public cannot expect to utilize private land without assuming some responsibility or compensating land owners.

The Open Space and Recreation Element to follow this report will provide an opportunity for constructive dialogue that *may* ultimately lead to a consensus over appropriate riverfront policy. For the purposes of this report, the riverfront should be identified as a valuable resource in the community; as critical today as it was when the Borough was established. For the purposes of public policy, it's worth pursuing a resolution to the public/private use of the riverfront.

HISTORICAL RESOURCES

A. General History

The history of Riverton is a tremendous part of the Borough's environment. The character of the Town is defined largely by the historic style of its homes, carriage houses, old fences, and lamp posts. Riverton has a distinctly historic environment. As time goes on, historic elements in Town are sometimes enhanced and restored to their original beauty, but other times they are obliterated to make way for more contemporary construction. The Master Plan repeatedly underscores the value of Riverton's historic features and the need to maintain them.

The town was founded when ten merchants from Philadelphia built a community of summer homes for their families in 1850. The original merchant founders were:

Founder	**Notes**	**Founder's Occupation**
William C. Biddle	Brother of Robert	Hardware merchant
Robert Biddle	Brother of William	Hardware merchant
Caleb Clothier	His son, Isaac was one of the founders of Strawbridge and Clothier	Owned a bricklaying company
James Clothier		Grocer
Prof. Charles D. Cleveland	A noted abolitionist	Owner of a girls' school
William D. Parrish	Brother of Dillwyn	Paper wholesaler
Dillwyn Parrish	Brother of William	Druggist
Daniel L. Miller, Jr.		Merchant
Rodman Wharton		Paint merchant
Chalkley Gillingham		Accountant

The men organized into a group called the Riverton Improvement Company. The company purchased 120 acres of prime farmland along the Delaware River across from the northern end of Philadelphia. It was a place that had easy access to Philadelphia via a rail line built in 1834. They eventually constructed a pier from which a ferry service to Philadelphia also operated. Since nine of the ten families were practicing Quakers, the area's close proximity to the Westfield Friends Meetinghouse was another attraction.

The land was initially purchased from two local farming families, the Lippincotts and the Atkinsons. The original farmhouses for these two families still stand as the two oldest homes in Riverton, located at 900 Main Street and 201 Main Street respectfully.

Lippincott Farmhouse, 900 Main Street
A Federal style home

Atkinson Farmhouse, 201 Main Street
A Georgian style home

After purchasing the land, the Riverton Improvement Company hired a famous architect, Samuel Sloan, to layout and design their new town. His design incorporated some over-arching guidelines for things like buildings and streetscapes; guidelines that created a unifying pattern and a sense of relaxing open space. The first town plan laid out 105 subdivided lots. It was the first *planned* residential community in America.

Original plan of Riverton, 1860

The town plan included a fairly rectilinear arrangement of tree-lined streets with the steamboat pier at the river's edge and a company store next to the railroad track. Sloan also designed several of the town's first homes or summertime 'villas.' Each one was distinctly different. Variety was important to Sloan's early vision of Riverton. That richness in the architectural styles is still evident today.

Sloan's early plan for Riverton had the largest residential lots on the Delaware. Lot sizes got smaller the farther they were from the river. There was a section of very small lots at the center of the plan near the intersection of Penn and Third Streets. Here Sloan envisioned working class people would live, within walking distance of their employers, the wealthy families of the Riverton Improvement Company.

Sloan also generated and insisted on the construction of some design details that would contribute heavily to the character of Riverton. Arguably, the most important detail that he advocated was the concept of the tree-lined streets. Heretofore, city planners had given little thought to the appearance of neighborhood streetscapes, but Sloan imagined

