With 2015 Addendum by the Springfield Environmental Commission

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2015 Addendum

PREFACE

In 1968, the State of New Jersey passed legislation that enabled municipalities to create Conservation Commissions. These Commissions, later renamed Environmental Commissions, are non-elective and advisory. The State Legislature suggested that the environmental commissions prepare natural resource inventories, plans and projects for recommendation of conservation measures to be included by planning boards in master plans for land use.

Springfield's Natural Resource Inventory was among the first. It was prepared in 1976 in consultation with the Department of Geography and Urban Studies at Montclair State College. Principal contributors were Joseph V. Contessa and David K. Robertson with assistance of Irma Chaiten, Field Botanist, and Marcia Forman, Chairperson of the Springfield Environmental Commission. It is a testament to the value of their work that much has been retained in this revision.

The 2011 Revision of the 1976 Natural Resource Inventory of Springfield has been written to provide updated information, acknowledge new programs, and record accomplishments. Specifically:

- New and updated data and map-making programs from the New Jersey Department of Environmental Protection and other sources is available and has been incorporated into this inventory.

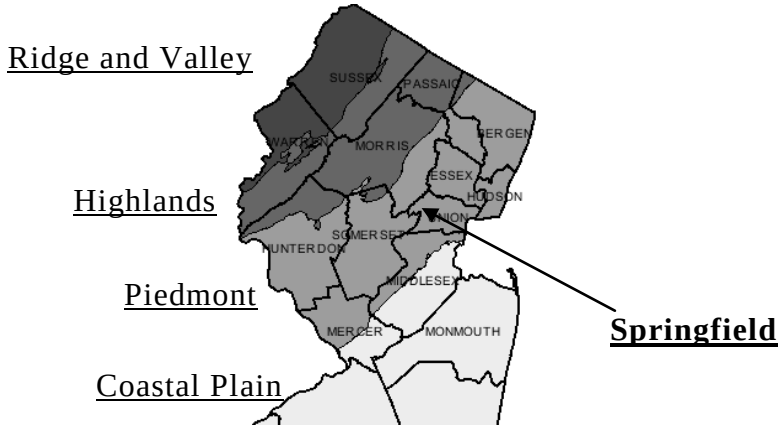
- NJ DEP regulations have resulted in several improvements in Springfield's environmental planning and engineering

    - Storm Water Management Plan
    - Community Forestry Management Plan

CHAPTER I GEOLOGY[1]

New Jersey is divided into four geologic regions, known as physiographic provinces, which have distinctive rocks and landforms. Springfield lies in the center of New Jersey's Piedmont physiographic region. The Piedmont region has more topographic relief than the Coastal Plain, but not as much as the Highlands. The Piedmont presents a low, hilly surface, broken by occasional ridges. The story of Springfield's geologic origins goes back millions of years.

Figure 2.1 New Jersey's Physiographic Provinces



[1] Information on geology can be found in the following: Widmer, K., 1964 *The Geology and Geography of New Jersey*. The New Jersey Historical Series, V. 19, D. Van Nostrand Company, Inc., Princeton, New Jersey; Wolfe, P., 1977 *The Geology and Landscapes of New Jersey*. Crane Russak and Company, Inc., New York, New York; Trailside Nature Museum, Watchung Reservation, Mountainside, New Jersey; Figure from NJ DEP.

During the Triassic Period, about 200 million years ago, as the giant continent Pangea began to break up, a series of northeast-to-southwest basins were formed in the Piedmont Plateau from Nova Scotia to North Carolina. Rocks eroded from the Appalachian Mountains, which were much taller then, filled these basins to a depth of 15,000 to 20,000 feet and began to establish the rock formations seen today, called the Newark Group. They were deposited as mud, and long periods of pressure caused them to harden (metamorphose) into red sandstones and shales, the result of iron-bearing minerals which were oxidized during the cyclic wetting and drying of the sediments as they were deposited and compressed into rock. The faults and fractures in these rocks hold ground water. In Summit, the New Jersey American Water Company operates five wells drilled into the Feltville Formation.

In early Jurassic time the Atlantic Ocean began to open near what would become Springfield. The opening ocean created tension and three distinct periods of volcanic eruption spilled basaltic lava over the sediments, forming the crescent shaped ridges of First, Second and Third Watchung Mountains. First Watchung Mountain (Orange Mountain) traverses the western part of Springfield. Basalt was quarried for gravel, concrete, and macadam in the Houdaille Quarry until 1977.

What would become Springfield emerged from the sea 70,000,000 years ago in the Eocene Period, exposing the land to weathering and erosion. Sandstones and shales erode more readily than the resistant lava (igneous basalt), creating today's differences in elevation and relief.

I. GEOLOGY

The Ice Age (Pleistocene) began approximately a million years ago. Four major ice movements occurred, but only the first and last glaciations moved as far south as New Jersey. The effects of the first glacial movement can be seen south and west of Springfield but not within Springfield, because the succeeding glacier destroyed most evidence of earlier glaciation.

The last glacial retreat began approximately 20,000 years ago and was completed 14,000 years ago (the Recent Period). Springfield today is dominated by relics of recent glaciation. With glacial advance the weight of the overlying half mile or more of ice physically crushed the earth's surface into fragments. Glacial movement incorporated rock fragments into the ice sheet to produce subsequent abrasion, a scraping action on the exposed surface. Because of the great weight of the ice, the base of the glacier became slushy, particularly in summer. The water infiltrated cracks and froze during winter. The expansive pressure of ice caused additional fractures and allowed plucking to occur, i.e, the lifting of material into the glacier. Under these conditions the sandstones reverted to sand, the shales to their mud-derived clays and silts, and the igneous basalt into boulders and gravels. Much of this material was incorporated into the glacier.

The effects of glacial retreat are readily apparent in the Springfield landscape. The glacier retreated by melting and the material within the glacier was deposited on the ground. The terminal moraine is material deposited by the glacier at its maximum extent. The ice advance was just balanced by melting which released the boulders, gravels, sands, silts, and clays into a pile at the end of the glacier. These now appear as Springfield's rolling hills.

Ground moraine (till) is material deposited by the retreating glacier. The thickness of accumulation was considerably less than the terminal moraine. Ground moraine is composed of materials similar to terminal moraine, but fewer boulders are present because they had been already deposited at the terminal moraine. This material completely covers Springfield at varying depths. The unsorted material in moraines usually provides good drainage. Where sands and gravels predominate, the moraine frequently is mined for the construction industry. Thick glacial deposits are conducive to well development for water supply.

Over the past 14,000 years, non-glacial erosion has been at work modifying the morainic surface. The erosional forces include streams, wind, and human activity. Figure 1.2 entitled Springfield's Geomorphology (surface geology) indicates some variations of this morainic surface. The terminal moraine crosses New Jersey in a general east-west direction with considerable weaving. Within Springfield the terminal moraine makes one of these weaves, forming a north-south deposit on the western side of the township.

The area to the west of the terminal moraine (designated Qsd and Qec) was not glaciated by the last glacial movement. This small western tip of Springfield probably would show evidence of the first glacial wave except for recent erosive effects which deposited stratified drift and aeolian material. Stratified drift is material carried from

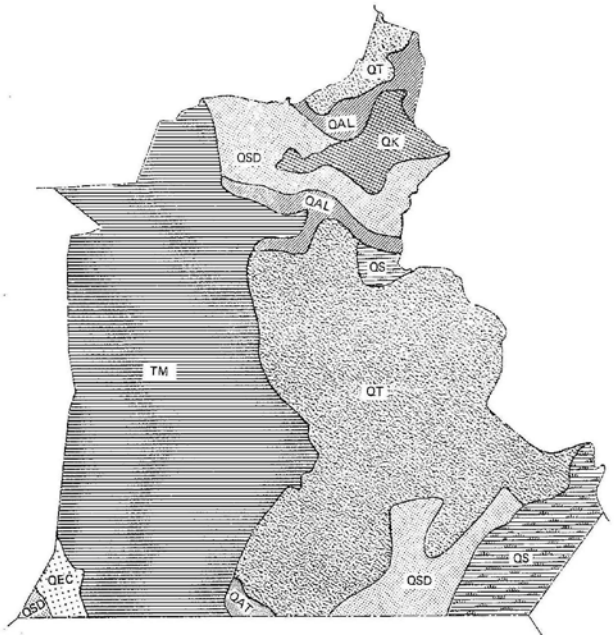
the terminal moraine by glacial melt water. Whereas moraine is unsorted, stratified drift is sorted by particle size; the larger particles are associated with locations of rapidly running melt water and the smaller clays and silts are associated with more slowly running melt water. The wind-driven aeolian materials are mostly clays blown from the terminal moraine. Few realize that the edge of a glacier is relatively dry in terms of rainfall. The cooling of the air above the glacier (conduction) caused atmospheric stability. Moreover, vegetation is lacking because of the constant freezing temperatures. The unprotected surface of the terminal moraine is subjected to the erosional process of wind. The map refers to aeolian cliff structures because the small clay particles deposited subsequently became eroded by running water into sharp-sided features, a characteristic of fine particle erosion and named 'badlands' in some areas. To the east of the terminal moraine is a large area of till, which is another name for ground moraine. Some of the till is covered by or mixed with stratified drift. Both till and stratified drift areas are characterized by flat to gentle topography.

Springfield has one geomorphic feature that is relatively rare. The unusual feature is a kame (pronounced 'came') having all the characteristics of an alluvial fan, which is material deposited by intermittent streams in dry regions at the base of a cliff. The difference between a kame and an alluvial fan is that the cliff is the edge of the glacier rather than an edge of rock. Streams flowing on the top of glaciers are highly unusual and short-lived: thus, an identifiable kame is an unusual event. Other than uniqueness a kame has no other significance to human habitation of an area.

Another category on the Geomorphology map is recent alluvium (symbol Qal) which is derived from sediments deposited by existing streams. Recent alluvium occurs in areas with low relief and frequently, but not necessarily, is associated with the flood plain. Resistant nick points along the bottom of a stream cause alluvium to accumulate. Stream meanders (bends in a river) also are associated with recent alluvium.

Swamp muck (QS) is another category on the map. In most cases swamps were open water now in the process of being filled in. In a glaciated area moraine can block drainage and a new channel forms at a higher elevation. Also, large, buried pieces of ice can be left behind as the glacier retreats. When the ice melts, the surface collapses forming a kettle lake. The swampy areas of Springfield seem to be the remains of Rahway River channels formed because of moraine blockage.

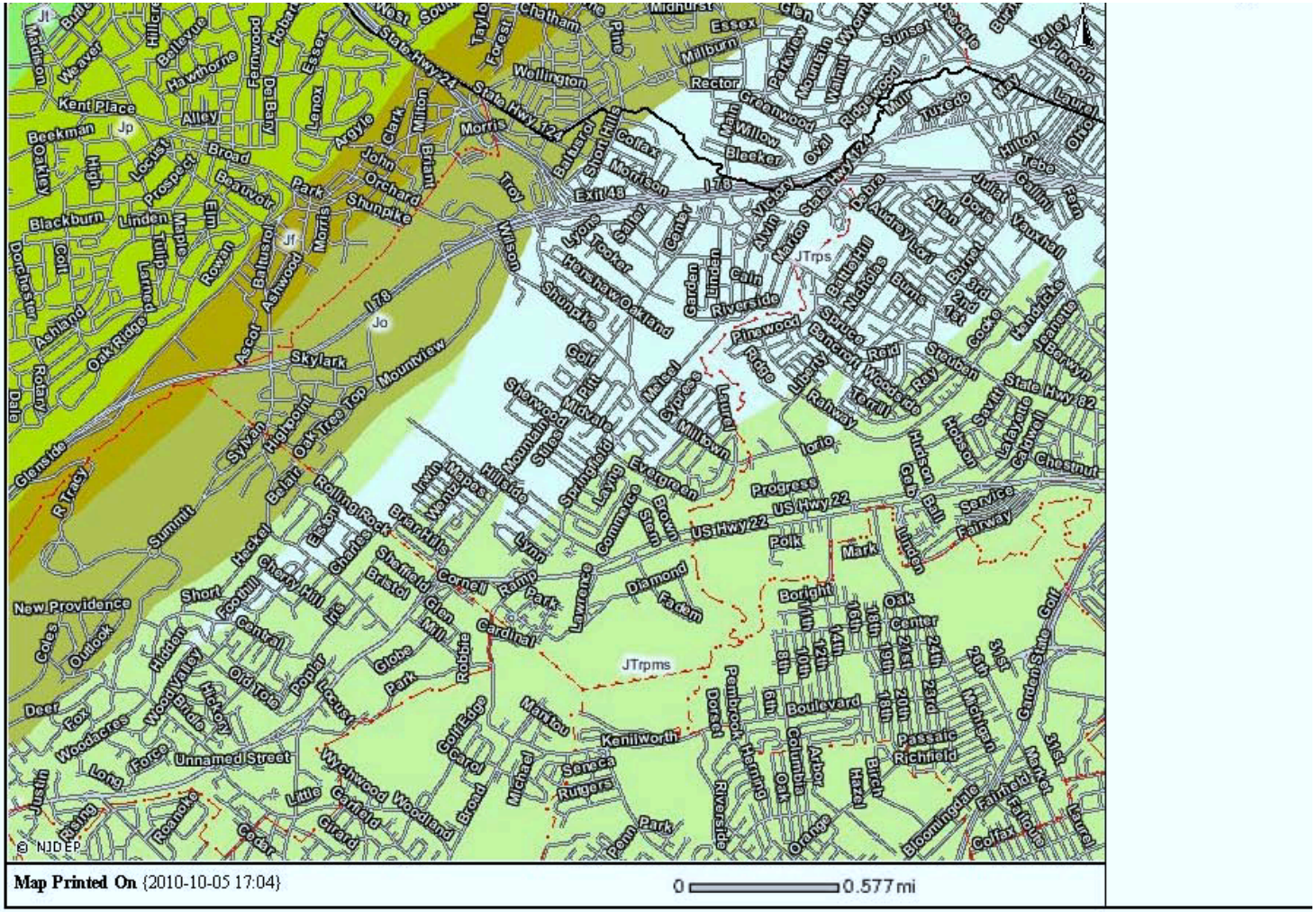
Figure 1.2 Springfield's Geomorphology
From *Geologic Atlas of New Jersey*, US Geologic Survey, 1908.



Legend

- Qal Recent Alluvium
- Qat Stratified Drift and Till
- Qec Quaternary Eolian Cliff Structures
- Qk Kame
- Qs Swamp Muck
- Qsd Stratified Drift
- Qt Till
- Tm Terminal Moraine

Figure 1.3 Bedrock Geology underlying Springfield



There are three types of bedrock that are most prevelant in Springfield. The bedrock abbreviated 'Jo', refers to orange mountain basalt which is fine to medium-grained. The middle and majority of Springfield is sandstone and siltstone. This is abbreviated with 'JTrps'. The last type of bedrock that is prevelant in Springfield is sandy mudstone, which is abbriviate with 'Jtrpms'.

CHAPTER II CLIMATE AND WEATHER[1]

New Jersey's location about halfway between the Equator and the North Pole, on the eastern coast of the United States results in the state being influenced by wet, dry, hot, and cold airstreams, resulting in daily weather that is highly variable. The dominant feature of the atmospheric circulation over North America, including New Jersey, is the broad, undulating flow from west to east across the middle latitudes of the continent. These "prevailing westerlies" shift north and south and vary in strength during the course of the year, exerting a major influence on the weather throughout the State.

Observations about the temperature and precipitation in New Jersey, relevant to Springfield include:

1. All stations have registered readings of 100° Fahrenheit or higher and have records of 0° Fahrenheit or below.

2. Average number of freeze-free days in the northern highlands is 179 in the central and southern interior.

3. Average annual precipitation ranges between 43 and 47 inches for most places in NJ, well above the national average of 20 inches.

4. Snow may fall from about October 15th to April 30th in the highlands and from about November 15 to April 15 in southern counties. Springfield is in the central area.

5. Most areas receive 25 to 30 thunderstorms per year, with fewer storms near the coast than farther inland. Approximately five tornadoes occur each year, and, in general, they tend to be weak.

6. Measurable precipitation falls on approximately 120 days. Fall months are usually the driest with an average of eight days of measurable precipitation. Other seasons average between 9 and 12 days per month with measurable precipitation. A chart of meteorological data from the Canoe Brook weather station, the closest station to Springfield, is in Table 2.1.

New Jersey has five distinct climate regions. The geology, distance from the Atlantic Ocean, and prevailing atmospheric flow patterns produce distinct variations in the daily weather between each of the regions. Springfield falls in New Jersey's Central Zone, corresponding roughly with the Piedmont physiographic province, running diagonally across the state from New York Harbor and the Lower Hudson River to the great bend of the Delaware River near Trenton. This region is highly developed and densely populated, with many urban

[1] Information is quoted from the NJ Climatologist website at: http://climate.rutgers.edu/stateclim/?section=njcp&target=NJCoverview

Table 2.1 Canoe Brook Weather Station Readings

	Normal Maximum Temp.	Normal Minimum Temp.	Normal Mean Temp.	Normal Precip. Inches	Normal Heating Degree Days	Normal Cooling Degree Days
January	38.7	18.2	28.5	4.13	1133	0
February	41.5	19.7	30.6	3.00	962	0
March	50.6	28.8	39.7	4.17	783	0
April	61.7	37.9	49.8	4.22	456	0
May	72.4	47.7	60.1	4.74	180	27
June	80.9	57.2	69.1	4.41	25	146
July	85.8	62.2	74.0	4.73	2	281
August	84.0	60.8	72.4	4.74	4	232
September	76.7	52.8	64.8	5.03	71	64
October	65.8	40.4	53.1	4.18	376	7
November	54.6	33.0	43.8	4.41	636	0
December	43.6	24.1	33.9	3.85	967	0
Average	63.0	40.2	51.7	51.61	5595	757

locations subject to large amounts of pollutants[2] produced by the high volume of automobile traffic and industrial processes. The concentration of buildings and paved surfaces retains more heat, raising the local temperatures. Because of the asphalt, brick, and concrete, the observed nighttime temperatures in heavily developed parts of the zone are regularly warmer than in surrounding suburban and rural areas. This phenomenon often is referred to as a "heat island." The northern edge of the Central Zone is often the boundary between freezing and non-freezing precipitation during wintertime. In summer, the northern reaches often mark the boundary between comfortable and uncomfortable sleeping conditions. Areas to the south of

[2] Please see the section on air quality for more information on air pollution.

the Central Zone tend to have nearly twice as many days with temperatures above 90° Fahrenheit than the 15-20 days commonly observed in the central portion of the state.

Humidity affects the level of human comfort and the operating ability of some types of equipment, making it is an important consideration in heating, cooling and air conditioning. Within each day, humidity is higher during the early morning hours, declines in the early afternoon heat, and then rises toward evening. The most humid months are June through November. The average historical relative humidity ranges from 50% to 80%. Consequently, Springfield's climate is described as "humid, hot-summer climate."

There have been seven major droughts in New Jersey over the last 100 years. The most severe was in 1964-1968 (when precipitation was 40% below normal), while the least severe was 1980-1984 (when precipitation was 20% below normal). The most recent drought of 2000–2002 was of average severity.

Springfield residents can reduce water consumption by limiting watering of lawns and outdoor plants to every other day. Landscaping, as opposed to green lawns, does not require daily watering, even during a drought. Watering should be done at night or in early morning, to allow the water to sink into the soil and not evaporate. Automatic rain shut-off controls are suggested for residents with sprinkler systems. In addition, lawn grass can be cut to a longer length, allowing the grass to survive during a drought period. Water conservation is enhanced by use of soaker hoses and soaker tree bags, in lieu of frequent sprinkling.