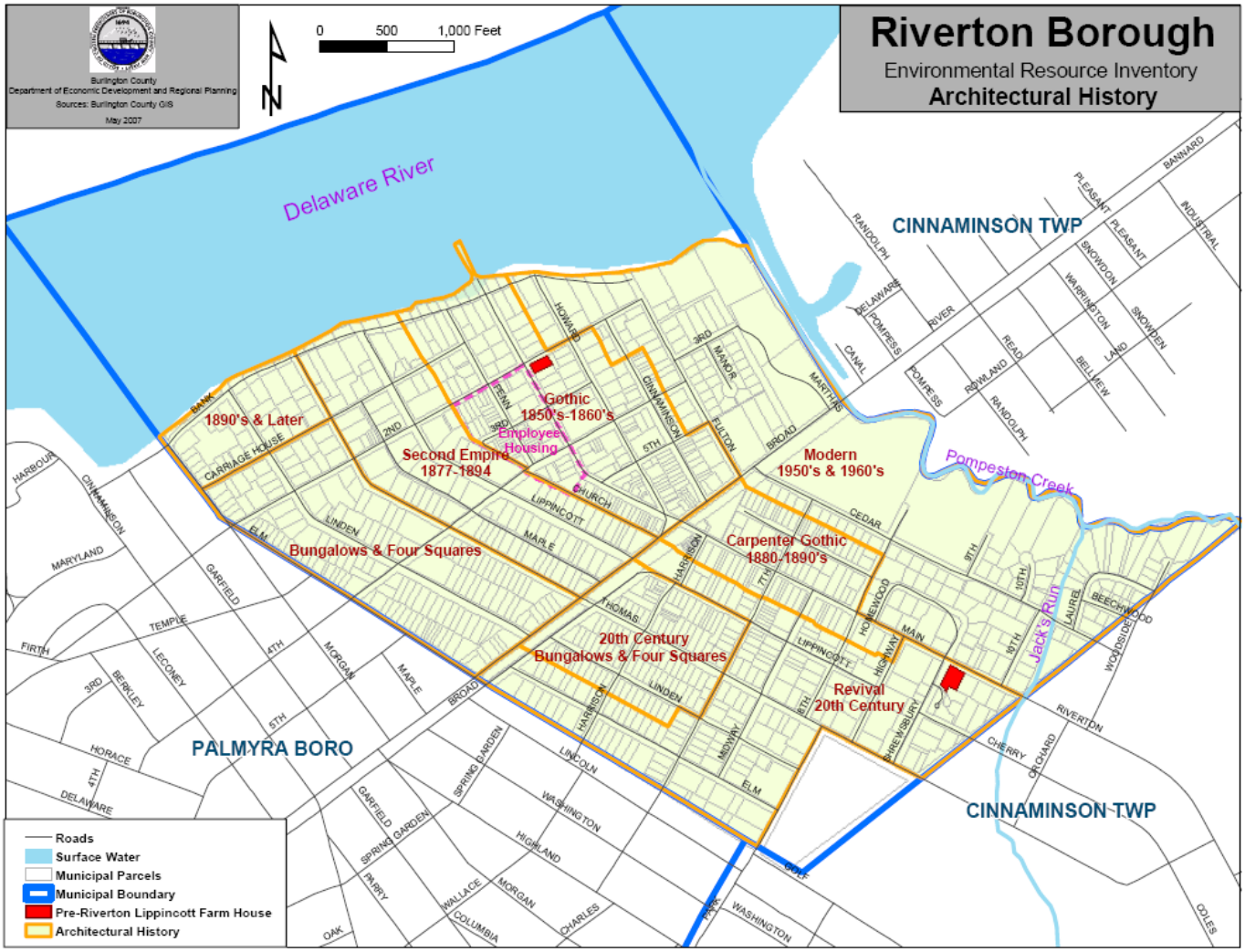
front lawns edged with sidewalks, abutting a planted strip with street trees between the sidewalks and the road pavement. This element remains a valued aspect of Riverton's environment.

Sloan's plans also included a village store at the intersection of Main and Howard Streets, a train station and a walled and landscaped riverbank along the Delaware. His attention to detail in both the buildings and the site at large was comprehensive and so the character of Riverton was fully developed when the town was born.

The earliest part of the Borough was built along Main and Howard Streets, between the river and the train tracks. Most of the homes built in the 1850's and 1860's were 'gothic' is style. More lots were added to the west beginning in 1877 when the 'Second Empire' style became fashionable. It wasn't until 1881 that the town plan was expanded across the railroad tracks and the 'Carpenter Gothic' period became popular. Soon after, the town grew westward along the river with small 'Bungalows' and 'Four Squares.' Each expansion meant another purchase of farmland from the Lippincotts or the Atkinsons.

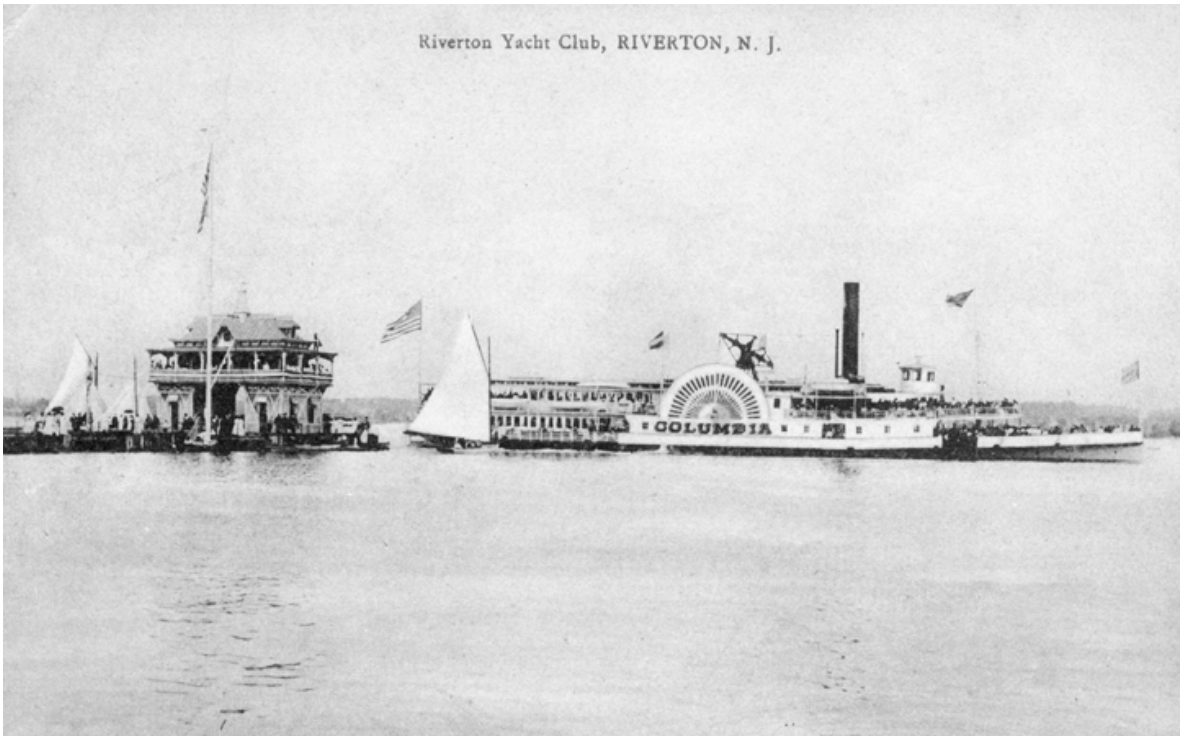
The invention of the automobile made traveling easier in the early 1900's, so the town continued to expand outward with more 'Bungalows' and 'Four Squares' as well as 'Revival' styled homes. The last couple of sections in Riverton, around Cedar, Ninth and Tenth Streets and Manor Court and Third Street, were built up in the 1950's and 60's. These last sections were built on land that was the old Dreer Nursery.

Each phase of the town's development can be traced through a dominant architectural style that prevailed at the time. It maps the richness of Riverton's housing as well as its development.



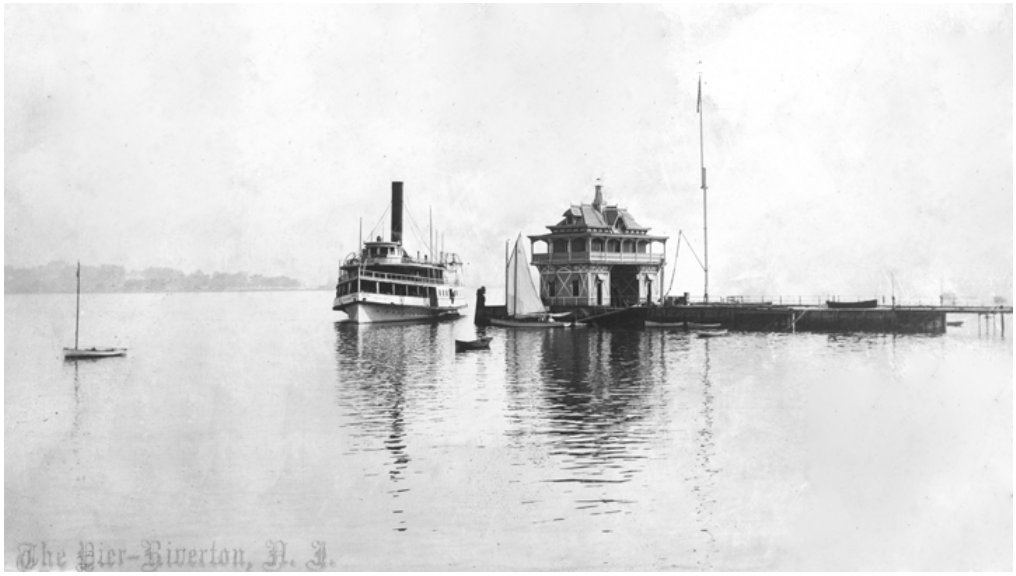
Map of Riverton and its phases by architectural styles.