During severe storms there can be severe flooding of low-lying areas. In these low-lying areas, when the dew point is high, there may be some fog. For the most part, flooding and fog are unusual situations. However, over time these climate characteristics may change as part of a larger pattern of global scale climate change. Springfield's flood control measures are discussed in the next chapter, on water resources.

Global Climate Change

The Earth is subject to a greenhouse effect where certain gases in the atmosphere trap heat from solar radiation which keeps the planet warmer than it would otherwise be. These greenhouse gases include carbon dioxide, methane, nitrous oxide, water vapor, and chlorofluorocarbons. Increases in the concentrations of these gases amplify the greenhouse effect which leads to global climate change.

Carbon dioxide, or CO2, has been responsible for over a half of the stimulated greenhouse effect seen so far[3]. CO2 emissions come from burning fossil fuels for energy in places like factories, power plants, or motor vehicles. The other greenhouse gases come from a combination of Earth's natural processes such as wetlands, gas hydrates, permafrost, and wildfires, and human-related activities such as burning fossil fuels, waste management, biomass burning, deforestation, agriculture cultivation, animal stockbreeding, and fertilizers.

Global climate change may have serious consequences for the planet. In the high northern latitudes the ice cover has shrunk by 2.7 % per decade, with larger decreases in the summer of 7.4 % per decade. The ice is melting due to higher average temperatures which are more pronounced in the higher latitudes. Since 1850, when the instrumental record of global surface temperature began, 1997-2006 rank among the twelve warmest years and 2010 was tied for being the warmest year on record. Due to the melting ice caps, the sea level has been persistently rising. Global average sea level has risen since 1961 at an average rate of 0.07 in/yr and since 1993 at 0.1 in/yr. In addition, in both Americas, Asia and Europe precipitation increased notably from 1990 to 2005.[4]

In 1990, New Jersey's carbon dioxide emissions were approximately 123 million tons per year. By 2004, those emissions had risen 11 percent to approximately 137 million tons per year. The emissions are projected to increase 25 percent from 1990 levels to approximately 154 million tons per year by 2020.[5] In 2007, New Jersey passed the Global Warming Response Act which aims to reduce the greenhouse gas emissions to the 1990 levels by 2020.

Temperature increases are projected for New Jersey with environmental and human health risks. "Climate models predict an increase in the number of days per year with temperatures above 90°F in the New York City metro area, with a potentially significant impact on human health due to heat stress."[6] The projections also call for an increase of short-term droughts due to higher temperatures and decreased summer rainfall. These changes could impact the freshwater supply, wildlife habitats and human health.

3 IPCC First Assessment Report. Intergovernmental Panel on Climate Change 1990. Available at: http://www.ipcc.ch/publications_and_data/publications_and_data_reports.htm

4 IPCC 2007 Climate Change Synthesis Report. Available at: http://www.ipcc.ch/publications_and_data/publications_and_data_reports.htm

5 Meeting New Jersey's 2020 Greenhouse Gas Limit: New Jersey's Global Warming Response Act Recommendations Report. December 2009. New Jersey Department of Environmental Protection.

6 http://www.state.nj.us/globalwarming/index.shtml

Chapter III Water Resources

Hydrology is the study of water's distribution and movement on land, including surface water and ground water. Hydrologists deduce the flow of underground water by considering the permeability of the soil and bedrock. Hydrology is also important to the study of water pollution. Knowledge of hydrology is used to determine the movement and extent of contamination from landfills, storm water runoff, and other point and non-point sources of contamination, to surface and underground water.

In Springfield, the average precipitation rate is close to 50 inches of water per year.[1] On average, about half of this water is returned to the atmosphere by evapotranspiration, which is evaporation and transpiration through trees and other biota. The remainder runs off into streams and rivers or becomes ground water. The Chief Hydrologist of the US Geological Survey (USGS) notes that "effective land and water management requires a clear understanding of the linkages between ground water and surface water as it applies to any given hydrologic setting."[2]

Ground Water

Aquifers are underground reservoirs of water held in the spaces between rocks. Wells tap into aquifers. Aquifers are recharged when rain or snow falls onto the source area over the aquifer and also by seepage of water from streams or lakes into the ground. The water table is the upper surface of this underground reservoir. When the elevation of the ground falls below the water table, ground water emerges onto the surface. Base flow of rivers and streams is maintained by steady seepage of groundwater onto the surface. Thus ground water and surface water are parts of the same hydrologic system.

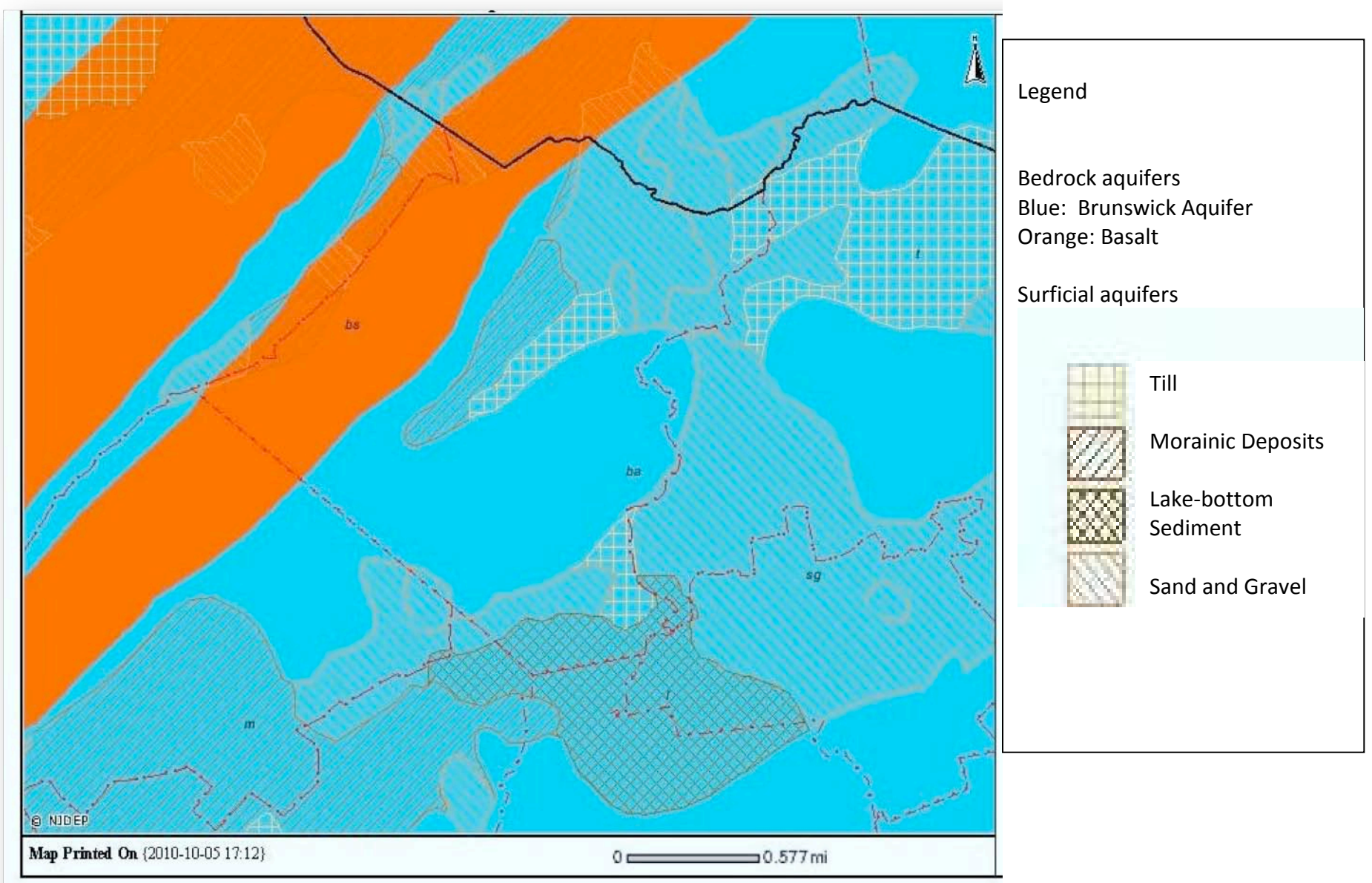
The aquifers under Springfield are held mostly in glacially-deposited sands and gravel with a maximum depth of about 200 feet, over bedrock of shales, sandstones and Watchung basalts. The sedimentary formations are part of the larger Brunswick Aquifer, which stores water in its joints and fractures. Wells of greatest yield are usually those between 200 and 500 feet deep where several source zones feed the well. These wells yield from 12 to 870 gallons per minute in Union County[3].

[1] Monthly and Annual Statewide Climate Data. Office of the NJ State Climatologist, Rutgers University. 2005. Website: <http://climate.rutgers.edu/ stateclim >

[2] Hirsch, Robert M., Chief Hydrologist, US Geological Survey. 1998. Ground Water And Surface Water: A Single Resource. USGS Circular 1139. Website: <http://water.usgs.gov/ogw/gwsw.html>

[3] Information on Buried Valley Aquifer is from a report prepared in 1980 upon petition by the Passaic River Coalition and City of East Orange under the Clean Water Act, and accessed at: <http://www.epa.gov/region02/water/aquifer/burval/buryval.htm#I30>

Figure 3.1 Springfield's Aquifers



Recharge Areas

Ground water recharge begins with rain, snow and other forms of water that drop out of the clouds and onto the ground. Water that falls on the land may run off over the surface, return to the atmosphere through evaporation, or seep into the soil. Water in the soil is either taken up by plants in the upper layers, or infiltrates down into deeper layers. In the upper layers of soil the pores, or spaces between the soil particles, often are filled with air so that water can trickle through. The deeper layers form a saturated zone where water is held, like a sponge, in all the spaces between the rock particles. The water table marks the top of this saturated zone. Water in the soil recharges ground water when it reaches the water table.

Ground water discharge occurs where the land's surface dips below the water table, allowing the water to flow out to the surface. Ground water exits the earth at discharge areas, coming to the surface to feed springs, streams and wetlands. **Base flow** is the ground water discharge that keeps streams and wetlands soggy between rainfalls, even during times of drought. When recharge areas are covered with impervious, or watertight, surfaces, rainwater can't replenish the ground water, base flow gets reduced, and streams run lower than usual during dry spells. Impervious surfaces also make flooding worse, because all the stormwater runoff that would normally soak into the ground then gets added to flood-swollen streams.

Ground water recharge areas are land surfaces where the soil naturally allows rainwater to seep down to the water table. Ground water recharge areas function best when the land surface and the ground beneath it are permeable so water can infiltrate into, and flow through, the ground. **Permeability** is the relative ease with which water can move through soil or rock. For instance, beach sands are highly permeable, and the ocean water soaks into them readily, while dense clays have a very low permeability and rain runs off of them instead of soaking into the ground. Trees, bushes and grasses put down roots, helping to keep soil permeable. It is the combination of water permeable soils and vegetation that keep ground and surface water sources of drinking water clean and plentiful. When land is built upon, impervious surfaces, such as buildings, roads, and parking lots, seal up recharge areas and prevent rainwater from seeping into the ground. Even converting forest or meadow landscapes into lawn makes the soil less permeable, and the recharge less abundant.

Land use changes recharge. People have developed the land in various ways. Many of these changes in land use have added impervious surfaces and decreased the permeability of soils. Nowadays less water soaks into the ground to recharge ground water than it did before the natural landscape was altered. This means that there is less water stored in the ground that can later be used for drinking water. A highly altered landscape such as a shopping center concentrates rain runoff, diverts it from

Figure 3.2 Ground water recharge areas in Springfield

recharge areas, and sends it into the nearest brook to be sped on its way out of town.

Much of the soils in town have the ability to absorb and infiltrate 10 to 14 inches of water. Much of this land has already been developed, but it is possible to make the best use of remaining undisturbed soil by directing storm water into the ground instead of allowing it to become runoff. For more information on how you can contain your rain, please see Passaic River Coalition's Homeowner Guides #2, #3, and #4. [4]

Flood Plains

Adjacent to the brooks, ponds, and rivers of Springfield are flood plains. A flood plain is the relatively flat area adjoining the channel of the stream or river that is covered with water during periods of high flow. Flood plains were formed by the action of seasonal floodwaters over time. Flooding is exacerbated by increases in impervious cover and compacted soils, which change surface conditions and thereby increase the velocity and volume of surface runoff. Preserving flood plains in a natural state with trees and other vegetation is essential to reducing flooding problems.

In New Jersey, the flood plain is regulated by the New Jersey Department of Environmental Protection (NJDEP) under the Flood Hazard Area Control Act of 1979.[5] Flood Hazard Areas can be expected to flood at least once in a hundred years. Flood Hazard Areas are divided into the stream channel, the floodway, and flood fringe areas. Floodways flood frequently, at least once in ten years on average. The areas mapped are approximations of floodway areas based on 2009 data from the New Jersey Department of Environmental Protection. While a relatively small proportion of Springfield is considered a floodway, it is important to remember that there are many more communities downstream which are much more flood prone and are impacted by stormwater from Springfield. The Municipal Stormwater Management Plan includes strategies for reducing flooding.[6]

Riparian Buffers

Riparian forest buffers, also called riparian corridors, are the areas of land connected or adjacent to rivers and streams, lakes and wetlands, that should be managed to function naturally in order to reduce the impact of neighboring land uses and nonpoint source pollution. Native trees, shrubs, and other vegetation, growing on the land on either side of waterways provide a transition zone between aquatic and the terrestrial environments. Springfield has adopted a riparian buffer zone

[4] Passaic River Coalition. 2004. Contain Your Rain, Soak It, Don't Send It, For Tomorrow You Drink It! Homeowners Guides #2, #3, #4.

[5] Flood Hazard Area Control Act, N.J.S.A. 58:16A-50 *et seq.* 1979. (N.J.A.C. 7:13 *et seq.*)

[6] Office of the Township Engineer. Municipal Storm Water Management Plan.

ordinance to help protect existing riparian buffers in town. The general purpose of this ordinance is to enhance water quality by protecting the areas adjacent to streams and other surface water bodies. The ordinance establishes a 50-foot wide strip on both sides of streams and rivers that cannot be built on. Protection or restoration of the natural resources of riparian buffers is especially critical in Springfield in order to protect water supplies and to reduce pollution and flooding.

Water Supplies

Potable water is supplied to Springfield by New Jersey American Water Company, which also provides water to many other New Jersey municipalities. For further information on the susceptibility of the NJ American Water Company, Short Hills Division, to pollution, see the Source Water Assessment Summary, which was developed by the New Jersey Department of Environmental Protection (NJDEP) and US Geological Survey (USGS), and is available on the Internet.

New Jersey American Water publishes an annual water quality report which is sent to consumers and is available online. Appendix A contains a list of detected contaminants in the Short Hills System (which includes the Canoe Brook Reservoirs and the Passaic River at Totowa) as detailed in the 2008 and 2009 reports. Most of the contaminants are at levels below the regulatory limits for drinking water. In the Short Hills report, sodium was measured at almost twice the recommended upper limit. Sodium is a secondary contaminant, which means it is not regulated. Sodium can enter water bodies from industries, sewage, fertilizers and roads. High blood pressure is the most common effect of high levels of sodium present in a human body.

Waste Water Management

Springfield's waste water is piped to the Rahway Valley Sewerage Authority (RVSA) treatment plant in Rahway.[7] This facility treats wastewater from 300,000 residents and 3,500 industrial and commercial customers in 14 towns within a 50 square-mile area. The RVSA is currently implementing a plant expansion and upgrades. The facility discharges treated wastewater into the Arthur Kill between New Jersey and Staten Island. This discharge is permitted under New Jersey Pollutant Discharge Elimination System (NJPDES) permits no. NJ0024643 (residential) and no. NJG0125211 (industrial).

Even treated wastewater can still be a source of pollution to waterways because the treatment process may not eliminate all of the pathogens or remove all of the nitrogen and phosphorus present in the water. New Jersey Department of Environmental Protection's Data Miner program can be used to retrieve Discharge Monitoring Reports from this facility (use the NJPDES DMR Data by NJPDES Permit Number search feature).[8] After wastewater treatment, the sludge dewatering facility processes

[7] http://www.rahwayvalleysa.com/flash_map.html

[8] New Jersey DEP Data Miner. http://datamine2.state.nj.us/DEP_OPRA/OpraMain/categories?category=NJPDES%20Permitting

wet sludge into a drier product, which is then removed by contractors for beneficial reuse, including land reclamation and agricultural application.[9]

Water Quality

There are many types of pollutant sources from which contaminants can leach into ground water or be carried in runoff into streams and rivers.

The New Jersey Department of Environmental Protection (NJDEP) has designated the uses that surface waters in the State should have.[10] Surface waters in Springfield are classified as FW2-NT. FW stands for fresh water and NT for non-trout. This designation means that these waters are supposed to be clean enough to be used for the "maintenance, migration, and propagation of the natural and established biota," and for "primary contact recreation, industrial and agricultural water supply, and public potable water supply after conventional filtration treatment."[11] Every two years states must submit what is called an "impaired waters list" or "303(d)" list to the U.S. Environmental Protection Agency (EPA).[12] This list is mandated as part of the Clean Water Act. A waterway is determined to be "impaired" if its water quality does not meet the state's standards for its designated uses. In order to restore an impaired water body to a more healthy condition the State can create a plan for the restoration of the waterway, called a "Total Maximum Daily Load" or "TDML" plan for each waterway on the list. The Rahway River has a TMDL plan to reduce fecal coliform contamination, as shown in the accompanying Figure 3.3.[13]

[9] RVSW website http://www.rahwayvalleysa.com/

[10] N.J. Department of Environmental Protection. 1998. N.J.A.C. 7:9B-1.15(e).

[11] N.J. Department of Environmental Protection. 1998. N.J.A.C. 7:9B-1.12(c).

[12] Section 303(d) of the Federal Clean Water Act (33 U.S.C. 1313(d)).

[13] Total Maximum Daily Loads for Fecal Coliform to Address 48 Streams in the Raritan Water Region, p. 12. 2003. http://www.epa.gov/waters/tmdldocs/NJ-2003-Fecal%20Coliform-48%20Streams%20Raritan%20Region.pdf

Figure 3.3 Fecal Coliform Impaired Streams in WMA 7 and TMDL plan numbers for remediation.

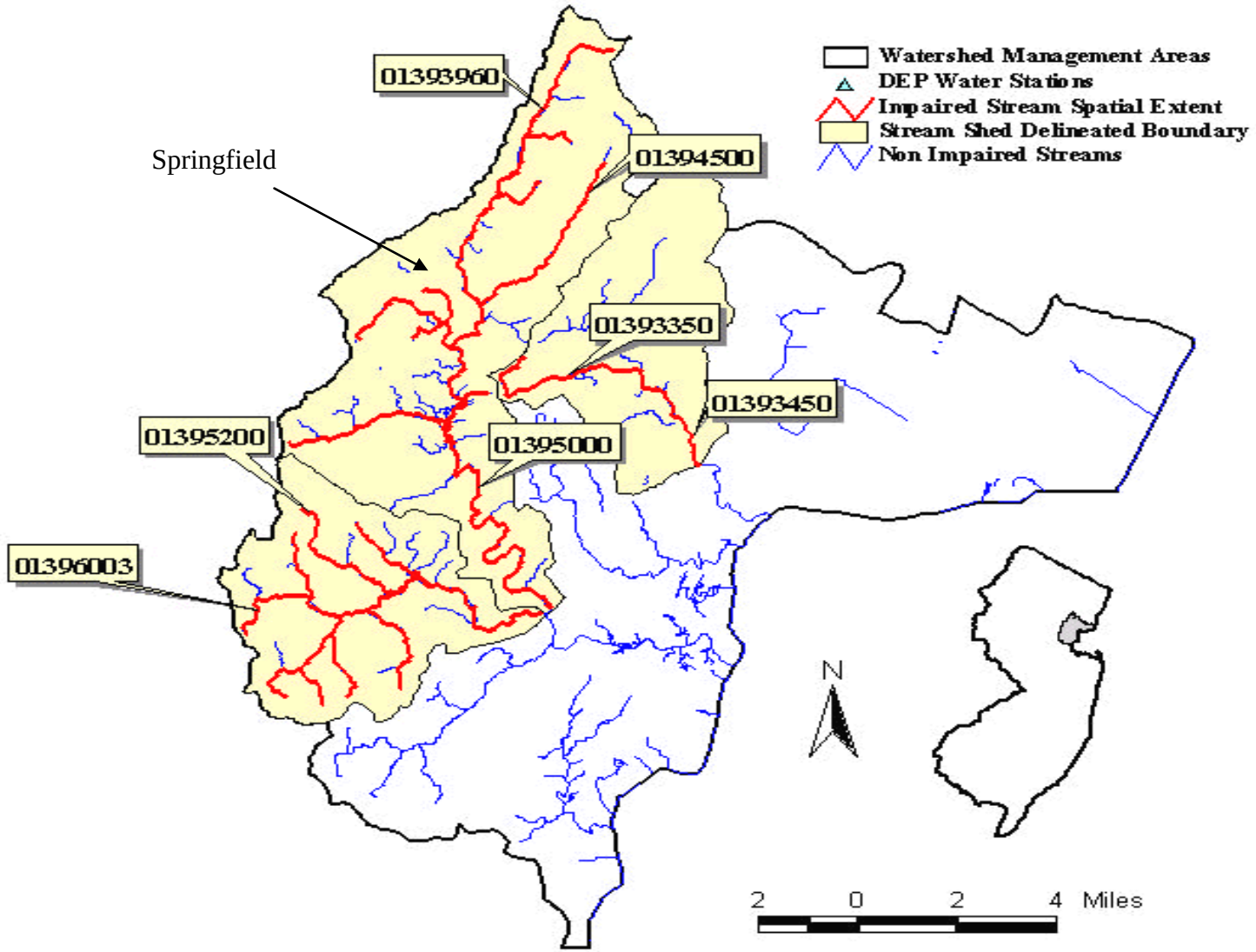
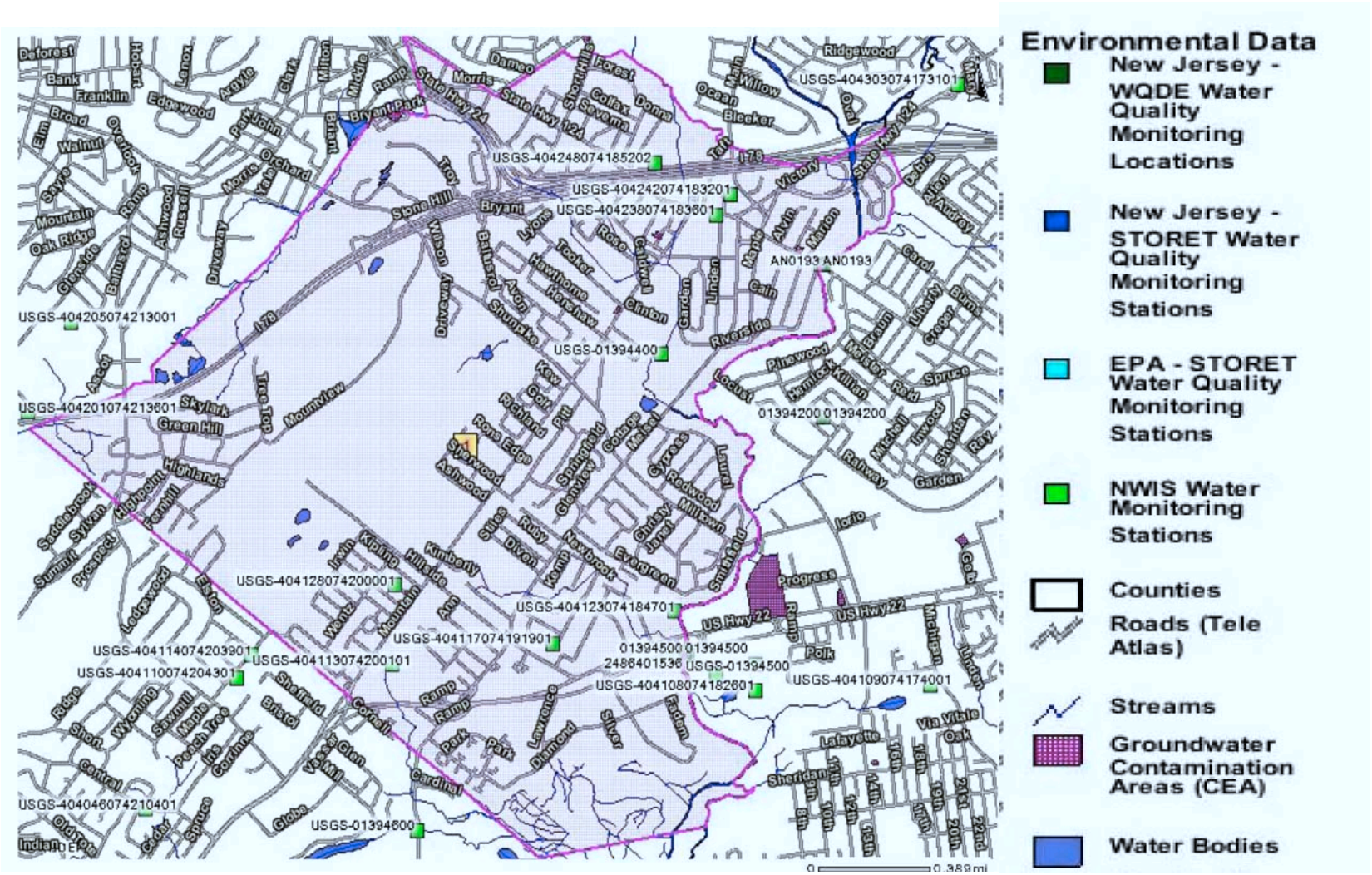


Figure 3.4 Water Quality Monitoring Stations in Springfield



The STORET data maintains the locations of water quality monitoring stations from NJDEP's NJ STORET (Modernized) database. A station is a location at which a data collection event takes place, such as a collection of a field sample, measurement of field parameters or evaluation of environmental habitats The Water Quality Data Exchange (WQDE) maintains the locations of water quality monitoring stations from NJDEP's COMPASS database. The U.S. Geological Survey maintains the National Water Information System that includes information on water resources in the United States. This layer contains the NWIS monitoring stations for surface and ground water in New Jersey. The surface water stations are mostly stream and estuary monitoring locations, whereas the ground water monitoring occurs at well locations.

Storm Water Management

Water is the lifeblood of all living organisms, especially including the people who live and work in Springfield. "The work that healthy watersheds and freshwater ecosystems perform naturally to purify drinking water, mitigate flood damages, and meet other societal goals … are being lost at a rapid rate."[14] These "ecosystem services" are being lost because "commercial markets rarely put a price on these services, and because governments are failing to protect them."[15]

The New Jersey Department of Environmental Protection required municipalities to create Stormwater Master Plans. Appropriate implementation of the Municipal Storm Water Management Plan is critical for the future well being of the Township as well as communities living downstream. The goals of this Plan are to:

1. Reduce artificially induced flood damage to public health, life, and property;
2. Minimize increased stormwater runoff rates and volumes;
3. Minimize the deterioration of existing structures that would result from increased rates of stormwater runoff;
4. Induce water recharge into the ground wherever suitable infiltration, soil permeability, and favorable geological conditions exist;
5. Prevent an increase in nonpoint source pollution;
6. Maintain the integrity and stability of stream channels and buffers for their ecological functions, as well as for drainage, the conveyance of floodwater, and other purposes;
7. Control and minimize soil erosion and the transport of sediment;
8. Minimize public safety hazards at any stormwater detention facility constructed pursuant to subdivision or site plan approval;
9. Maintain adequate base flow and natural flow regimes in all streams and other surface water bodies to protect the aquatic ecosystem;
10. Protect all surface water resources from degradation; and
11. Protect groundwater resources from degradation and diminution.

The Springfield Plan contains design standards for storm water management measures and is implemented through decisions made by the Springfield Planning and Zoning Boards as well as through the oversight of construction projects.

The Springfield Plan advocates using nonstructural or Low Impact Development Best Management Practices (LID-BMPs). The purpose of low impact development techniques is to minimize or

[14] Postel, Sandra. 2005. Liquid Assets, The Critical Need to Safeguard Freshwater Ecosystems, State of the World Library 2005, Worldwatch Paper 170, July 2005, page 5.

[15] *Ibid.*

eliminate post-development increases in both runoff volumes and peak flow rates. Low impact development techniques help rain water to soak into the ground instead of running off rapidly, to mimic a site's natural hydrology. The following are examples of low impact development techniques:

- Minimize the amount of impervious surface;
- Disconnect impervious surfaces;
- Maintain natural vegetated buffer areas;
- Increase water flow "time of concentration" by flattening slopes, increasing surface roughness, and using vegetated swales;
- Concentrate development on soils with low permeability rates and minimize development on soils with high permeability rates; and
- Maintain natural drainage patterns.

By reducing impervious surfaces, runoff is reduced. Driveway and parking lot areas should be minimized as much as possible. Porous pavement materials should be considered. Disconnecting impervious surfaces can be done by redirecting runoff from impervious surfaces to vegetated areas. Roof leaders can be directed into dry wells. By maintaining or restoring "natural" buffer areas, such as meadows or woods, water can infiltrate into the ground instead of running off. If turf grass is replaced with meadow or woodland plants, then more water will soak into the ground, and fewer nutrients from fertilizers will pollute the water.

If the velocity of water running off the land is slowed down, then the rushing water does less damage from erosion, and doesn't reach a stream so fast that flooding results. Runoff velocities can be reduced by flattening slopes, increasing surface roughness, and using vegetated swales instead of "hard" storm water drainage conveyance systems.

Rain gardens, or bio-retention systems, are another method for reducing storm water runoff. They are perennial gardens designed to promote greater infiltration of rainwater and can capture 30% more water than a lawn.[16]

By employing these low impact development techniques in future development and redevelopment, including improvements made by homeowners, Springfield could realize the goals of the Municipal Storm Water Management Plan. There are so many benefits to be gained from using these low impact development and redevelopment techniques that educating residents about these techniques should be a high priority. The Passaic River Coalition has prepared homeowner guides to help Springfield' residents to improve stormwater

[16] New Jersey Agricultural experiment Station, Water Resources Program. 2009. Rain Gardens. Website: http://www.water.rutgers.edu/Rain_Gardens/RGWebsite/raingardens.html

management at their homes, to "Contain Your Rain: Soak It, Don't Send It, For Tomorrow You Drink It."[17]

Wetlands in Springfield

"Wetlands" is a collective term for marshes, swamps, bogs and similar areas. Generally, wetlands are found in flat vegetative areas, in landscape depressions and between water and dry land along the edges of streams, rivers, ponds, lakes and coastlines. While the characteristics of wetlands vary widely because of regional and local differences in soil, topography, climate, hydrology, water chemistry, vegetation and other external factors, including human disturbance, they collectively serve as a linchpin for the earth's ecosystems and the biosphere.

Wetlands can provide a multitude of benefits including flood and storm protection, erosion and sediment control, water quality maintenance and improvement, groundwater recharge and discharge, fish and wildlife habitat and food, nutrient production and cycling, recreation and open space, education research and overall bio-diversity. Wetland values may be derived from outputs that can be consumed directly, such as food, recreation or timber, indirect uses which arise from functions occurring within the ecosystem, such as water quality and flood control, possible future direct outputs or indirect uses, such as bio-diversity or conserved habitats, and even from the knowledge that such habitats or species exist. Whatever value is placed on wetlands, it is clear that they play a critical role in the protection of our environment.

Since the 1600s, more than half (approximately 117 million acres[18]) of the original wetlands in the forty-eight contiguous states have been destroyed[19]. To preserve the remaining wetlands and protect the waters of the United States, the Federal Government enacted the Clean Water Act in 1972. Under Section 104 of the Act ("§404 Program"), the U.S. Army Corps of Engineers administers regulatory and enforcement activities pertaining to wetland protection and dredge and fill activities in navigable waterways and waters that affect interstate commerce. In New Jersey, the Department of Environmental Protection ("NJDEP") implements the §404 program for all wetlands projects that impact non-navigable waterways[20]. NJDEP derives its authority to implement the §404 Program and protect wetlands under the New Jersey Freshwater Wetlands Protection Act, N.J.S.A. 13:9B-1.1 *et seq*. Furthermore, New Jersey's program regulates buffer zones around wetlands ranging from 50 to 300 feet, depending on the quality of the resource.

[17] Passaic River Coalition. 2004. Contain Your Rain, Soak It, Don't Send It, For Tomorrow You Drink It! Homeowners Guides. http://www.passaicriver.org/campaign.html

[18] This figure grows daily as small portions of wetlands are destroyed.

[19] See http://www. epa.gov (wetlands section).

[20] NJDEP's Land Use Regulation Office ("LUR") is charged with implementing New Jersey's Freshwater Wetlands Protection Program. Information regarding the Program can be obtained from the LUR at: 5 Station Plaza, 501 East Trenton, New Jersey or from their website at: <www.state.nj.us/dep/landuse>

To identify and delineate "wetlands", NJDEP uses a three parameter approach which includes an evaluation of: hydrology, vegetation, and soil. Pursuant to N.J.A.C. 7:7A-1.4, "Freshwater wetland" or "wetland" is defined as an area that is inundated or saturated with surface or ground water at a frequency and duration sufficient to support, and that under normal circumstances does support, a prevalence of vegetation typically adapted for life in saturated soil conditions. See N.J.A.C. 7:7A-1.4. Generally, water saturation is the dominant factor determining the nature of the wetlands soil development and the types of plants and organisms living in the soil and on its surface. In addition to the three parameters noted above, NJDEP utilizes the following sources of information in making wetlands determinations:

1) NJDEP Wetlands Maps[21];
2) United States Department of Agricultural Soil Surveys;
3) USGA Quad Maps;
4) United States Geological Survey Topographic Maps;
5) Applicant Letters containing site specific data;
6) Comments filed by municipal and county governments and interested citizens; and
7) Comments filed by State and Federal Agencies.

See N.J.A.C. 7:7A-2.3.

To further assist in protecting the State's remaining wetlands, New Jersey classifies wetland areas according to their resource value. Areas are classified as: (1) Exceptional, (2) Ordinary, and (3) Intermediate value. NJDEP considers resource value classifications when rendering various regulatory decisions concerning wetlands within the state. Additional information regarding wetland resource classifications may be found at N.J.A.C. 7:7A-2.4.

Under the New Jersey Wetlands Program, property owners are required to obtain general or individual freshwater wetlands permits before engaging in activities that will impact wetlands. The Freshwater Wetlands Protection Act requires NJDEP to regulate virtually all activities proposed in the wetland, including, but not limited to, cutting vegetation, dredging, excavation or soil removal, drainage or disturbance of the water level, filing or discharging of any materials, driving of pilings, and placing of obstructions. There are currently twenty-seven "General" permits that will be issued for small routine wetland disturbances. All other projects require affected property owners to obtain an "Individual" permit. See N.J.A.C. 7:7A-7.1 *et seq*. The individual permit process has a myriad of strict requirements that must be satisfied before a property owner will be permitted to disturb areas in and around wetlands.

Unfortunately, the wetlands in and around Springfield have also been disappearing at an alarming rate. Current or prospective owners of properties in and around the areas delineated on the

[21] New Jersey Freshwater Wetlands Maps are available at: (1) County Clerk's Office of register of deeds and mortgages in each county; (2) municipal clerk of each municipality; and (3) NJDEP Maps & Publications Sales Office (609) 777-1038.

existing wetlands maps should consult with NJDEP, a wetlands environmental consultant, and/or an environmental attorney prior to engaging in projects that may impact these extremely valuable natural resources and their surrounding areas.[22] DEP regulates virtually all activities in, or near, wetlands, including cutting of vegetation, disturbance of the water level, and any sort of construction or digging.[23] A familiarity with the functions and values of wetlands ecosystems and New Jersey Freshwater Wetlands Protection laws and regulations can improve decision making today and protect values that may be held by future generations and the future residents of Springfield.

Rahway River Watershed

The drainage basin of the Rahway River covers an area of approximately 82 square miles. Draining an area of 17.8 square miles to the north, the Rahway River's eastern and western branches are confined to narrow and parallel valleys by the First and Second Watchung Mountains. At Springfield the two branches merge to form the main channel.

[22] Property owners in the vicinity of brooks, streams, rivers and/or drainage ditches should also consult the requirements set forth under New Jersey's Flood Hazard Area Control Act, N.J.S.A. 58:16A-50 et seq., and its implementing regulations promulgated at N.J.A.C. 7:13-1 et seq., prior to engaging in projects that may affect the flood plain.

[23] NJDEP website has information about wetlands and their regulation, specifically as they apply to property owners. Website: http://www.state.nj.us/dep/landuse

Flood Control

To control flooding, the Corps of Engineers (1974) has proposed widening the Rahway River's bottom channel to 80 feet and providing an average channel depth of 3.5 feet. While this program has not materialized, other Corps proposals have been incorporated into Springfield's program. A two-fold solution of the township's drainage problem is essentially a plan for constructing: 1) adequate channeling to handle peak discharges and 2) diking and pumping stations to make the township's drainage system independent of the Rahway River's hydraulic gradient (Jeske, 1968).

The following sites are proposed flood prevention projects for Springfield Township. A description of each site and associated problems and remedies are presented.

Sites 1 and 2 have been completed. Site 3 has been completed but not for the "100 Year Storm" designation. Sites 8 and 9 have not been completed. ***2015: Site 2 has not been completed.***

Site 1. Location: Marion Avenue
Problem: Dating from 1903, there has been repetitive flood damage in the area of Alvin, Warner and Marion Avenues. Since 1968, a greater frequency of flooding occurred. Today approximately 45 houses are affected by flooding in this region.
Remedy: A dike extends from Morris to Springfield Avenues.

The construction of a pumping station and retention basin has been completed.

Site 2. Location: Morris Avenue Bridge
Problem: The Morris Avenue Bridge restricts flow.
Remedy: The structure was converted to a single span reducing the back water curve one to two feet at times of peak flow. This remedy benefits areas previously experiencing flooding in Springfield, Union and Millburn townships. ***see update, bottom right***

Site 3. Location: Joanne Way to Riverside Drive
Problem: Some sixty houses are located in an area encompassing Marion, Riverside and Washington Avenues north of Cain Street, were subjected to frequent flooding.
Remedy: Construction of a dike following Riverside Drive along the backyard line of Washington Avenue, and a storm sewer system, retention basin and pumping station. This alleviates flooding, but not for the 100 year storm.