But Riverton is more than beautiful historic homes. The Yacht Club, founded in 1865, is the oldest yacht club on the Delaware and the ninth oldest in the nation.



When the town was built, the original founder constructed a pier from which they chartered a side-wheeler to provide ferry service from Riverton to neighboring towns and Philadelphia. Then, in 1880 and 1881, a clubhouse was constructed on the pier. It was built with a stipulation that the building include a 'waiting room' for steamboat passengers. The waiting room is actually a breezeway through the first floor of the building.

The yacht club building was restored in 2001 with a grant from the William B. Dietrich Foundation. It's still a beautiful example of the town's 'Victorian Stick' style of architecture.



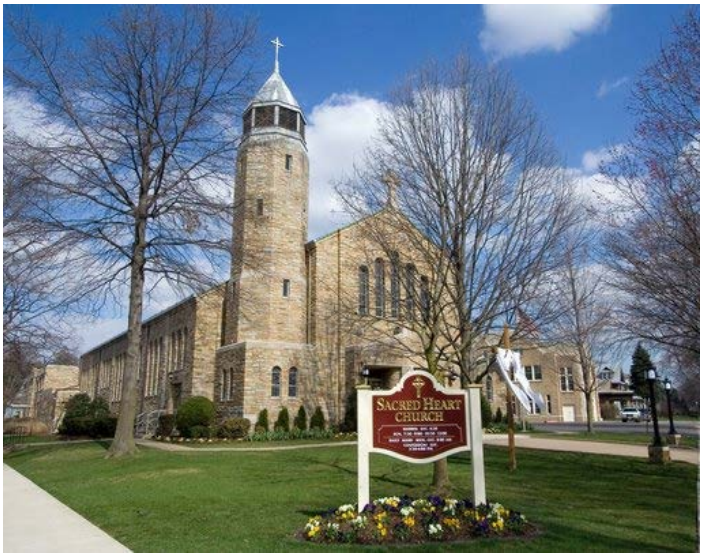
The Original Yacht Club

The Yacht Club today

The religious history of Riverton is as old as the town itself. The first congregation to assemble was that of the Christ Church. Members originally met in the private home of residents until a church was built in 1859. That building was expanded, and relocated, and expanded again. Then, in 1895 a new church was constructed and the original was moved to Palmyra.

Many other churches and faiths followed and opened their doors in Riverton. They included the Calvery Presbyterian Church, 1879, and the Catholic Church of the Sacred Heart, 1879, along with the Mount Zion A.M.E Church, 1896, St. Paul's Baptist Church, 1889. They are all beautiful and important elements of life in Riverton.

Calvary Presbyterian Church, 1879



Church of the Sacred Heart, 1879

In 1998 a significant portion of Riverton was approved for inclusion on the State's Register of Historic Places. The nomination for designation includes 526 properties. The following year, the properties were officially added to the National Register of Historic Places. A map of the 526 properties is currently under production.

Plan of State and National Historic Sites Registry (Map to be added in the future)

HISTORICAL RESOURCES

B. Specific Historic Styles

Many of the town's most significant architectural examples can be found in a compilation of the Borough's architecture, people and events called Historic Riverton by Bill Washington. A few of the notable sites that are representative of the various styles of architecture throughout the town include the following.

There are a couple of different types of Gothic style homes in town, including Gothic Revival and Carpenter Gothic. They were both prevalent between 1840 and 1880. **Gothic Revival** is characterized by steeply pitched roofs, cross gables and dormers, pointed windows, a one story porch and decorative 'vergeboards'.

102 Penn Street, Gothic Revival architecture

A 'vergeboard' is a decorative trim that hangs from the eaves of a gabled roof.

A very similar style is called **Carpenter Gothic.** It has the same steep roof, cross gables and pointed windows, but this style incorporates a vertical, board and batten type of siding. This siding was originally made of wood, a material that was very common in early American buildings.

The Riverton Free Library at 306 Main Street, an example of Carpenter Gothic architecture.

The **Second Empire** style dominated the second phase of Riverton's expansion between 1877 and 1894. This style is most easily recognized by its mansard roof line which usually includes rounded dormers. Houses are often symmetrical, rectangular and very large, with two and three stories with very tall, windows. The front entry is centered and includes two doors, or a 'double-leafed entrance'. The Biddle House is a nice example. It was built for Charles M. Biddle, the son of one of Riverton's original founders, hardware merchant Robert Biddle.

The Biddle House at 201 Bank Avenue, a Second Empire styled home.

Another common form of architecture is the **Stick style,** popular between 1850 and 1890, with its typical steep roof and gables, topped with ironwork ornamentation. It uses flat boards to form geometric designs over the exterior clapboards of the facades. Support posts and beams are square and the building is painted with bright, contrasting colors.

405 Main Street, a classic Stick style building.

The **Georgian style** of the 1700's is known for its symmetry, a floor plan that has four rooms on the first floor and four rooms on the second, otherwise known as 'four over four,' and the structures usually have five windows across the front. The entrance includes transom lights and pilasters around the door.

Georgian Style, as typified in this house at 400 Main Street.

Pilaster: A vertical column, often ornamental, that projects slightly from a wall.

The common box shape of the fairly symmetrical style of the **Federal or Adams** style house was popular around the turn of the 19th century. The main house was often modified with projecting wings or additions off of the main part of the house. Windows were aligned in symmetrical rows; with a six over six or four over four fenestration pattern and stone lintels overtop. There were elliptical fanlights over the front door, and decorative crowns, cornices and moldings, often with tooth-like dentils.

The Federal style as shown in this home at 900 Main Street, the original Lippincott farmhouse.

From 1825 to 1860, the low pitch of a hip roof and a centrally located cupola on a **Greek Revival** style houses distinguished them from other similarly symmetrical homes. The entrances are centered with transom windows and narrow sidelights. Porches with square columns span the full width of the house. A wide band of trim behind the porch roof and a cornice on the main roof are common. Six over six windows are usually painted black, while the rest of the structure is white.

The Caleb Clothier House, a Greek Revival home at 503 Bank Avenue.

Like so many other styles in Riverton, the **Italianate** style of the mid-1800's is a large, symmetrical and rectangular. However, the low pitched, hipped roof has wide eaves with supporting, decorative brackets. These houses usually include a cupola and sometimes a square tower. The windows on the first floor are particularly tall and narrow and the windows in the tower, if it has one, have arched tops. The front door, like Second Empire homes, is usually a double-leafed entrance.

The Italianate Style of James Clothier's house at 101 Main Street.

Riverton's **Queen Anne** style homes might have the most architectural variety of all the Borough's distinctive architectural themes. Popular around the turn of the 20th century, the style is not symmetrical. It has steeply pitched roofs, adorned with multiple gables and dormers. The façade of each floor may have a different material or style of clapboard. "L"-shaped porches are common and decorative woodwork and spindles abound. Stained glass windows and transoms are typically used with a unique fenestration that has small windows surrounding a large center pane.

A Queen Anne styled home built by Henry T. Walnut at 204 Lippincott Avenue.

From 1880 to 1900, one of the least ornate architectural styles was the **Shingle** style, characterized by its natural colors, informal appearance and fairly plain facades. The roofs were steeply pitched and gabled, often with several different levels of eaves. Porches often span the whole width of the house and the chimneys were large and visually prominent.

The Shingle design of the Spackman House at 205 Lippincott Avenue.

Less often recognized, but no less important to Riverton's environment, are the many bungalows that were built as the town grew and compact homes for the working class families that served the wealthier founding families.

A typical bungalow at 16 Carriage House Lane.

A typical home of the working class.