Site 4. Location: Fadem Road
Problem and Remedy: To reduce the hazard of flooding the Fisher Scientific Corporation constructed a dike and pumping station.

Site 5. Location: The Bryant Brook East-West Project
Problem: Forty to fifty houses experienced continuous flooding.
Remedy: From the Interstate 78 to Mountain Avenue, Briant Brook was channelized to handle peak flow periods. In the process, three bridges had to be constructed by the county.

Site 6. Location: Mountain Avenue to the Rahway Valley Railroad
Problem: The Van Winkles channel was unable to handle peak flows and caused a back-up of flood waters. A second problem was the frequent flooding of fifteen to eighteen homes in the Garden Oval area.
Remedy: The Van Winkles Brook was channelized and a dike constructed along the left bank. The plan is similar to one prepared by the Corps of Engineers. To reduce the problem of flooding in the Garden Oval area, an internal drainage conveyance system linked to a storm retention basin was constructed.

Site 7. Location: Springfield-Mountainside Project
Problem: Flooding occurs in Springfield (Briar Hill Circle) and Mountainside (Charles Street).
Remedy: A retention storage basin and collection system are proposed. This should reduce flooding at Briar Hill Circle near Route 22.

For the following sites, flood prevention plans have been submitted to the county for funding:

2015 Site 2 Update: Remedy: The New Jersey Department of Transportation is working on plans for the replacement of the bridge. The structure may be converted to a span which will reduce the back water curve one to two feet at times of peak flow.

Site 8. Location: Van Winkles Brook from Hannah Street to Morris Avenue to Route 78.
Problem: Severe flooding occurs in the commercial business district.
Remedy: Channelization of the brook is the proposed method to achieve proper carrying capacity. ***2015: The site is part of the proposed Downtown Revitalization Plan.***
Site 9: Location: Laurel Drive - Cyprus Terrace
Problem: In this location, the Rahway River has flooded low lying areas.
Remedy: To reduce the flood hazard, the construction of a dike, storm water drains and pump.ing station are proposed.

Under county standards, the following projects are not readily justified and are not receiving priority status. Each project has a low damage to cost ratio:

Site 10. Location: Hillside Avenue - Kipling Avenue
Problem: Local flooding.
Remedy: Storm water relief sewer.

Site 11. Location: Lyon Place - Hawthorn Avenue
Problem: Several houses experience flooding.
Remedy: Storm water relief sewer.

Site 12. Location: Van Winkles Brook from Millburn Avenue to Route 78
Problem: Flooding and erosion of Forest Avenue and municipal recreation lands.

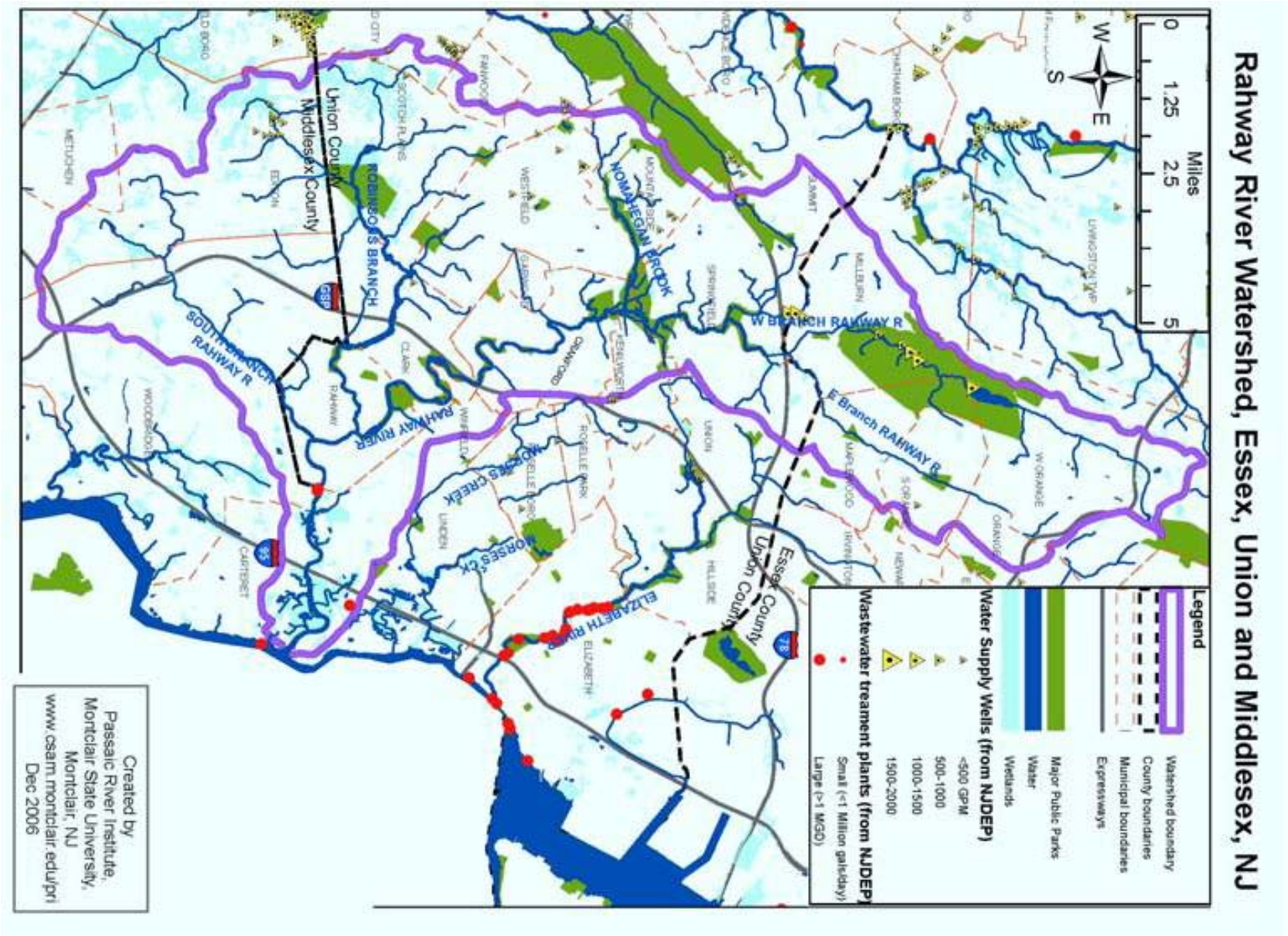
Site 13. Location: Mountain Avenue near Sherwood Road
Proposed: Retention Storage Basin

Site 14. Location: Janet Lane and Craig Road
Problem: Local flooding

The various construction programs should reduce the township's present drainage burden. In order to alleviate these conditions in the future, a Storm Water Control and Flood Plain Ordinance has been developed.

> *In order to duplicate as nearly as possible natural drainage conditions, regulation and control of storm water runoff and erosion for any land area to be developed shall be through onsite storm water detention and/or ground absorption systems …*

These systems include: detention areas, rooftop storage, dry wells, porous asphalt and/or any system or combination of techniques which will serve to limit storm water runoff. Other sections of the ordinance are concerned with regulating the land use of the flood plain. In summary, the Springfield flood control program is a two-fold remedy: to construct flood projects and to regulate land use.


Rahway River Watershed, Essex, Union and Middlesex, NJ
Miles
0 1.25 2.5 5
W E S
Legend
Watershed boundary
County boundaries
Municipal boundaries
Expressways
Major Public Parks
Water
Wetlands
Water Supply Wells (from NJDEP)
<500 GPM
500-1000
1000-1500
1500-2000
Wastewater treament plants (from NJDEP)
Small (<1 Million gal/day)
Large (>1 MGD)
Union County
Middlesex County
Essex County
Union County
W BRANCH RAHWAY R
E Branch RAHWAY R
SOUTH BRANCH RAHWAY R
ROBINSON'S BRANCH
NOMAHEGAN BROOK
RAHWAY RIVER
MOSES CREEK
MOSES CK
ELIZABETH RIVER
Created by
Passaic River Institute,
Montclair State University,
Montclair, NJ
www.csam.montclair.edu/pri
Dec 2006

CHAPTER IV SOILS

Soil is made up of rock particles, organic material, air, and water. The source of soil is weathered bedrock or material carried to its present location by glacial ice, wind and running water. Decaying vegetable and animal matter, the organic part of soil, mixes with the rock particles. Air and water fill the spaces between this combination of mineral and organic substances, the end result being soil. An ideal soil should have moderate levels of nutrients, a pH of 6-8, moderate amounts of water and contain living and dead organisms.

Importance of Soil

As a substrate for most plant species, soil is crucial to the survival of other species, including humans. These plants form the base of the food web and are dependent on quality soil. Soils are an important part of nutrient and water cycles, which enable the growth of vegetation and other microscopic organisms within soils. These organisms living in the soil are essential to soil fertility, nutrient cycling, water infiltration and the overall heath of the growing plants.

Soil Removal

Springfield requires a permit for removal of soil. There cannot be any pit or depressions in the soil, the property has to be leveled off and clear of debris, and there cannot be any detriment to adjoining properties. The topsoil to a depth of four inches must be preserved. In order to remove soil, a resident must apply for a permit and post a bond. The Township Committee reviews the application. The minimum penalty is $100.00. The maximum penalty is 90 days of community service or jail time or $ 2,000.00.

Soil Characteristics and Properties

The physical characteristics of soils vary, depending upon the parent material (in which they develop), the climate, and the topography. The mineral component of soil consists of particles of sand, silt, and clay in different proportions. Sand particles are the largest, silt smaller, and clay the finest. Soils are classified according to the size of the particles they contain. Single soil classes seldom exist alone; they contain a mix of sand, silt and clay. Soil scientists use terms like sandy loam, silt loam, or clay loam to describe the texture of a soil. Loam soils, for example, contain 7 to 27 percent clay, 28 to 50 percent silt, and less than 52 percent sand. In most soils, the organic components are rarely greater than 5 percent. Darker soil is usually an indication of a higher percentage organic material. Organic materials improve the texture and ability to retain and supply water and nutrients to plants. The relative amount of water and air in a soil depends on local precipitation and on the properties of the soil itself. As water moves down through the voids between the solid particles, the roots of plants and trees absorb some water. Long-term presence of water gives the soil a gray color. Drier soil, which

has been exposed to open air, has a brownish or reddish color. The relative ratio of clay, silt and sand in the soil, in other words its texture, affects the soil's porosity. Porosity is the amount of open or void space between the particles in the soil. Fine textured soils, with the dominant particle being clay, have a large amount of pore space because the small irregular shaped particles create micropores. However, these smaller pores are not well connected so fluids such as water cannot easily flow through. This creates a soil with low permeability. Contrarily, coarse soils, with sand as the dominant particle, have less open space but their pores are better connected, so the soil is has higher permeability.

Natural soil drainage characteristics for the soil types found in Springfield are described in Table 4.1. Where soil drainage is poor because the soil has a low permeability and water can't soak in readily or because the soil is already saturated with water, then rain runs off rapidly and causes flooding. The water also isn't stored in the ground to be used later as ground water or base flow in a nearby stream. Extreme caution is needed in development on poorly drained soils. Some of these soils occur in wetlands where development is prohibited under provisions of the Freshwater Wetlands Protection Act. Most of the precipitation on well drained soils, if they are also well vegetated, will either evaporate or soak into the ground, so that runoff is minimal. Development on these soils decreases permeability and increases runoff. Good stormwater management is essential for protecting both the land and water resources of Springfield.

Compost can be used in a garden to improve soil drainage, nutrient availability, and water absorption. Springfield residents can get their soils tested for pH, texture, and nutrient availability by the Rutgers New Jersey Agricultural Experiment Station.

Soil Erosion

Over a long period of time, water entering the soil sorts soil materials into layers called soil horizons. Clay particles, being finer, are carried down into the subsoil, leaving coarser particles in the topsoil. Below the topsoil and subsoil, there is a third layer, which contains parent material that has been changed very little by the soil-forming process. The sequence of natural layers in a soil is called a soil profile. Beneath the three layers of soil lies the bedrock.

Erosion is the breaking down and transportation of solids (sediment, rock, soil, and other particles) from one place to another. It is caused by wind, water, and tillage. There are two types of soil erosion: background, which happens at the same rate that the soil is formed, and accelerated, where erosion happens at a faster rate than soil formation. The accelerated erosion has become a frequent phenomenon caused by

human actions, such as overgrazing, unsuitable cultivation and agricultural processes, excessive land imperviousness, and irresponsible land use management. These leave the land unprotected and vulnerable. During times of erosive rainfall or windstorms, soil may be detached, transported, and deposited someplace else.

Infiltration capacity of the soil refers to the ability of water to enter and pass through the soil. Erosion of soil is reduced when the soil is well drained and coarse textured, with extensive root development. Soils erode faster when they are bare, fine textured and compacted. The slope of the land also affects soil erosion; the greater the slope the easier it is for soil to erode. One inch of topsoil takes 500 years to be generated naturally. Erosion removes topsoil, leaving the area barren and less productive. When soil is eroded, it is ultimately deposited somewhere else; and when water is involved the new resting place is in streams, rivers, and lakes. This sediment pollution can destroy aquatic habitat, diminish water quality, exacerbate flooding, and reduce the storage capacity of reservoirs.

In 1976, the State of New Jersey passed the Soil Erosion and Sediment Control Act, addressing the extensive development of land which often has been accompanied by damage to the natural resources, including erosion. Upon the act, individuals planning land disturbance activities must obtain the Soil Erosion and Sediment Control Plan Certification from the Soil Conservation District.

Soil Types in Springfield

Most of the soils in Springfield are derived from the morainic material at the surface. Temperature, moisture, and vegetational cover over long periods of time have modified the weathered material of moraine into a soil. When climate, vegetation, and time are the principal con- trolling factors, the result is a zonal soil usually covering large areas. Springfield also has interzonal and azonal categories as well which will be considered later.

Soil texture refers to the size of the soil particle and is an important characteristic. Sandy soils have predominantly large sized particles and clay soils have predominantly small sized particles. Silts are of intermediate size. Soils with a mixture of sizes within a certain range of proportions are loams. A portion of humus also is characteristic of loams. Loams predominate in Springfield, a zonal characteristic of a large portion of the glaciated area in the northeastern part of the United States. Note that there are various names associated with loams. If the ratio of particles changes from one area to the next, the local name of the loam changes (e.g. Beraudian loam, Podunk loam, Wethersfield loam, Dunellen loam, etc.). The actual local names frequently are cultural artifacts from

early days. Descriptive adjectives such as "gravelly", "silty", "fine-sandy", etc. further refine the categories.

Swamp, muck, and meadow soils are interzonal categories of soil. Climatic extremes characterize interzonal soils, and for Springfield these are areas with too much moisture. A high ground-water table promotes almost continuous soil saturation. The terms “swampy”, "muck", and "meadow" relate to the severity of moisture in the order of most severe to least severe. Large accumulations of organic material (humus) are characteristic of these soils. Organic debris such as leaves, sticks, and dead grasses cannot readily decompose because most of the air space is filled with water. The lack of air or oxygen, called anaerobic, limits normal decomposition. The chemical reactions within the humus produce odorous gases, notably methane, ammonia, and hydrogen sulfide (the rotten egg smell), When swamp, muck, or meadow soils are present, they delineate areas least desirable for dumping or fill.

From an economic point of view one might consider that dumping and filling of these under-utilized areas would contribute to greater utility. Experience with the Hackensack Meadows Sports Center has shown otherwise; all the dumped material and fill and even the muck soils had to be removed prior to construction. Lack of structural stability plus the odors contributed to the removal decision. Recent alluvium (deposits of clay, silt, sand, and gravel left by flowing streams in a river valley or delta) for soils is distinct from recent alluvium of surface geology. In the latter, recent alluvium refers to the past 10,000 to 15,000 years. In the former, recent alluvium refers to the last few hundred years.

Sediment loading of streams provides the material which is then deposited. Sediment loading (or overloading) may be a result of high slope, low soil permeability, structurally weak surface materials, insufficient vegetation cover, and a host of smaller factors. Sediment loading also may be related to human activities because of changes in slope (grading), changes in soil permeability (urbanization), changes in structure (fill), and/or changes in vegetation cover (forest to lawns). Probably all of these factors are active in Springfield with the First Watchung Mountain contributing the natural sediment loading and construction contributing additional sediment.

Soil classifications for the northern portion of Springfield are obscured by urban development. The basic material is morainic Wethersfield loam, but the surface has been highly altered by fill and other leveling procedures, plus additions to lawns of liming and fertilization, as well as accumulation of urban debris, roads and buildings. The U. S. Soil Conservation Service calls this "Urbanized Area” and provides no details. Samples analyzed in 1976 indicated extreme variability with no possibility of utilizing a classification system.

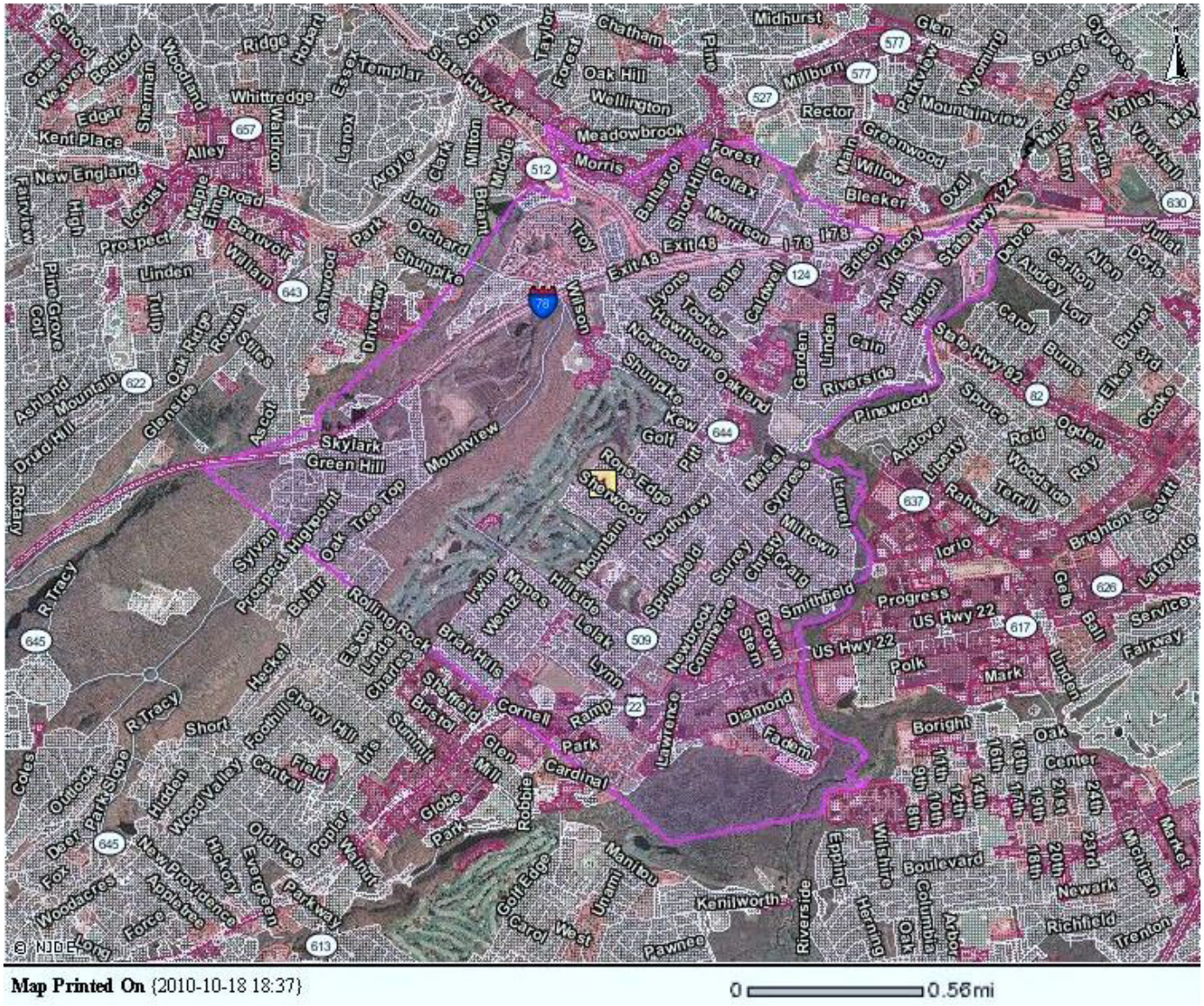
Soil Moisture Storage

The amount of water stored in the soil is of particular interest to those in agriculture, which in Springfield principally means the home gardener. The timing and amount of irrigation can be calculated by serious gardeners and landscaping professionals if soil moisture storage data are known. To others, the data provide a relative factor for irrigation. For garden crops and lawns, soils with lower values of inches of water per increment of soil depth require more frequent irrigation than soils with higher numbers.