COMMUNITY RESOURCES

A. Water, Sewer, Cable, Telephone and Electrical Services

Riverton's water service is provided by New Jersey American Water (NJAW). Headquartered in Voorhees, New Jersey, the company has serviced New Jersey for more than 100 years. It has three divisions in New Jersey. Riverton is part of the 'Western Division.' This division has 71 wells, one surface water intake source and eleven 'points of source water' – points of source water are points at which NJAW purchases water from the Maple Shade Water Department. Only 41 of the wells are in permanent use. The others are either used seasonally, on an emergency basis or shut down and waiting in reserve. While the company has the ability to draw water from any of its sources, run the water through the treatment plant and direct it to anywhere in the Western Division system, most of Riverton's water comes from the company's single surface water intake, located in Cinnaminson at the end of Taylors Lane.

The wells draw water from the lower, middle and upper Potomac-Raritan-Magothy aquifers. They generate anywhere from 100,000 gallons of water per day to a little over two million gallons of water per day. The surface water intake, which takes in water from the Delaware River, provides 40 million gallons of water per day. It is clearly the largest water source for the region.

The company's water quality reports track a series of potential contaminants which could affect water quality. Of course, the water company treats all of the source water, making it potable for human consumption. It monitors contaminants like inorganic chemicals, (barium, fluoride and nitrate) and treatment by-products; these are chemicals that are the by-product of drinking water disinfection. It also tracks volatile organic chemicals (man-made compounds), the water's turbidity, and radiological substances; along with total organic carbon (which occurs naturally in the environment) and chlorine, a disinfectant used in the water treatment process.

American Water reported compliance levels for all these contaminants, but what's interesting to note is the source of most of them. Many of these contaminants get into the water through the erosion of natural deposits. These contaminants are in both the surface water of the Delaware and the well water. This means that the water company's water quality reports confirm earlier observations made in the soil and water resources sections of this ERI which noted that local soils are easily eroded and, with the aquifer so close to the surface, the eroded soils with associated pollutants flow directly into the groundwater.

While the community can be confident that the Water Company will treat all source water adequately and make it safe to drink, it would be prudent to remain cognizant of potential problems that could arise when aquifers are depleted and groundwater becomes increasingly polluted. Obviously the concentration of contaminants in the aquifer could rise which wouldn't be good for the environment or the communities that depend on it.

Sewer service in Riverton is managed locally. The Borough's sewage treatment plant was built in 1999 and came on line in 2000. It replaced the previous plant that had been constructed in 1915 and renovated in 1953.

The new plant has the capacity to treat 220,000 gallons per day. The average daily flow is about 150,000 gallons, but in the morning, the peak flow usually reaches between 160,000 and 170,000 gallons. The plant managers prefer to run the plant at 85 to 90% capacity, which allows some room for unexpected situations. For instance, the sewer lines under the local streets are old and often cracked. The old lines get replaced when other, unrelated projects require tearing up the road and exposing pipes, but otherwise, the Town makes due with the old sewer lines.

Because many of the lines are cracked, there's a noticeable amount of infiltration of rainwater into the sewer lines during rain storms. Rainwater percolates into the soil, collects around the buried sewer lines and infiltrates into the sewer lines, hence, the flow into the plant increases during rainy periods. And yet, even with this infiltration, the plant maintains adequate capacity for minor developments, such as one new house here or there, but any major development would require additional sewer plant capacity.

Cable, electrical and telephone services are all provided on overhead wires. Cable service is provided by Comcast under a fifteen year franchise agreement which was entered into by the Borough in 1999. The agreement expires on January 10, 2014. Three years prior to that date, a review period begins, during which the Borough evaluates the cable operator's service based on specific federal guidelines and tests. A report by the Borough is due on or before January 10, 2013. If problems are identified, Comcast will be given an opportunity to correct the problems, before the franchise agreement expires and the contract is re-negotiated.

Electric power and gas services are provided to Borough residents by Public Service Electric and Gas (PSEG). For purposes of public security, the company does not routinely release information on the location of its substations and gas mains, nor would it be prudent for the Borough to publish such information, if it was known.

Most of the electric service in the Borough is provided on overhead lines. Those lines, and the poles on which they hang, are owned by PSEG. The utility company shares the poles with Comcast for cable service and Verizon for telephone service. Electric power lines are at the top, cable lines are in the middle and the lowest lines are the telephone wires.

PSE&G is responsible for all the overhead electrical lines. When residents or businesses choose to bury electrical service lines, the buried lines, between the right of way and the building become the property of the land owner – PSE&G does not retain ownership of buried lines on private property.