Table 4.1 Soil Moisture Storage Values

Soil Types	0-6Inches	0-12 Inches	0-18Inches	0-24 Inches
Bernudian Loam	1.68	3.36	5.04	6.72
Croton Silt	1.74	3.42	4.98	6.42
Dunellen Loam	1.08	2.16	3.06	3.90
Eolyofee(All Types)	1.32	2.64	4.08	5.52
Muck	1.90	3.80	4.70	6.60
Wethersfield(All Types)	1.20	2.40	3.84	5.28

Figure 4.1 Impervious Surface in Springfield, 2002 (shown in red).



CHAPTER V FLORA & FAUNA

Native Vegetation[1]

Vegetation is defined as the plant life or the plant ground cover of a particular region. Plants are the primary producers in food webs because of their unique ability to convert inorganic substances - carbon dioxide and water - to organic materials and oxygen. Strictly speaking, "natural vegetation" is plant cover that has never been influenced by other than natural processes, but the impact of humans has been so pervasive that today it has come to mean plants that grow and develop without human intervention, though they may be subject to human actions.

Plants are important because they support many vital functions in the biosphere. They are also essential in local and global energy balances. Vegetation regulates the flow of several biogeochemical cycles, such as water, carbon, and nitrogen. Such cycles are important for global patterns of climate as well as global ecosystems. Vegetation also strongly affects various soil characteristics, including soil chemistry, volume, texture, and plays a role in reducing soil erosion. Those soil characteristics then feed back to affect different characteristics of vegetation, including productivity and structure. Vegetation provides habitat for wildlife and provides the energy source for a variety of animal species. In urban areas, plants help offset the urban heat island effect – where the urban environment generates and traps more heat than a less developed one. The most important function vegetation provides is the sequestration of carbon dioxide and the production of oxygen. Oxygen is vital to the environment because it enables aerobic species to evolve and persist.

Vegetation is one of five ecosystem components, the others being: climactic elements, geologic and soil features, animals, and human activities. Climactic elements affect vegetation by temperature, the amount of precipitation, and light. Geology creates a variety of landscapes and influences the development of the texture, structure and drainage characteristics of soil. Animals have both positive and negative effects on vegetation. Organisms such as earthworms improve the soil. Other animals - such as birds, insects and bats - disperse seeds, aiding plant reproduction. Adverse impacts include leaf chewing activities, such as those of gypsy moths or deer, which can be quite destructive. Human activities are believed to have upset the balance of nature. For example, in the past, natural factors such as predation or starvation often curbed overpopulation of both gypsy moths and deer.

[1] Information on plants can be found in the following references: *Plant Communities of New Jersey A Study in Landscape Diversity* by Beryl Robichaud Collins and Karl H. Anderson, Rutgers University Press, 1994.
Living in Springfield 1997-98 - Ruby Press, Springfield

Soil moisture is the most important of the factors governing plant habitat. The characterization of the habitats is based on the combination of soil moisture, temperature, water salinity and water acidity. Several plant habitats are found in the Springfield area. They include Type 5: North Jersey swamps and floodplains, with swamps located mostly in glaciated areas, and floodplains found, of course, along watercourses; and Type 7: North Jersey Uplands, including the slopes, hilltops, valleys and ravines of the Piedmont.

Springfield is located in the Piedmont region of New Jersey, which provides some of the best soils in the state. Unfortunately for farmers and gardeners, these good soils are located in the areas where demand for housing, industries, roads and shopping centers is the highest. Due to mankind's intervention, the present vegetation does not accurately represent the natural vegetation that would otherwise be present. Nevertheless, the vegetation in this part of the state is very distinct and interesting. A mix of sugar-maples, white and red pine, eastern hemlock, red oak and white birch are the most common tree species seen around the Piedmont area. Biologists consider the Piedmont vegetation as the "southern extensions of the northern-type forests…"[2] Appendix B lists native plants that will grow well in Springfield, and Appendix C lists native trees and shrubs of New Jersey's Piedmont Region.

Vegetation typically consists of layers. At the top is the forest canopy created by mature trees. In the summer when in full leaf, the canopy intercepts a considerable amount of light and rain. Below the canopy is a sub-canopy or tree understory, consisting of smaller trees - both immature trees that will eventually become part of the forest canopy and species which remain smaller in maturity. Below the sub-canopy is a shrub layer. Few shrubs will reach their maximum development in this layer because they are restricted by the shade; few flower and produce fruit. Below the shrubs is the herb layer, which is most active in the spring, before the vegetation above has leafed out. Finally, the forest floor is itself a layer -- of leaf and branch litter, fungi and great numbers of minute animals. All of these are an interrelated, living dynamic unit. The death of a large tree and the subsequent increase in light and water to the vegetation underneath will trigger significant change in the vegetation in the immediate area.

Biodiversity is defined as "the variability among living organisms and the ecological complexes of which they are a part; this includes diversity within species, between

[2] Stansfield Jr., Charles A., 2004. "A Geography of New Jersey" Second Edition.

species, and of ecosystems."[3] Biodiversity supports a healthy food web and provides various ecosystem services, biological resources and societal benefits. Species depend on each other in order to survive. An ecosystem that contains diverse plant and animal species is better able to handle changing conditions. A forest with only one tree species would easily be destroyed if a species-specific disease was introduced; but, a forest with many types of trees would fare better.

In recent decades, habitat loss, habitat fragmentation and degradation have been impacting biodiversity and accelerating rates of extinction. Researchers estimate that current rates of species extinction are about 100 times higher than long-term average rates based on fossil data.[4] It is very important, now more than ever, to promote biodiversity, healthy ecosystems and natural habitats. Residents of Springfield can advocate nature conservation and ecological restoration. For a complete list of NJ threatened and endangered species, please go to: http://ecos.fws.gov/tess_public/pub/stateListingAndOccurrenceIndividual.jsp?state=NJ.

Humans have had an impact on vegetation in the Springfield area since before the arrival of European settlers. Native Americans used wood for housing, transportation and fuel, and also periodically set fire to the forests to aid hunting and traveling. Since certain tree species are more fire resistant than others, this had an impact on the nature of the forest. The predominance of oak may be attributed to its more fire-resistant nature compared to that of hemlock, for example. The early colonists continued this practice, and by the Revolution, the entire Piedmont area had been cleared for agricultural use. Those areas not fit for farming were retained as a source of wood for household use and for grazing by domestic animals. Cutting of trees in woodlots favored those trees -- oaks, hickories, dogwoods -- which sprout readily from tree stumps. Similarly, hemlock, which is not eaten by cattle, is likely to have remained and perpetuated itself. During the 1800's, the demand for wood increased, driven by both population and new methods of transportation that required wood as fuel.

Today, much of Springfield is developed, but there are undeveloped areas of substantial size in town and nearby. The Houdaille Quarry, Hidden Valley Park, Briant Park, Lenape Park, Echo Lake Park, Rahway River Park, and the Watchung Reservation are all Union County parks. The township parks include a variety of playgrounds, ball fields, historic buildings and other open spaces, described in videos on the township website. The Baltusrol Golf Course, in addition to its legacy of championship golf, is also a

[3] Encyclopedia of Earth. http://www.eoearth.org/article/biodiversity
[4] Encyclopedia of Earth http://www.eoearth.org/article/biodiversity

champion of the environment, as a certified Audubon Cooperative Sancuary. The unique value of these parks in providing opportunities for passive forms of recreation in an increasingly urbanized region should not be overlooked when faced with competing needs.

Trees

Through the continuous efforts and energy of the Department of Public Works, Springfield has become a Tree City USA municipality and a member of the New Jersey Shade Tree Federation. The DPW plants and maintains all shade trees in the parks and along the streets. At present, the township employs a certified tree expert whose arboreal responsibilities and activities include the removal of dead trees and the pruning and removal of hazardous conditions caused by dead limbs, low limbs, broken limbs, etc. The Department averages approximately 60 removals, 100 prunings, and at least 25 plantings at a cost of $150,000 each year. The DPW, however, does not prune trees for esthetic purposes. The DPW each year applies for grants from various federal, state and private organizations to supplement its efforts.

Among the notable items in its tree inventory, Springfield is the proud home of two ancient American Elms, survivors of the Dutch Elm blight that struck New Jersey beginning in 1931. In 1992, the DPW planted 55 Liberty Elm trees that they grew from saplings. As of this writing, 40 are healthy trees.

Union County plants trees annually on county roads and properties. On streets with utility wires, compact trees are planted, with large trees reserved for wire-free locations.

Since 1991 Springfield Township has had a Tree Ordinance. In order to remove trees, residents of Springfield must obtain a permit. Without a permit, a resident can incur a $ 250.00 fine per tree removed. Some of the private residential cutting down of the trees in town has caused increased soil erosion, increased dust and increased noise level. This cutting down trees has adversely affected the property value of the land and the deterioration of land which ultimately affects the general well-being of the people.

Bio-blitz plant survey

In 2009, the Union County Department of Parks and Community Renewal Bio-Blitz biodiversity survey in Hidden Valley Park, Briant Park and Houdaille Quarry recorded around 240 plant species. Wetland, field, overstory and understory all consisted of a diverse combination of plants. Interestingly, a healthy population of the American wintergreen, an understory

shrub, was found during the survey. This means that the deer-related damage is not as excessive as in other parks in NJ[5]. (More about the deer management problem in Section VI Wildlife).

Plant surveys from 1975 in various natural sites around Springfield are listed in the township's Master Plan.

Invasive Plants

This section would not be complete without mention of one of the greatest threats to our native plants and the wildlife which depend on them -- namely non-native plants. Thousands of non-native plants have been brought to North America over the past three centuries, and some have spread from other parts of the U.S. While most are well-behaved, others -- variously called alien, introduced, or exotic -- are highly invasive in their new ecosystem. Invasives tend to be very successful, highly competitive and reproduce quickly in the invaded land. They usually do not have a natural predator which makes them extra devastating to the natural environment. In addition to the scourge of the lawn -- crab grass and field garlic -- the list includes others. Some examples are: Japanese knotweed *(Polygonum cuspidatum),* a well-known threat to riparian areas, found in profusion at Briant Park, and some natives such as the reed grass, *Phragmites*, that has become invasive due to either hybridization or introduction of a new strain, and can be seen at Lake Surprise in the Watchung Reservation. Some of our popular landscape plants such as Japanese honeysuckle and Barbary, also are considered invasive species, and continue to be planted by unknowing property owners. These invasive plants readily sprout and grow vigorously in woods, fields and wetlands, and crowd out native species. Even shade trees such as Norway maple, and the ubiquitous Ailanthus, the Tree of Heaven, are invasive species that have taken root throughout Springfield. Appendix D provides a list of invasive plants.

[5] Results and Findings for Bio-Blitz 2007 and 2009. Union County Parks Department. Available at: http://www.ucnj.org/parks/bioblitz.html

Wildlife[6]

New Jersey is home to some 500 species of wildlife, largely due to its diverse geography and location at the edge of the "northern" range for many southern species and "southern" range for many northern species. Springfield's publicly-owned natural areas, coupled with some sizable private properties, particularly the Baltustrol Golf Course, offer habitat to a diversity of species.

Wildlife needs healthy, contiguous space to live and thrive. A species' habitat refers to the food, water, cover, and other resources necessary for its survival and reproduction. An increasing issue for animal and plant species is habitat loss. Habitat loss can occur in different forms, such as:

- Destruction - reducing natural areas
- Degradation – altering a habitat so it cannot support a dense or diverse range of species
- Fragmentation - dividing large natural space into smaller, isolated areas

When a threatened or endangered species habitat is clear-cut (destruction), broken into many pieces by sprawl and development (fragmentation), or overrun by invasive species or pollution (degradation), it becomes increasingly difficult for the species to find the resources it needs to survive. This can result in reductions in population size and at worst, extinction. Besides destruction, degradation, and fragmentation, man-made threats can be divided into these other categories:

- Climate Change - increasing amounts of greenhouse gases in the Earth's atmosphere causes changes to the global climate
- Over-Exploitation of Resources - Exploitation of wild populations for food, i.e. fishing, has resulted in population crashes
- Hunting, Poaching, Illegal Trade of Endangered Species - some endangered species are targeted for their value in illegal markets
- Accidental Deaths - car accidents, window collisions by birds, or run-ins with ships or propellers cause a decrease in population for many species

Residents of Springfield should understand the importance of wildlife and should take proactive steps towards wildlife protection. They include: protecting wildlife habitat, joining a conservation organization, reducing the threat of

6 The following are references for wildlife in New Jersey: NJ Audubon website
The Status and Distribution of New Jersey's Birds - Charles F. Leck - Rutgers - 1984
NJ Landscape Project, <www.invasivespecies.gov>
<http://www.state.nj.us/dep/forestry/community/ALB.html>

invasive species, recycling, reducing energy use, minimizing the use of pesticides and insecticides and educating others.

Bird life is diverse in New Jersey due to its location along the Atlantic flyway, one of the great bird migration routes. More than 400 species have been sighted reliably over the years. Some 208 species have been seen in the Watchung Reservation since record-keeping began in 1940. The likelihood of spotting the occasional rare wanderer locally is enhanced by Springfield's location between the Watchung Reservation to the south and the Great Swamp National Wildlife Refuge, located not far to the northwest in Morris County.

The Landscape Project, developed under the New Jersey Endangered and Nongame Species Program by the Division of Fish, Game and Wildlife in the New Jersey Department of Environmental Protection has produced maps of areas that should be conserved in order to protect wildlife habitat in New Jersey. No endangered species have been identified in Springfield, but suitable habitat for them is present in the parks around Springfield's periphery. Surveys by the U.S. Fish and Wildlife Service show that:

> *Protecting large expanses of fields, forests and wetlands helps to ensure that rare species will remain a part of New Jersey's future. In addition to providing habitat for the conservation of rare species, the Landscape project will result in more open space for outdoor recreation. Recent (findings show that) 60 percent of Americans participate in some form of wildlife-related recreation. Open spaces provide places where people can escape the confines of urban and suburban living. Retaining habitats in their natural state provides other benefits such as reducing the threat of flooding, allowing for the biodegradation of environmental contaminants and recharging ground water reserves.*[7]

Hidden Valley Park, located in Springfield and Summit, consists of 81 acres of which 50 acres lie within Springfield. At present there is no official entrance to the park nor any established parking areas. The park can be reached by Old Coach Road off Baltusrol Road in Summit, the access road near Jefferson School on Ashwood Road in Summit, or through Harvard Street in Summit. The terrain is extremely diversified with woodlands, marsh, swamp habitats, several ponds and a one acre lake. Some portions of the area were previously used as a nursery. The canopy flora includes oak, beech, maple and hickory. The understory consists of

[7] Niles, Lawrence J., Jim Myers, Mike Valent. 2000. The Landscape Project. NJ Endangered and Nongame Species Program, Division of Fish, Game & Wildlife, NJ Department of Environmental Protection. Page 5.

dogwood, birch, aspen, and hornbeam. A well-developed shrub layer provides habitat for birds and other wildlife.

In 2009 the Union County Department of Parks and Community Renewal held a Bio-Blitz biodiversity survey in Hidden Valley Park, Briant Park and Houdaille Quarry. The 24-hour survey resulted in a diverse list of species: 60 fungi, 258 insects, 9 aquatic invertebrates (some were considered pollution intolerant and pollution sensitive species), 8 reptiles and amphibians, 6 fish (3 of which were invasive species), 50 birds and 9 mammals.[8]

In 2007 the Bio-Blitz biodiversity survey in Watchung Reservation, the group of scientists and volunteers identified around 180 insects, 58 fungi, 15 aquatic invertebrates, 16 fish, 19 reptiles and amphibians, 92 birds and 13 mammals. Most of the aquatic invertebrate found are considered sensitive to pollution, so finding them in Blue Brook was an indication that the pollution in the waterway is relatively low.[9]

[8] Bio-Blitz 2009 Results and Findings.. Hidden Valley Park, Briant Park and Houdaille Quarry. Union County Department of Parks and Community Renewal. Available at http://www.ucnj.org/parks/bioblitz.html

[9] Bio-Blitz 2007 Results and Findings. Watchung Reservation. Union County Department of Parks and Community Renewal. Available at: http://www.ucnj.org/parks/bioblitz.html

Invasive species

Springfield is home to invasive, non-native species of animals that pose a threat to native flora and fauna. These include the European starling (*Sturnus vulgaris),* the European gypsy moth (*Lymantria dispar)* and the Hemlock wooly adelgid (*Adelgas tsugae*). Starlings, an aggressive bird, inhibit avian diversity, cause crop damage, and can carry diseases. The favorite food of gypsy moths is oak trees; the most recent severe outbreaks were in early 1980's. Infestations of Hemlock wooly adelgids have been recorded in Union County since 1992. Integrated pest management and cultural practices can be effective in controlling this pest.

Of growing concern in recent years are the large year-round populations of Canada Geese and white-tailed deer (throughout Springfield, but particularly in neighborhoods adjacent to areas of natural vegetation). Both have done substantial damage to the ecosystem. New visitors – coyotes and young black bears -- have been sighted both in Springfield and nearby communities with increasing regularity. Rabies in wildlife and domestic animals is endemic in Springfield, meaning that we see sporadic cases of the disease in the area.

The following subsections discuss in further detail white-tailed deer, coyotes, and Canada geese which are

considered by some people to be nuisance species and are found in Springfield. The third subsection describes the threat of "white-nose syndrome" on bat populations. The last subsection discusses the Asian longhorned beetle and its invasive nature.

White-Tailed Deer

The deer population in Union County, including Springfield, has grown to problematic levels. The population's carrying capacity, which is the number of species that could be supported by a given habitat, has been exceeded because its productivity is imbalanced with its mortality. The major reasons for this imbalance are the lack of the deer's natural predators and their potential for rapid growth. Many forests suffer significantly due to the deer's understory dining preferences. These herbivores have been recognized as causing the most damage to shrubs, young shoots and other herbaceous plants, which are essential for the long-term survival of the forests. The deer are also known to cause vehicle collisions, agricultural and landscape damage and increase the number of deer ticks which carry various diseases.

Based on these disadvantages of deer overabundance in New Jersey, many communities have found it necessary to manage the deer population in a practical and fiscally responsible fashion. There are several options to control deer populations, such as: use fencing and repellents, trapping and transporting the animals, fertility control, reintroducing predators, sharpshooting, and regulated hunting. Most of these options are expensive, dangerous, hard to maintain, need more research or are ineffective. According to the Northeast Deer Technical Committee, regulated hunting has proven to be the most effecting deer population management tool.[10] Regulated hunting involves killing of deer during a hunting season under restricted conditions (hunter density, methods of take or size of huntable area).

Due to a strongly urbanized landscape in Union County, the deer population density is not high and the effects of the deer are not as severe as in the rest of the state. In Union County, during hunting season 2009-2010, the deer harvest total was 24 compared to 8,519 in Hunterdon county. The numbers of culled deer were the highest during seasons 2005-2006, 2006-2007, 2007-2008, but then they decreased in 2008-2009 and 2009-2010.[11] To control the deer population in the Watchung Reservation, a professional company conducts regulated hunting in

[10] Northeast Deer Technical Committee. May 2009. An Evaluation of Deer Management Options. Website: <http://www.state.nj.us/dep//fgw/pdf/deer_mgt_options.pdf>

[11] NJDEP Division of Fish and Wildlife. New Jersey White-tailed Deer Harvest by County - 2005-06 through 2009-10 Seasons. Website: <http://www.state.nj.us/dep//fgw/deer.htm.>

designated sites and from elevated tree stands. The hunt will not be performed in 2011 due to budget cuts.[12]

Coyotes

The coyote is a wild member of the dog family. This resourceful mammal has expanded its range significantly in the recent past, colonizing the entire Northeast and now found throughout the Garden State. The coyote was never introduced or stocked in New Jersey, but has firmly established itself in our area through its extremely adaptable nature.

The coyote resembles a small German shepherd with the exception of a long snout and bushy, black-tipped tail. Another key difference from a domestic dog is readily noticeable even from a distance: The coyote has a habit of holding its tail in a horizontal position or lower while standing, walking and running.

Coyotes adjust well to their surroundings and can survive on whatever food is available. They prey on rabbits, mice, birds and other small animals, as well as young and weakened deer. They also consume carrion (decaying tissue). They are tolerant of human activities and rapidly adapt to changes in their environment.[13]

Canada Geese

Canada geese are known to litter lawns with feces and destroy vegetation. Excessive droppings and grazing pose major threats to human health, water quality and agriculture. In 2009, a flock of geese flew into an airplane engine causing the plane to make an emergency landing in the Hudson River.[14] The Canada Geese are considered migratory. The Migratory Bird Treaty Act of 1918 states it is illegal to "pursue, hunt, take, capture, kill, possess, sell, purchase, barter, import, export, or transport any migratory bird, or any part, nest, or egg of any such bird, unless authorized by permit"[15]

At the beginning of 2010, Union County entered an agreement with the Wildlife Services Bureau of the U.S. Department of Agriculture (USDA) to manage the geese populations in Union County. Members of the USDA have developed a program called Integrated Damage Management, which controls the geese population in lethal and non-lethal ways. Lethal options include euthanasia and hunting, and non-lethal ways include harassment, nest

[12] Borough of Watchung. Deer Management Program. Phone: 908-756-0080.

[13] New Jersey DEP http://www.state.nj.us/dep/fgw/coyote_info.htm

[14] "US Ariways Flight 1549" The New York Times, June 9, 2009. Website: http://topics.nytimes.com/top/reference/timestopics/subjects/a/airplane_accidents_and_incidents/us_airways_flight_1549/index.html

[15] Canada Geese New Jersey. Migratory Bird Treaty Act. Website: http://www.canadageesenewjersey.com/Migratory%20Bird%20Treaty%20Act.htm

disruption, preventive landscape management, and educating the public to stop feeding wildlife.[16] A debate over whether lethal approaches are considered appropriate and humane has been taking place, which involves the public and the decision makers.

Northeastern Bats

Since 2006, several bat species in the Northeastern region of United States and Canada have been infected by a mysterious fungal disease, caused by the pathogen, *Geomyces destructans*, called "the white-nose syndrome". The fungus attacks the bats while they are hibernating and vulnerable. It is suspected that the fungus wakes up the bats prematurely and due to low temperatures, low body fat, and the lack of food, they die. More than a million Northeastern bats have died since 2006.[17] So far, scientists have not found a remedy against this deadly disease, although it has been reported that a treatment with an apple cider vinegar shows positive results.[18]

Bats are very important for the environment. One bat could eat about 3,000 insects in one night and pollinate 600 to 1,000 plant species. The United States Department of Agriculture estimates that the pest-eating Indiana Bats help save American farmers over 1 billion dollars in pest related damages annually.[19] In addition to pests, bats feed on mosquitoes, widely known to cause discomfort and transmit diseases in humans and other species. Due to the decline in bat populations, mosquito populations are going to increase, causing more diseases to be spread and more insecticides to be used. Insecticides might protect humans from mosquitoes for a short period of time but in the long-run, they harm and kill other species, contaminate waterways and are harmful to humans.

Asian Long-Horned Beetle

A threat to Springfield's trees is the Asian long-horned beetle (*Anoplophora glabripennis).* The beetle entered the U.S. in crates from China. First found in New York City, but discovered some time ago in Jersey City, Carteret, Woodbridge and Linden. It has the potential to destroy large numbers of trees in Springfield. Most susceptible are maples, horse chestnuts, poplars, willows, elms, mulberries, and black locusts. Mature beetles emerge from

16 "Union County Authorizes U.S Department of Agriculture to Manage Canada Geese." February 17, 2009. Website: <http://www.unioncountynj.org/news/1002geese.html>

17 "An Emotional Toll" Bat Conservation Times. Volume 8, Number 6, June 2010.

18 Kashmenr, Jackie. "Results of Apple Cider Vinegar to Treat White Nose Syndrome Affected Bats." Bat World New Jersey, 2009. Website: <http://www.batmanagement.com/wns/WNStreatment-BWNJ.pdf>

19 United States Department of Agriculture. Natural Resources Conservation Service. "Bats Help Battle Crop Pests" 2008.

infested trees from late May through October. Look for their perfectly round exit holes about the diameter of a pencil. If you suspect that a tree is infested with the Asian Longhorned Beetle call the US Department of Agriculture toll-free at 1-866-BEETLE1.

Asian long-horned beetle

CHAPTER VI HISTORIC PRESERVATION

Location and brief descriptions of some historical sites in Springfield

"Historic Preservation" is the identification, evaluation, and protection of historical and archaeological resources so that they continue to play an integral and vibrant role in their communities, according to the Office of State Planning. Historical preservation is a visionary concept that is designed to protect the physical records of the events and people that shaped our nation, New Jersey and Springfield Township. Historical properties protected through historic preservation are irreplaceable assets that decorate our landscape and link the present to the past. Similar to environmental conservation, historical preservation plays a quintessential role in preserving invaluable resources with significant economic and cultural value for future generations.

Historic preservation is a recognized public policy and activity. Supported and implemented at the national, state and municipal levels, it is undertaken by individuals, organizations and government. In New Jersey, the public commitment to historical preservation is defined by three distinct designation types: the National Register of Historical Places, the New Jersey Register of Historical Places, and designation by a municipality pursuant to authority derived from the Municipal Land Use Law, N.J.S.A. 40:55D-1 et seq. ("MLUL").

At the national level, the Historic Preservation Act, 16 U.S.C. 470(f) ("NHPA"), requires federal agencies to evaluate the effect of their undertakings on historic properties through a process commonly referred to as a Section 106 Review. Similarly, at the state level, the New Jersey Register of Historical Preservation Act, N.J.S.A. 13:1B-15.128 et seq., protects listed historical properties from detrimental effects of public undertakings. At the municipal level, municipalities are empowered by the MLUL to designate and promote the conservation of historical sites.

The Springfield Historical Society

Springfield's Historical Society is a community organization. The Society operates the Historic Cannon Ball House as a museum and an educational historic site. Its headquarters are at the Cannon Ball House, located at 126 Morris Ave Springfield, NJ, telephone (973) 912 4464.

Sites, monuments and buildings are visible evidence of Springfield's early history. Settled in the early 1700's, the

township was the scene of a Revolutionary battle which occurred on June 23, 1780. The locations and brief descriptions are provided below. For further information, the reader is referred to the Springfield Historical Society and the fine collection of materials at the town library.

1 First Bridge. Located at Morris and Washington Avenues at the Rahway River, a monument marks the site of the original bridge where a major portion of the Revolutionary Battle of Springfield was fought on June 23, 1780.

2 Cannon Ball House. Located at 126 Morris Avenue, the building is a distinguished town landmark. It receives its name as a result of a hole pierced in its side by an American cannon ball during the Battle of Springfield. The house is one of four that escaped burning by the British. The cannon ball is displayed in the house.

3 First Presbyterian Church. The church is located on Church Mall and Morris Avenue. Erected in 1791, the building stands on the foundations of the original church which was burned during the Battle of Springfield.

4 Smallest State Park in New Jersey. Adjacent to the First Presbyterian Church, a statue of a colonial soldier stands in New Jersey's smallest state park: the ground immediately beneath the monument, 25 square feet in area.

5 Presbyterian Cemetery. Located on Church Mall opposite the church, the cemetery contains the graves of twenty-five Revolutionary officers and soldiers, veterans of the War of 1812, and many prominent early families.

6 Old Presbyterian Parsonage. Located on Church Mall. The original parsonage was torn down and rebuilt in 1844. The foundation is from the pre-Revolutionary building which was partially burned during the Battle of Springfield.

7 Springfield Emanuel United Methodist Church. Situated at 40 Church Mall, the church was built in 1832.

8 Academy Green. Situated between the Methodist Church and Sarah Bailey House, the area was originally the location of Springfield's Union Academy (1799-1901).

9 Second Bridge. The site represents the second line of defense of the Continental Army where the British Advance was halted. The bridge was located at the point where Van Winkles Brook goes under Morris Avenue.

10 Revolutionary Cemetery. Situated on the east side of Mountain Avenue about 300 feet south of Morris Avenue. This cemetery contains the grave of William Stites, one of the first

inhabitants of the Township, as well as graves of local revolutionary officers.

11 Large Presbyterian Cemetery. Situated at Taft Avenue north of Route 78, this cemetery contains the graves of Revolutionary War veterans, the graves of the Poole brothers who served on opposite sides during the Civil War, and of Edward Wade who was mortally wounded at Antietam. Also impressive is the monument to Elia Kim Littell, a hero of the French and Indian War as well as the Revolution.

12 Anthony Swaim House. Built in 1744, this is the second oldest house in Springfield. It is still occupied as a private residence.

13 Sayre House. Built in 1729, this house served as an Indian trading post. While the house has much of its original structure, it has been altered considerably and continues to be a private residence.

14 French Richards Cemetery. The site is situated at Route 22 and Silver Spring Court in the industrial section of the township It contains the graves of the French and Richard families some of whom were pre-revolutionary settlers of Springfield.

The following are also valuable historic sites: The circa 1895 Rahway Valley Railroad Station located at 195 Mountain Avenue, the Baltusrol Golf Course established in 1895, and an early 19th century house, located at 701 Mountain Avenue which exhibits many early American architectural features.

The Cannon Ball House, 126 Morris Avenue

CHAPTER VII. LAND USE

CHAPTER VII LAND USE

The major change in the land use in Springfield has been the loss of all agricultural areas. Most of the farms and nurseries within the township have been converted to developments of various kinds. Now, even though there are more acres of "open space" it has been at an environmental usage cost. The good news is that the more recent developments have been required and have had the foresight to include community gardens and open green areas within their complexes.

The industrial areas of the town are located mainly on or adjacent to the Route 22 corridor.

There are six business districts:

1) Along Morris Avenue, "The Center"
2) Along Route 22
3) Echo Plaza
4) Mountain Avenue and Henshaw and Waverly
5) Mountain Avenue from Kipling to Edgewood
6) South Springfield - North and South from the intersection with Hillside Avenue.

The Township owns and maintains 42 miles of roads, including the easements on either side, equivalent to 280 acres.

A Catalogue of Open Space

Springfield has 1,309.6 acres of open space, of a total land area of 3,328 acres, almost 40% of the land area.

NEW JERSEY DEPARTMENT OF TRANSPORTATION

- Houdaille Quarry 131.5 acres
  (leased to Union County Park Commission)
- Western section of the township ~ 82 acres

UNION COUNTY PARK COMMISSION PROPERTY

- Briant Park (also in Summit) 14.7 acres
- Lenape Park & Rahway River Parkway 278.8 acres
  (also in Cranford, Westfield, Union, Kenilworth, Clark and Rahway)
- Watchung Reservation 29.7 acres
  (also in Summit, Berkeley Heights, Scotch Plains, and Mountainside)
- Hidden Valley Park (also in Summit) 50.79 acres
- Meisel Pond and Athletic Field 10.49 acres
- Smithfield playground 10.47 acres
- Washington Avenue playground 15.28 acres
- Houdaille Quarry land on Mount View Rd. 37.2 acres
- Property near Union Township Border 11.23 acres
  (Block 406 Lot 20)

RECREATIONAL LAND OWNED BY SPRINGFIELD

- Veterans' Park 2.17 acres
  (previously known as Fadem Park)
  Mountain Avenue and Shunpike Road
  Purchased with Green Acres funds
- Municipal Pool - off Morrison Rd 15.74 acres
- Denham Road playground 1.4 acres
- Laurel playground - Laurel Dr. 1.26 acres
- Henshaw Avenue playground 1.38 acres
- Irwin Street playground 5.35 acres
- Ruby playground - Caldwell Place 6.0 acres
- Alvin Terrace playground 0.8 acres
- Cohn playground - Baltusrol Way 0.8 acres
- Dayton Fields including Patriot's Park 9.3 acres
  (Block 802 Lot 1)
  purchased with Green Acres Funds
- Chisholm Park (including building) 4.32 acres
- Trivitt Park adjacent to Library 1.4 acres

SPRINGFIELD BOARD OF EDUCATION

- Land at the end of Treetop Drive 9.6 acres

PRIVATELY OWNED LAND

- Baltusrol Golf Club 470.0 acres
- Industrial Zone off Route 22 East 52.0 acres
- Land adjoining former BOE property 14.0 acres
- Rahway Valley Railroad 14.0 acres
  ~ 8,000' long x 75' wide
- Springfield Nurseries – Mountain Ave. 4.0 acres

PRIVATELY OWNED LAND - Parcels under 10 acres

The remainder of the township's vacant or undeveloped land consists of small lots of 1 acre or less scattered throughout the residential areas. 65.8 acres

CHAPTER VIII ENVIRONMENTAL POLLUTION

Sites in Springfield with known contamination

New Jersey became the Nation's leader in contaminated site remediation in 1976 with the passage of the *New Jersey Spill Compensation and Control Act, N.J.S.A.* **58:10-**23.11 *et seq.* (Spill Act). New Jersey's Site Remediation Program was the first program in the country designed to clean up and monitor contaminated sites that posed a danger to human health and the environment. Following New Jersey's lead, the national legislature passed the *Comprehensive Environmental Response and Recovery Act,* 42 U.S.C. §9601, *et seq.* (CERCLA or Superfund) which was designed to identify, cleanup and monitor contaminated sites nationwide.

New Jersey's Site Remediation Program (SRP) is a Division within the New Jersey Department of Environmental Protection (NJDEP). SRP is charged, among other things, with overseeing private and publicly funded contaminated site cleanups. Information regarding NJDEP's Site Remediation Program may be obtained from NJDEP's website at www.state.nj.us/dep/srp or by contacting (609) 292-1250.

NJDEP - Site Remediation Program
401 E. State Street
6th Floor, East Wing, P.O. Box 028
Trenton, New Jersey 08625

In 2009, the Site Remediation Reform Act (SRRA) was signed. This legislation changes the process of environmental investigations and cleanups in New Jersey by allowing private licensed site remediation professionals (LSRPs) to supervise the cleanup of properties and certify that they have been remediated.

To inform New Jersey residents about potential environmental hazards emanating from nearby or adjacent properties, NJDEP's SRP Office maintains a list of all known contaminated sites within the State. Listings by site name, county and municipality are available on the NJDEP SRP website. A map and list of sites in Springfield with known sources of contamination are included in Figure 8.1 and Table 8.1. According to the New Jersey Department of Environmental

Protection (NJDEP) 2010 report, there are thirty two known contaminated sites in Springfield. In many cases the contamination is caused by leaking underground storage tanks. Any of these cases could cause contaminants to leach into ground water, and well water or stream water might become contaminated.

Nearly half of New Jersey's residents get their drinking water from ground water pumped by wells. Springfield passed a well head protection ordinance to safeguard public community wells from different types of contamination. The protected area is delineated as three tiers. The outer edge of a tier marks the time that ground water must travel to be drawn into a well, based on pumping rates and soil permeability: Tier 1 – two years; Tier 2 – five years; Tier 3 – 12 years. Springfield's Wellhead Protection Areas are shown in Figure 8.1.

The tiers are used to assess the relative risk of contamination to the well by placing a higher priority on pollution sources, prevention, and remedies in tiers closest to the wells. Tier 1 is the closest tier and major pollutant sources are prohibited in that area. Major pollutant sources in Tier 2 are also prohibited but minor pollutant sources require best management practices. Both, major and minor pollutant sources require best management practices in Tier 3. There are several contaminated sites within Tier 1, 2 and 3 found in Springfield. Site no. 34, has been within Tier 1 since 1998. Overlook Hospital (site no.6) and Stephens-Miller Co (site no.1) are within Tier 2. Site no. 1 has been in Tier 3 since 1997. There are 7 sites in Tier 3 area. Residents are urged to monitor the status of contaminated sites within the municipality to ensure property owners are complying with New Jersey Environmental Laws and Regulations.