Telephone lines located on PSE&G poles are owned jointly by Verizon and PSE&G. When residents or businesses contract with telephone service providers other than Verizon, the other service providers pay a fee to Verizon for the use of their lines; effectively the other phone service providers 'lease' the lines from Verizon.

Occasionally, telephone or cable lines are strung in locations where PSE&G does not have high voltage cables. In those incidents, the cable or telephone company may install their own poles from which to hang their lines. Presently fiber optic service, which could provide faster telephone and Internet service or clearer television service, is not available in Riverton.

In 2005, the Borough entered into an agreement with Omnipoint Communications Enterprise to lease a portion of the Borough's sewer plant site for the construction of a wireless phone service tower for T-Mobile. That tower has since been constructed and the tower is operating.

COMMUNITY RESOURCES

B. Transportation

The Borough of Riverton has a long history related to transportation. The area was selected by the original founders in part because it was accessible to both the railroad and ferry service to and from Philadelphia.

For much of the twentieth century the rairoad was dormant, but it was reactivated in March of 2004. The line was upgraded and reopened under the management of a group known as the Southern New Jersey Rail Group (SNJRG), an association including Bechtel Infrastructure Corporation, Adtranz and Parsons Brinckerhoff. The SNJRG was contracted by New Jersey Transit to design, build, operate and maintain the new light rail system.

The system is thirty-four mile long, connecting Trenton with Camden. It has twenty stations, including Riverton and it is the first light rail line in the United States to use deisel engines; most light rail systems use electric powered engines. The line parellels Route 130 and the Delaware River, running between the two, approximately a mile and a quarter west of the highway.

Service on the line is shared by NJTransit, which operates passenger trains and Conrail, which runs freight trains. The use of the tracks is divided according to a schedule that allows passenger trains to run during peak hours and freight trains to run during off peak hours.

Each train station is a little different. Per the Borough Master Plan, the Riverton station was designed to be a 'kissme stop,' not a destination stop. A kissme stop is a small railroad station with minimal parking. This design is appropriate for a compact, downtown setting like Riverton where a large parking lot would adversely impact the downtown.

The small scale of the Riverton station is designed to encourage people to walk or ride their bikes to the train, or to ask a friend or relative to drop them off, hence the term 'kissme stop.'

Senior citizens, children ages five through eleven and disabled citizens can all ride the rail at reduced fares. There is no ticket counter in Riverton, although the stop has two ticket vending machines. Bicylces are permitted on all RiverLINE trains, as long as they are secured in the on-board bike racks.

In addition to encouraging people to ride their bikes to the station, the rail line interesects with a New Jersey Transit bus line, route number 419. This provides an excellent oppurtunity for intermodal transportation. The bus line runs down Broad Street, parellel to the rail line. The current schedule for the bus can be found at the following website: http://www.njtransit.com/pdf/bus/T0419.pdf.

By coordinating bus and train schedules, passengers can ride the bus to the train and on to Philadelphia or Trenton. The current train schedule can be found at this website: http://www.riverline.com/NJL3450_Timetable_PD8_web%20nf%2091906.pdf.

Bikes are another mode of transportation in Riverton. The Town does not have a coordinated bicycle system, though it is small enough so that almost anyone could bike to almost anywhere within the Borough with little effort. Yet, conflicts with vehicular traffic cause problems for bikers. A recent grant from the New Jersey Department of Transportation (NJDOT) was given to the Borough to study ways to improve bicycle and pedestrian circulation and safety. The results of the study and any plans it generated should be coupled to this report.

Vehicular transportation is a issue of particular concern in Riverton. Broad Street is a busy County road and a signficant amount of commuter traffic comes along Broad Street to Main Street to funnel people to Route 130. Many commuters have discovered shortcuts over Riverton's local roads, like Linden, Thomas and Lippincott. The wide cartway of these local streets make them particularly attractive for cut through traffic.

Broad Street is the subject of a streetscape enhancement project. Some improvements were made to the road when the rail line was renovated. On street parking was added, some interesections were redesigned and made narrower, commonly referred to as a choker intersection, and substantial improvements were made to the interesection of Main and Broad Streets.