Emerging Contaminants

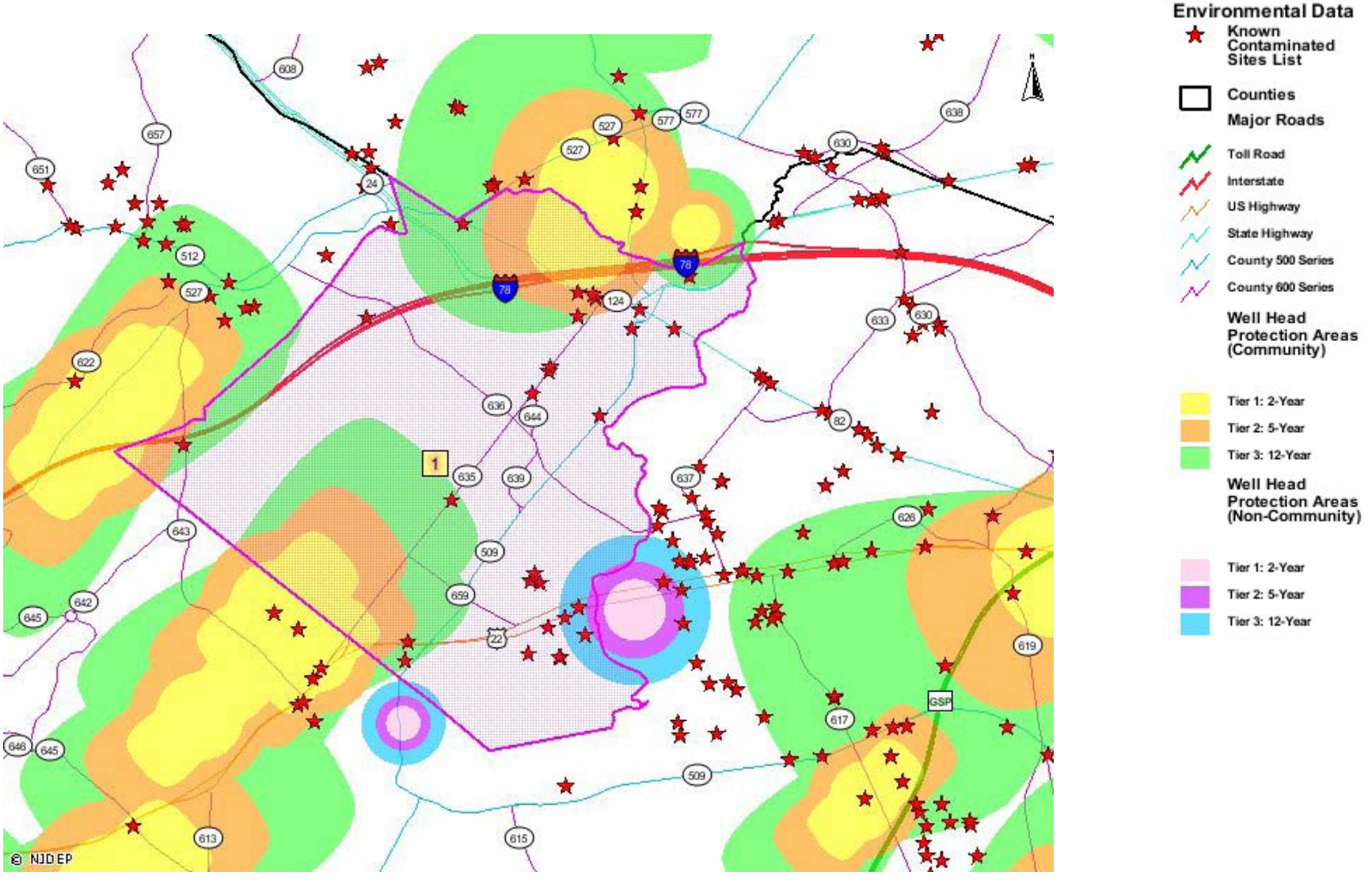
There is a growing concern about finding emergent contaminants in waterways as studies have found pharmaceutical ingredients such as barbiturates, opioids, antidepressants, and muscle relaxants in the environment. These substances mostly enter aquatic ecosystems through discharge from wastewater treatment plants. For many types of medicine, the body does not use all of the active ingredients in the pill or syrup taken by a person. These un-metabolized ingredients are excreted by the body and thus enter the wastewater stream. Similarly, topical medications can enter wastewater when the user washes. Pharmaceuticals can also enter the wastewater stream when unused medications are flushed down the toilet. Wastewater from pharmaceutical

manufacturing facilities is another source.

Most wastewater treatment facilities are engineered to remove organic material, nitrogen, phosphorus, suspended solids, and pathogens from wastewater before discharging into natural waterways. In their present form these facilities are ineffective at removing pharmaceutical ingredients. In some cases, pharmaceutical ingredients such as antibiotics may be harmful to the bacterial colonies used in the treatment plants. While there are currently no studies demonstrating negative impacts on human health, at higher concentrations some pharmaceutical ingredients can be harmful to aquatic life. As this issue continues to be investigated, one source that has been targeted for reductions is the flushing of unused medicines. In addition to environmental benefits, proper medicine disposal reduces the availability of prescription drugs for misuse.

VIII. ENVIRONMENTAL POLLUTION

Figure 8.1 Known Contaminated Sites and Well Head Protection Areas in Springfield



VIII. ENVIRONMENTAL POLLUTION

Table 8.11 Known Contaminated Sites in Springfield[1]

Site ID	PI Name	Address	Home owner
216165	104 BRIAR HILLS CIRCLE	104 BRIAR HILLS CIR	Yes
168104	137 SOUTH MAPLE AVENUE	137 S MAPLE AVE	Yes
384160	20 MILLBURN AVE COMMERCIAL BUILDING	20 MILLBURN AVE	No
398807	407 MILLTOWN ROAD	407 MILLTOWN RD	Yes
362807	72 BRIAR HILL CIRCLE	72 BRIAR CIR	Yes
408967	753 SOUTH SPRINGFIELD AVENUE	753 S SPRINGFIELD AVE	Yes
404619	901 MOUNTAIN AVENUE	901 MOUNTAIN AVE	No
129505	9 PROFFIT AVENUE	9 PROFITT AVE	Yes
15039	AMOCO SERVICE STATION 12841	128 HILLSIDE AVE	No
13169	ATLANTIC METAL PRODUCTS INC	21 FADEM RD	No
20607	B & E ELECTROFORM CO	16 18 COMMERCE ST	No
371	BP SERVICE STATION #20522	5 MEISEL AVE	No
66092	CARTER BELL MANUFACTURING	BRIANT PARK DR	No
55301	CHARLIE'S GETTY SERVICE	54 MEISEL AVE	No
66739	ELIZABETHTOWN WC SPRINGFIELD WELLFIELD	CONTAMINATION VARIOUS LOCATION	No
127279	GENERAL ELECTRIC COMPANY	99 RT 22	No
68356	GENERAL GREENE SHOPPING CENTER	201 MORRIS AVE	No
224338	HOLIDAY INN	304 RT 22 W	No
49866	HOUDAILLE QUARRY	QUARRY RD	No
47270	JONATHAN DAYTON HIGH SCHOOL	101 MOUNTAIN AVE	No
92781	MEISEL PARK	MEISEL AVE	No
44044	M P USA LLC (DELTA GAS)	958 S SPRINGFIELD AVE	No
708	PACIFICO BROS INC	569 MORRIS AVE	No
52253	PERRELLIS TEXACO	251 MORRIS AVE	No
718	PINKAVAS MOTOR COMPANY INC	4 CALDWELL PL	No
33713	RALPH LIBONATI CO	24 FADEM RD	No
66150	SARGENT WELSH SCIENTIFIC COMPANY	35 STERN AVE	No
712	SCHAIBLE OIL CO	192 MOUNTAIN AVE	No
714	SHELL SERVICE STATION #138510	245 MOUNTAIN AVE	No
49988	SUMMIT PUMP STATION	127 SUMMIT RD	No
80406	SUNOCO S/S (FORMER)	46 MORRIS AVE	No
13166	YSI TEMPERATURE	118 VICTORY RD	No
Total: 32			

[1] NJ Department of Environmental Protection, Site Remediation Program 2010. Active Sites With Confirmed Contamination in Springfield, NJ. Website: <http://www.nj.gov/dep/srp/kcsnj/kcsnj_active.

VIII. ENVIRONMENTAL POLLUTION

Noise

Springfield's noise levels reflect the suburban lifestyle followed by most of the inhabitants. Excessive noise can come from many sources, including:

- Commercial and industrial sites
- Air traffic
- Highways
- Construction
- Outdoor maintenance, such as lawn mowers and leaf blowers
- Nuisance, such as loud parties or amateur music band practices

The Township has ordinances to regulate noise levels and prohibiting construction before 8 AM and after 9 PM. Union County supplies noise monitor tests for complaints about industrial noise.

Air traffic comes mainly from Newark Airport. Although the primary runways at Newark Airport run north - south, causing relatively little air traffic noise from commercial jets taking off or landing, other runways do result in air traffic over Springfield. Noise levels are highest during takeoff, the point in the flight when the greatest amount of energy is required. Primary winds come from the south; so most aircraft take off in a southerly direction over Elizabeth, however all surrounding communities share in the noise exposure.

The two major highways through Springfield are Interstate 78 and Route 22. Noise barricades have been placed along the highways in an attempt to dampen the sound. However, these barriers are often perceived as an appeasement to residents in the highway neighborhood, and do not stop the noise, but only redirect it.

Loudspeakers on trucks are prohibited. Operation of lawnmowers, leaf blowers and other garden equipment on weekdays is prohibited prior to 8AM and after 6PM for commercial operators, and 8PM for residents. On weekends, the prohibited times are before 9AM and after 6PM for residential, while commercial operators cannot work at all on Sundays and holidays. Golf Course maintenance may be performed between 6:30AM and 8PM on weekdays; 6:30AM to 6PM on weekends and holidays. Air conditioners shall not be run so as to annoy the comfort, repose, sleep and peace of any person.

VIII. ENVIRONMENTAL POLLUTION

Outdoor Air Pollution[2]

New Jersey's air quality on the whole has improved significantly since the Federal Clean Air Act became law 35 years ago. The Garden State has met the health-based standard for carbon monoxide, sulfur dioxide and lead and has made progress cleaning up other air pollutants, such as ozone and particulates. Even so, Union County ranked among the dirtiest of NJ's counties in terms of nitrogen dioxide, sulfur dioxide and particulates.

In northeastern New Jersey the priority pollutants of greatest concern are nitrogen oxides (NO_x) (Figure 8.2), ozone (O_3) (Figure 8.33), and particulates (PM) (Figure 8.4). Lead (Pb) levels in the air have been greatly reduced since gasoline became lead-free. Sulfur dioxide (SO_2) (Figure 8.5) is still a concern, but most of the sulfur dioxide is blown in from the west, from coal burning power plants. Carbon monoxide (CO) (Figure 8.6) is a concern where fossil fuel combustion, as in motor vehicles, is inefficient. Air quality report and data for particular monitoring stations in New Jersey can be found at the Department of Environmental Protection's Air Monitoring Site: www.njaqinow.net

Nitrogen oxides in the air are a threat to human health. Breathing in the acid-forming nitrogen oxides can cause bronchitis and asthma suffering to be more severe.[3] Nitrogen oxides also cause acid rain. The quality of precipitation is as important as the quantity. Most of the northeastern United States is experiencing acid deposition, more commonly known as acid rain. Acid rain is caused by the wash out of certain pollutants from the air. The air pollutants that are causing the most problems are nitrogen oxides. Nitrogen oxides dissolve in rain and snow to form nitrous or nitric acid. Acidity is measured in terms of pH on a scale of 0 to 14. Seven is considered neutral. Water with pH values from 9 to 14 is alkaline, and water with pH values less than 5 is acidic. Precipitation should normally have a pH reading of 5.0-5.6.[4] Once the pH falls below 5.1, acid deposition damages structures and ecosystems. Refer to Figure 8.2 for nitrogen oxide measurements (1990-2008).

One of many concerns about the deposition of nitrogen from acid rain in the waters of Springfield and the Rahway River is that it can cause an overgrowth of algae. When the algae die

[2] Information from Environmental Defense scorecard for Union County, http://www.scorecard.org/env-releases/cap/county.tcl?fips_county_code=34039 and NJDEP.

[3] US Environmental Protection Agency. 2004. Acid Rain Program. Website: <http://www.epa.gov/acidrain/effects/health.html>

[4] Miller, G.T. 1996. Living in the Environment. Wadsworth Publishing Company, New York, NY.

they decompose, and this process takes oxygen out of the water. This means that there is less oxygen for fish to breathe so they can die.

Furthermore, nitrogen oxides react with carbon monoxide, methane, and other organic compounds in the air to form ozone. Elevated ozone concentrations, commonly referred to as smog, cause a range of adverse environmental impacts, particularly on human health and natural vegetation.[5] In addition, ozone is an important greenhouse gas. Ozone contributes to global warming because it reflects heat back to the earth from the lower atmosphere.

Ozone can irritate a person's airways, reduce lung function, aggravate asthma, and inflame and damage the cell lining of the lungs. It also may aggravate chronic lung diseases like emphysema and bronchitis, may reduce the immune system's ability to fight off bacterial infections in the respiratory system, and long-term, repeated exposure may cause permanent lung damage. Attaining the new federal health-based standard for ozone in New Jersey would prevent about 40,000 asthma attacks each year and substantially reduce hospital admissions and emergency-room visits for children and adults with asthma and other respiratory diseases. In 2008, the Environmental Protection Agency proposed the 8-hour ozone standard to be set at 0.075 ppm. In 2010, the EPA proposed new primary and secondary standards than those set in 2008. The recommended standards are lower: 0.060-0.070 ppm, to provide increased protection against O3.[6] Figure 8.3 shows that the levels of ozone in Jersey City, NJ are above the national standards.

According to EPA, Union County, N.J is considered a nonattainment county for fine particulate matter (P.M2.5)[7]. A nonattainment area is a region where air pollution levels persistently exceed National Ambient Air Quality Standards, or that contributes to ambient air quality in a nearby area that fails to meet standards. P.M2.5 is composed of particles less than 2.5 microns in diameter, and includes both carbon particles and liquid droplets. Fine particulate matter is very dangerous because it can be inhaled deep within the lungs and

[5] Derwent, Richard, William Collins, Colin Johnson & David Stevenson. 2002. Global Ozone Concentrations and Regional Air Quality. *Environmental Science & Technology*, 1 October 2002, vol. 36, no. 19, pages 379A-380A.

[6] U.S Environmental Protecion. Regulatory Actions. Federal Register / Vol. 75, No. 11 / Tuesday, January 19, 2010 / Proposed Rules. Website: <http://www.epa.gov/air/ozonepollution/fr/20100119.pdf>

[7] U.S Environmental Protection Agency. Fine Particle Designations. Website: <http://www.epa.gov/pmdesignations/2006standards/documents/2009-10-08/finaltable.htm>

can enter the blood stream. PM2.5 can seriously damage human health, and even result in premature death.

One of the sources of P.M2.5 is a diesel exhaust. It is classified as a known carcinogen. The Diesel Retrofit Law (2008) was created to reduce PM2.5 emitted from the targeted vehicles. "Diesel-powered engines, such as those found in trucks and buses, are responsible for a significant amount of the particulate pollution in New Jersey, which can disproportionately affect people in densely populated high traffic areas, especially in urban centers . . . By focusing on these types of vehicles, the Diesel Retrofit Law prioritizes the reduction of PM2.5 in urban communities, which are often the areas with the highest concentrations of PM2.5 in the State."[8] Refer to Figure 8.4 for P.M2.5 trends in N.J (2000-2008).

Residents of Springfield are urged to lower their pollution producing activities. Many methods to reduce pollution are simple and time-efficient. Turning off lights when not in use, washing clothes in warm or cold water, buying energy efficient appliances and carpooling when possible are just a few examples of all the things that could be done. Ways to reduce air pollution are listed in the U.S EPA website: http://www.epa.gov/air/peg/reduce.html

Indoor Air Pollution

Radon is a decay product of uranium and occurs naturally in soil and rock, and therefore radon levels can vary from home to home. Other sources of radon include well water and building materials. One can not see or smell radon because it is a colorless, odorless gas.

Radon gas is radioactive and has been identified as a leading cause of lung cancer, second only to cigarette smoking in the United States. The National Academy of Sciences estimates that radon gas causes between 15,000 and 22,000 U.S. deaths per year from lung cancer. Generally, newer homes are more prone to trap radon gas , because they were built with tighter construction to conserve energy and thereby trap the radon gas.

The Westfield Health Department provides an inexpensive radon kit for homeowners to test for radon themselves. For houses that have radon above the EPA recommended limit, there are means to correct the problem. Improving ventilation, covering sump pumps, caulking cement floors are all recommended methods to decrease radon to acceptable

[8] NJDEP Division of Air Quality. Diesel Retrofit Program Rule Proposal. Website: <http://www.nj.gov/dep/aqm/Diesel%20Retrofit%20Program%20Rule%20Proposal.pdf>

limits. In Springfield, no more than approximately 5-10% of homes have radon exposure that would require remediation.

Asbestos is another pollutant found indoors. It is a mineral fiber that has been used commonly in a variety of building construction materials for insulation and as a fire-retardant. Sources of asbestos include: deteriorating, damaged, or disturbed insulation, fireproofing, acoustical materials, and floor tiles. Today, asbestos is mostly found in older homes. Inhaling asbestos fibers may cause lung cancer, mesothelioma, and asbestosis. If asbestos is identified anywhere, it should be removed and disposed of by a licensed contractor.

Light Pollution

Dark Skies at night are a natural resource that currently needs not only protection; but also, an awakening of awareness on the part of the general public. The most obvious adverse effect of excessive light is the increasing inaccessibility to see a starry sky. Humans have always lived with starry nights, until now. And the production of excessive light at night has also affected the natural biological rhythms and behavioral habits of many other species. Nocturnal, diurnal, and crepuscular creatures have also been negatively affected.

Bird populations are being affected the most. Especially the nocturnal birds who use the moon and stars for navigation during their bi-annual migration. Flying through a brightly lit area, the birds become disoriented and will often crash into buildings and other brilliantly lit structures. The flight paths of migratory moths are also being affected. This in turn has caused numerous flowering plants which depend upon the moths for pollination to decline. Other creatures, such as some snakes, salamanders and frogs, that use the night to hide from predators, are accustomed to being able to hunt and to scavenge on moonless nights. However, due to excessive urban and suburban artificial lighting, darkness is never allowed to fall. The result is a decline in the population of some of the nocturnal species including all 986 species of bats and most smaller carnivores and rodents. Fireflies, which have also been in decline in recent years, do not mate normally near incandescent light because it mimics the spectrum they create when they light up.

The solution is not just simply turning off the lights. Our society needs artificial light to function. There are some steps that can be taken to lessen our light pollution impact. The first is to use lighting equipment that properly directs light where it is required, and not to the sides or towards the sky. The second is to use efficient lighting sources that produce less light pollution. The third is to use an appropriate level of lighting and to only light when necessary – timers and sensors on municipal and BOE buildings. Ultimately these solutions have an economic benefit, the more specific the lighting, the less energy used. The less energy used, the less money spent.

VIII. ENVIRONMENTAL POLLUTION

Figure 8.2[9]

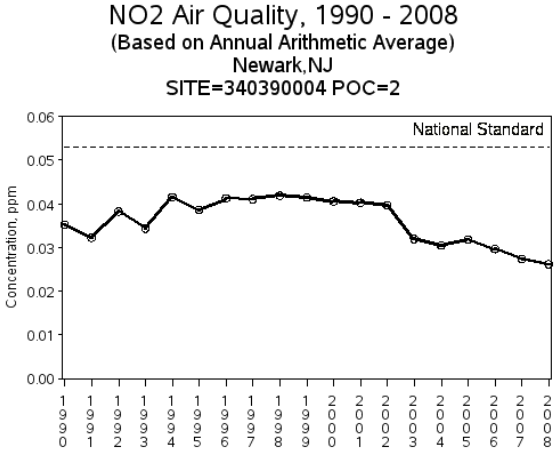


Figure 8.3

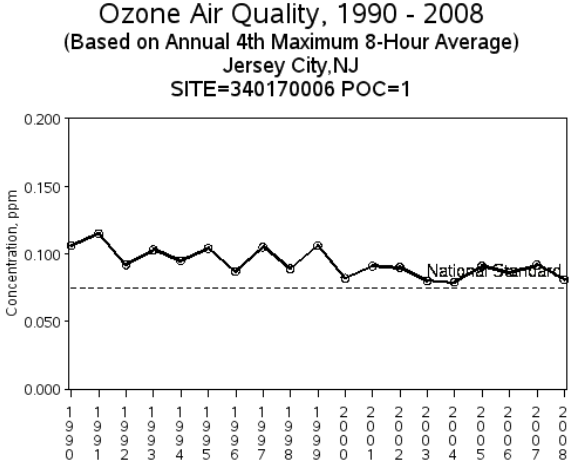


Figure 8.4

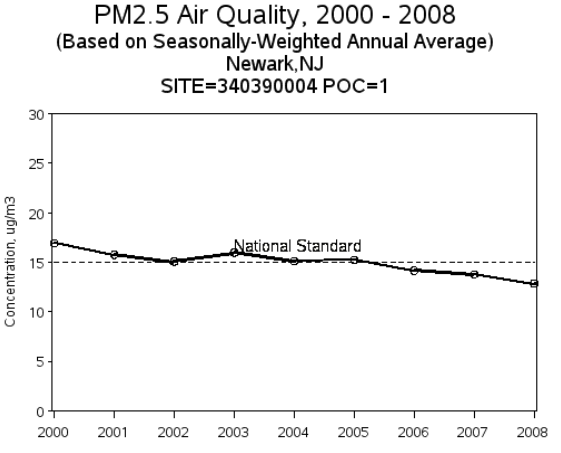
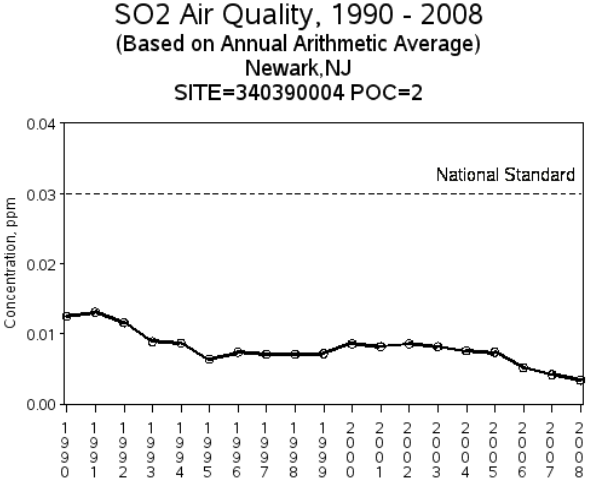
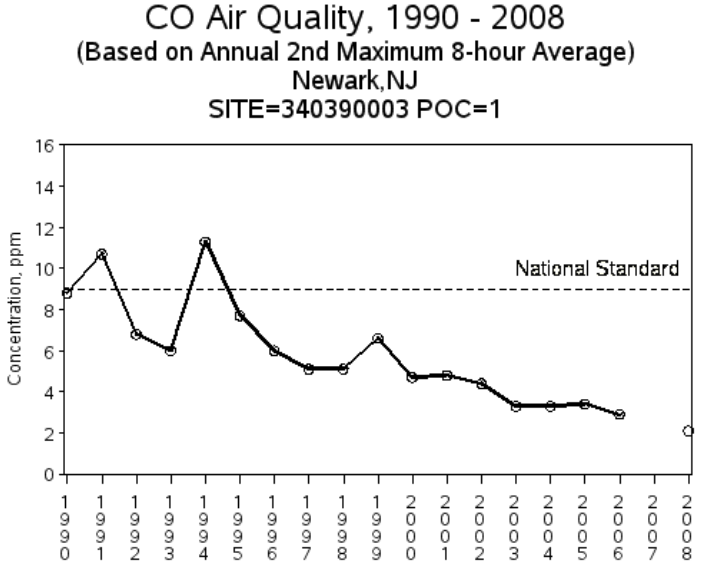


Figure 8.5



[9] U.S Environmental Protection Agency. Air Trends. Website: http://www.epa.gov/airtrends

Figure 8.6[10]



[10] U.S Environmental Protection Agency. Air Trends. Website: http://www.epa.gov/airtrends/carbon.html

Chapter IX MAINTAINING and SUSTAINING NATURAL RESOURCES IN SPRINGFIELD

The Environmental Commission recommends that the following efforts be made to improve the living environment of Springfield:

Energy

- Continue to improve energy efficiency and to explore further uses of Renewable Energy whenever possible;
- Require that all Municipal and Joint Capital Improvement (School Board) building projects comply with Green building LEED (Leadership in Energy and Environmental Design) standards;
- Purchase recycled products;
- Explore the possibly of establishing a Geothermal grid field;
- Install timers and/or sensors for lighting on and in all school buildings and in parks;
- Develop and implement an educational program - for residents and municipal employees - on the ways to reduce personal daily energy use;

Transportation

- Purchase energy efficient and/or alternatively fueled vehicles;
- Work with Union County to begin to establish bicycle lanes on Mountain Avenue, Meisel Avenue, South Springfield Avenue, Hillside Avenue, Milltown Road, and Morris Avenue;
- Contact the Rahway Valley Railroad to help build a walkway from South Springfield Avenue to Mountain Avenue along the old Railroad track, eventually spanning the length of the tracks through Springfield;
- Beautify and improve the business and downtown areas to encourage foot traffic commerce;

Solid Waste and Recycling

- Encourage more recycling through advertising, educating the public, increasing the number of days for recycling pick-up, and establishing one day a week for town–wide recycling pick-up, not to be combined with garbage collection; ***2015: recycling/garbage change established***
- Employ a recycling enforcer possibly as a shared services program with other towns. The enforcer could be hired through local college programs or grants;
- Consider a PAYT (Pay As You Throw) program;
- Implement an Unused Medicine Disposal Education Program; ***2015: Eliminate; Police Station Drop Box in place***
- Purchase a Biodigestor to convert the schools' food waste either into energy or waste water;
- Develop a composting program;

Water

- Encourage residents to do Odd - Even lawn watering;
- Review Springfield's contract with the NJ American Water Company to further benefit the residents;
- Plant drought resistant native flora (ie. Buffalo Grass, sweet ferns, etc.) when applicable on all municipal lands and parks and Board of Education properties;
- Protect the floral and faunal diversity of Wildlife Habitats in Springfield;
- Improve Storm Water Management through minimizing the use of pesticides by the municipality and by private, public, and corporate entities this can be accomplished by following the Integrated Pest Management (IPM) control measures as well as by following and enforcing any newly mandated federal, state or local fertilizer policies or ordinances;
- Implement the IPM measures on Township properties within two years;
- Continue to sponsor the Clean Communities Day Clean-ups of the Rahway River and Township streams;
- Encourage property owners whose land is adjacent to the waterways to help keep them clean;
- Continue water quality and visual assessments of the Rahway River and its tributaries;
- Begin to develop a Regional Approach to protect and enhance the recreational use of the Rahway River through the participation in the Rahway River Association and continued contact with the Rutgers University researchers of *Connectivity Along Urban Rivers: A Keepsake Process for Urban Ecosystems*;
- Monitor compliance with the 2011 NJ Fertilizer Law, A-2290;

Brownfields

- Update and review the Brownfield inventory to assess threats to ground water;

Environmental

- Develop a Geographic Information System (GIS) to aid in Site Review Process;
- Continue to adopt and enforce Environmental Ordinances to protect Springfield's Natural Resources; and
- Continue involvement in Sustainable Jersey.

2015: Establish a fracking ban.

Ultimately, if there is a choice between a natural renewable solution vs. a synthetic man-made one; the natural one should take precedence.

We do not wish to be one of the major causes of a possible Anthropocene Era. The Anthropocene is an informal geological epoch that serves to mark the recent extent of human activities that have had a significant global impact on the Earth's ecosystems.

APPENDIX A: NEW JERSEY AMERICAN ANNUAL WATER QUALITY REPORTS

Table A.1 – Detected Contaminants, Short Hills System 2009[1]

Contaminant	Unit	MCL*	Highest Detected Level	Typical Source
Total Trihalomethanes (TTHM)	ppb	80	35.6	By-product of drinking water disinfection
Five Haloacetic Acids (HAA5)	ppb	60	21.6	By-product of drinking water disinfection
Bromate	ppb	10	2.9	By-product of drinking water disinfection
Dichloromethane	ppb	3	2.2	Discharge from petroleum factories.
Toluene	ppm	1	0.0002	Discharge from petroleum factories.
Trichloroethylene	ppb	1	0.6	Discharge from petroleum factories.
Arsenic	ppb	5	2	Erosion of natural deposits.
Barium	ppm	2	0.300	Erosion of natural deposits.
Chromium	ppb	100	3	Discharge from steel and pulp mills; erosion of natural deposits.
Fluoride	ppm	4	0.7	Erosion of natural deposits; water additive that promotes strong teeth.
Lead	ppb	15	11	Erosion of natural deposits.
Nickel	ppb	100	12.8	Erosion of natural deposits.
Nitrate	ppm	10	2.62	Runoff from fertilizer use; leaching from septic tanks, sewage; erosion of natural deposits.
Selenium	ppb	50	4	Erosion of natural deposits.
Total organic Carbon	ppm	atment	1.08	Naturally present in the environment.
Chlorine	ppm	4	0.58	Water additive used to control microbes.
Chloramine	ppm	4	0.7	Water additive used to control microbes.
N-nitrosopyrrolidine (NPYR)	ppb	N/A	0.0023	Byproducts in chemical synthesis and manufacture; by action of nitrate-reducing bacteria.
Radon	pCi/L	N/A	1,432	Naturally present in some groundwater; present while doing household work.
Secondary Contaminants		**Recommended Upper Limit**	**Highest Detected Limit**	
Sodium	ppm	50	110	Erosion of natural deposits.
Unregulated Contaminant			**Highest Detected Limit**	
N-nitrosopyrrolidine (NPYR)	ppb	N/A	0.0023	Byproducts in chemical synthesis and manufacture; by action of nitrate-reducing bacteria.

*MCL – Maximum Contaminant Level - the highest level of a contaminant that is allowed in drinking water.

[1] New Jersey American Water. 2009 Water Quality Report for Essex, Morris, Passaic, Somerset, and Union Counties. Website:http://www.amwater.com/ensuring-water-quality/water-quality-reports.html

APPENDIX B: NATIVE PLANTS

Easy to grow native plants

Bee Balm, *Monarda didyma, Monarda fistulosa*
Black-eyed Susan, *Rudbeckia hirta*
Black snakeroot, *Cimicifuga racemosa*
Butterfly weed, *Asclepias tuberosa*
Cardinal Flower, *Lobelia cardinalis*
Columbine, *Aquilegia formosa*
Coneflower, *Echinacea purpura*
Fancy Wood Fern, *Dryopteris intermedia*
Lance-leaved Coreopsis, *Coreopsis landeolata*
Obedient Plant, *Physostegia vigniana*
Rough Blazing Star, *Liatris aspera*
Spiderwort, *Tradescantia virginiana*
Virgin's Bower, *Clematis virginiana*
Western Bleeding Heart, *Dicentra Formosa*
Wild Ginger, *Asarum canadense*

Where to see native plants

Reeves-Reed Arboretum
Summit

Tourne County Park
Emilie K. Hammond Wildflower Trail
Boonton Township
53 E. Hanover Ave., Morristown NJ 07962-1295
Tel: 973-326-7600

Native Plant Reserve
River Road, Highland Park, NJ

APPENDIX C: NATIVE TREES AND SHRUBS OF THE PIEDMONT REGION OF NEW JERSEY*

Trees - Overstory

Sweet or Black birch - *Betula lenta*
River birch - *Betula nigra*
Bitternut hickory - *Carya cordiformis*
Pignut hickory - *Carya glabra*
Mockernut hickory - *Carya tomentosa*
Hackberry - *Celtis occidentalis*
American beech - *Fagus grandifolia*
White ash - *Fraxinus americana*
Green ash - *Fraxinus pennsylvanica*
Tuliptree - *Liriodendron tulipifera*
Pitch pine - *Pinus rigida*
White pine - *Pinus strobus*
Sycamore - *Platanus occidentalis*
Swamp white oak - *Quercus bicolor*
Scarlet oak - *Quercus coccinea*
Pin oak - *Quercus palustris*
Chestnut oak - *Quercus prinus*
Red oak - *Quercus rubra*
Black oak - *Quercus velutina*
Black willow - *Salix nigra*
Eastern hemlock - *Tsuga canadensis*
Slippery elm - *Ulmus rubra*

Trees - Understory

Smooth alder - *Alnus serrulata*
Downy juneberry - *Amelanchier arborea*
Shadbush - *Amelanchier canadensis*
Smooth juneberry - *Amelanchier laevis*
Gray birch - *Betula populifolia*
Ironwood - *Carpinus caroliniana*
Alternate-leaf dogwood - *Cornus alternifolia*
Flowering dogwood - *Cornus florida*
Persimmon - *Diospyros virginiana*
American holly - *Ilex opaca*
Red cedar - *Juniperus virginiana*
Black gum - *Nyssa sylvatica*
Hoptree - *Ptelea trifoliata*
Choke cherry - *Prunus virginiana*
Aromatic sumac - *Rhus aromatica*
Winged sumac - *Rhus coppalina*
Blackhaw - *Viburnum prunifolium*
Possumhaw - *Viburnum nudum*

Shrubs

Red chokeberry - *Aronia arbutifolia*
Black chokeberry - *Aronia melanocarpa*
Purple chokeberry - *Aronia prunifolia*
Buttonbush - *Cephalanthus occidentalis*
Virgin's Bower - *Clematis virginiana*
Sweet pepperbush - *Clethra alnifolia*
Silky dogwood - *Cornus amomum*
Gray dogwood - *Cornus racemosa*
Winterberry - *Ilex verticillata*
Mountain laurel - *Kalmia latifolia*
Spicebush - *Lindera benzoin*
Maleberry - *Lyonia ligustrina*
Northern bayberry - *Myrica pennsylvanica*
Common ninebark - *Physocarpus opulifolius*
Swamp azalea - *Rhododendron viscosum*
Swamp rose - *Rosa palustris*
Elderberry - *Sambucus canadensis*
Meadowsweet - *Spirea latifolia*
Steeplebush - *Spirea tomentosa*
American bladdernut - *Staphylea trifolia*
Witherod - *Viburnum cassenoides*
Highbush blueberry - *Vaccinium corymbosum*
Arrowwood - *Viburnum dentatum*

Bold = more commonly available
* This list was prepared using this resource: http://www.rce.rutgers.edu/njriparianforestbuffers/nativePIEDMONT.htm#trees

APPENDIX D: INVASIVE PLANTS

Strongly Invasive and Widespread

Herbaceous Dicots

Achillea millefolium, Yarrow
Alliaria petiolata, Garlic Mustard
Artemisia vulgaris, Mugwort
Cichorium intybus, Chickory
Coronilla varia, Crown Vetch
Daucus carota, Wild Carrot
Glechoma hederacea, Gill-Over-The - Ground
Hesperis matronalis, Dane's Rocket
Lythrum salicaria, Purple Loosestrife
Malva moschata, Musk Mallow
Meliotus alba, White Sweet Clover
Plantago lanceolata, English Plantain
Polygonium cuspidatam, Japanese Knotweed
Rumex crispus, Curly Dock
Trifolium pratense, Red Clover
T. repens, White Clover

Monocots

Allium vineale, Field Garlic
Arundinaria, Bambusa, Hardy Bamboo
Commelina communis, Day Flower
Dendrocalamus, Bamboo
Cynodon dactylon, Bermuda Grass
Dactylis glomerata, Orchard Grass
Digitaria sanguinalis, Crab Grass
Echinochloa crusgalli, Barnyard Grass
Hemercallus fulva, Day Lily
Microstegium vimineum, Japanese Stilt Grass
Phragmites australis, Common Reed

Vines and Woody Plants

Acer platanoides, Norway Maple
Albizia julibrissin, Mimosa
Ailanthus altissima, Tree of Heaven
Berberis thunbergii, Japanese Barberry
Celastrus orbiculatus, Asian Bittersweet
Elaeaghus angustifolia, Russian Olive
E. umbellata, Autumn Olive
Hedera helix, English Ivy
Lonicera japonica, Japanese Honeysuckle
Prunus avium, Crab Cherry
Rhamnus cartharticus, Buckthorn
R. frangula, Alder Buckthorn
Rosa multiflora, Multiflora Rose
Wisteria floribunda and Wisteria frutescens, Wisteria

Invasive But Not As Widespread (Yet)

Ajuga reptans, Common Bugleweed
Centaurea maculosa, Spotted Knapweed
Chelidonium majus, Celandine
Chrysanthemum leucanthemum, Ox-Eye Daisy
Dianthus armeria, Depford Pink
Galinsoga ciliata, Galinsoga
Lamium purpureum, Purple Dead Nettle
Linaria vulgaris, Butter-and-Eggs
Lysimachia nummularia, Moneywort
Matricaria matricariodes, Pineapple Weed
Mentha spicata, Spearment
Polygonum persicaria, Lady's-Thumb
Portulaca oleracea, Purslane
Ranunculus acris, Common Buttercup
R. bulbosus, Bulbous Buttercup
R. ficaria, Lesser Celandine
R. repens, Creeping Buttercup
Rumex acetosella, Sheep's Sorrel
Rumex obtusifolius, Broad Dock
Verbascum thapsus, Common Mullein
V. blattaria, Moth Mullein

2015: Appendix E has been superseded by the availability of a Prescription Drop Box at the police station.

APPENDIX E GUIDELINES FOR DISPOSING OF UNUSED MEDICATION

The New Jersey Department of Environmental Protection recommends the following steps to dispose of medical waste:

1. Keep medicine in original container. Mark out personal information on prescription bottles.
2. Mix liquid medicine with undesirable substance like coffee grinds, cat litter, or dirt. Dilute pills with water, then add coffee grinds, cat litter, or dirt to make it unpalatable to children and pets.
3. Place bottles in an opaque container, like a yogurt container, and secure lid; or wrap in a dark colored plastic bag.
4. Hide the container in the trash. Do NOT recycle. [2]

It is important to note, however, that for safety reasons the Food and Drug Administration recommend that some medicines be disposed of by flushing down the sink or toilet. Most of the drugs on this list are narcotics and can do serious harm if taken by someone other than the patient.[3]

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[2] New Jersey Department of Environmental Protection – Solid and Hazardous Waste Program. Website: http://www.ucnj.org/recycle/NJDEP%20med%20disposal%20guidance%20%282%29.pdf

[3] United States Food and Drug Administration. April 2010. Website: <http://www.fda.gov/Drugs/ResourcesForYou/Consumers/BuyingUsingMedicineSafely/EnsuringSafeUseofMedicine/SafeDisposalofMedicines/ucm186187.htm#MEDICINES>

Natural Resources Inventory
Township of Springfield
Addendum 2015

The pages referenced below have been annotated to reflect the following changes based on a review by The Springfield Environmental Commission in January 2015.

Chapter III WATER RESOURCE - Flood Control

(page 25)

Site 1. Has been completed. Site 3 has been competed but not for the "100 Year Storm" designation.
Sites 2, 8 and 9 have not been completed.

(page 26)

Remedy: The New Jersey Department of Transportation is working on plans for the replacement of the bridge. The structure may be converted to a span which will reduce the back water curve one to two feet at times of peak flow.

(page 27)

Remedy: The site is part of the proposed Downtown Revitalization plan. Channelization…

Chapter IX MAINTAINING & SUSTAINING NATURAL RESOURCES IN SPRINGFIELD

(page 64)

Solid Waste & Recycling

- One day a week for town-wide recycling pick-up, not combined with regular garbage collection established
- Unused Medicine Disposal site - at the Police Station - established

(page 65)

Environmental

- Establish a Fracking ban.

Appendix E Guidelines for Disposing of Unused Medication

(page 70)

Eliminate - have a site at the Police Station.