The upcoming enhancement project will continue improvements to Broad Street's sidewalks, curbing and lighting. While the appeal of Broad Street is improving, it is still difficult for pedestrians to cross the wide cartway at any location. Therefore, this county road effectively divides the town. The NJDOT pedestrian and bicycle study generated interesting proposals for resolving this situation and improving the cohesiveness of the town.

Lastly, no discussion of transportation would be complete without some mention of boating in the Borough. The Riverton Yacht Club is a private sailing club. With the long established stipulation that the club maintain a waiting area for the public, specifically steamboat passengers, the general public retains access rights along the pier through the building.

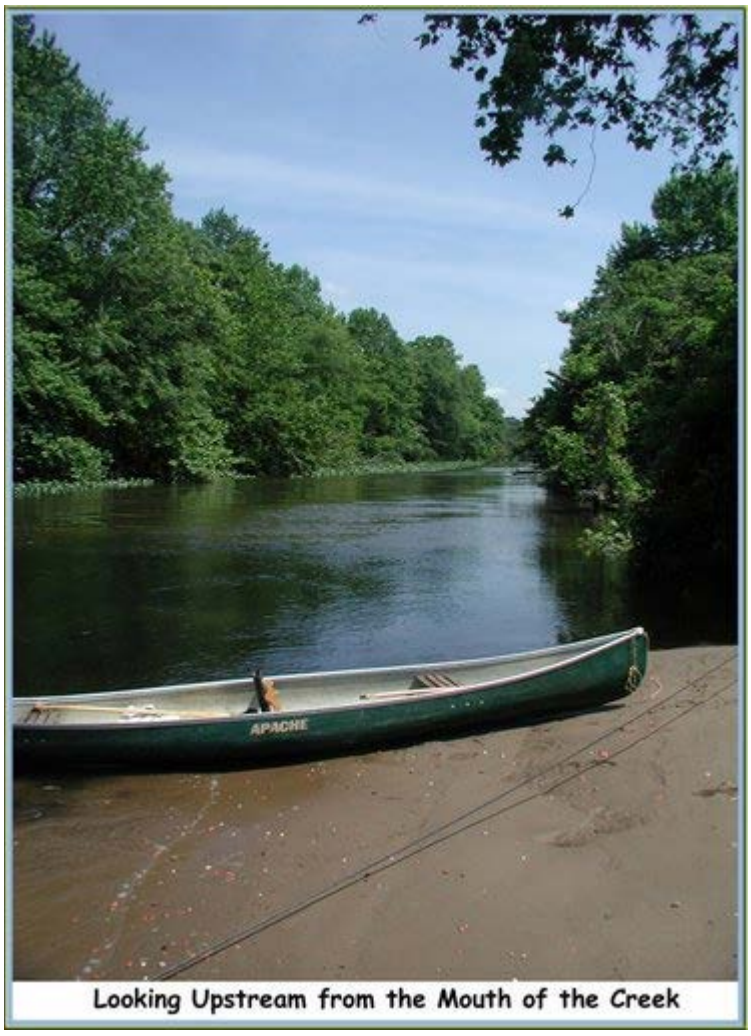
The yacht club hosts many racing events throughout the year, including the Governor's Cup Regatta. Many different classes of boats are moored and raced in Riverton and it is a popular source of local recreation.

Small crafts like canoes and kayaks are commonly seen on the Delaware River, but also on the Pompeston Creek. Currently, the best place to launch a small, non-motoroized boat is at the mouth of the Pompeston, where it meets the Delaware, but the area is difficult to reach and access to the water is cumbersome.

From boating to bikes to trains, buses and cars, the little town of Riverton accomodates them all. The original plans for the light rail line predicted that rail service would reduce vehicular traffic and thereby improve pedestrian and bicycle circulation. It's too early to tell if the predictions will come true, but it is unlikely that the Borough can rest all its hopes for controlling traffic on the operation of the light rail line.

CONCLUSION

This Environmental Resource Inventory represents a snapshot of Riverton. It describes the built and natural environment of the Borough from the underlying geology and beautiful waterways to the historic architectural and recreational facilities. This document should be amended and updated periodically. For instance, when the Riverton Borough Shade Tree Commission completes its shade tree mapping of the Borough's street trees, that information should be added to this inventory. The results of the bicycle and pedestrian circulation study should be integrated into the document. By keeping this document up to date, the Borough will maintain a valuable source of important information on which to base sound planning policies and decisions.



Looking Upstream from the Mouth of the Creek

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