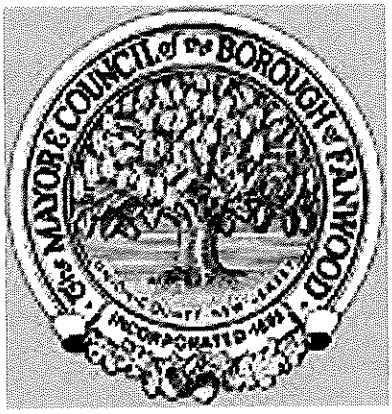

ENVIRONMENTAL RESOURCES INVENTORY

4th Edition

2018

Borough of Fanwood

Union County, New Jersey

Produced by:
FANWOOD ENVIRONMENTAL COMMISSION
with
FANWOOD'S PROFESSIONAL STAFF, BOARDS, COMMISSIONS, AND AMY S. GREENE CONSULTANTS

In conjunction with a grant from:
ASSOCIATION OF NEW JERSEY ENVIRONMENTAL COMMISSIONS

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ACKNOWLEDGEMENTS—2018 Edition

Producing a document like the Environmental Resource Inventory takes the work and input of many individuals and organizations. First we would like to thank the Association of New Jersey Environmental Commissions (ANJEC) for organizing and operating the grant program that allowed us to begin this important work. Special thanks at ANJEC go to Ms. Kerry Miller for her guidance and extreme patience during this undertaking. At home, we would like to express our gratitude to Mayor Colleen Mahr and the Borough Council for their support in providing the matching funds for the ANJEC grant. Additional thanks go the Harry Strano of Amy S. Greene Associates for advice, review, and work on producing maps of the Borough for the report, specifically the Fanwood Nature Center. Borough Clerk and Administrator, Eleanor McGovern helped keep us on track for this project—and to the mayor's assistant and purchasing agent Pat Hoynes for answering numerous procedure questions.

The Borough is indebted to Environmental Commission members Margaret Chowdhury, Phyllis Sandrock, Sandy Redder, Mathew Juckes (former Planning Board Liaison), Eric Gaulin, and former member Karen Diaz. Also alternate David Schwartzberg for his review and comments as well as to Harold Clark, head of the Recycling Association. Special thanks go to the Commission's secretary, Moenika Chowdhury for her work in making changes, editing, arranging, collating, and numerous other little (and large) items of work while juggling her schoolwork and getting ready for and now attending college. Addition thanks go to former Commission member and Nature Center caretaker Dean Talcott for his review and input. We also appreciate the time and effort of our former Council Liaisons, Jack Molenaar, and current liaison, Kathy Mitchell as well. Many environmental projects would not have been completed if not for the hard work of the Boy and Girl Scouts (and their supportive parents). These include Andrew Van Haasteren (and his mother, Master Gardener Jane Van Haasteren) [first butterfly garden]; Perry Sandrock (and her mother Phyllis Sandrock) [second butterfly garden]; Chris Bondarowicz [bat boxes]; Ann Marie (and her mother) [municipal pollinator garden]; Ricky Abinchandani["Welcome to Fanwood" sign]; Julia Guarneri [Nature signs].

As this document is based on previous ERIs, we acknowledge the work of our predecessors including the 2007 Environmental Resource Inventory, which in turn was based on the 1991 report prepared by the consultant, Najarian Associates as well as their excellent follow-up report on the Nature Center and Midway Circle of 1994. We are very grateful to the Environmental Commission of 1976 whose superb Natural Resource Inventory of that year was a masterful blend of research, investigation, writing, dedication, and hard work. Their outstanding publication still stands out as a model to other commissions to emulate.

Fanwood Environmental Commission

Eric Gaulin, Chair ***Gary Szelc, Co-chair*** ***Margaret Chowdhury*** ***Sandy Redder*** ***Phyllis Sandrock*** ***Carol Walczuk***
David Schwartzberg
Moenika Chowdhury, Secretary
Mathew Juckes, Planning Board Liaison
Kevin Boris, Council Liaison
Gary W. Szelc, Chair

PREFACE to the 2018 4th Edition

of the

Fanwood Environmental Resource Inventory

Although it has only been ten years since the last edition of the Environmental Resource Inventory (2007), various changes have taken place that has made an update of this document a worthwhile project. It was also decided that various maps and figures should be part of the main text and not just tucked away in a DVD (although the disk is an important supplement to the document). Also, another important item not found in the 2007 edition are photographs of the town, the Nature Center, parks, and other notable features. Photographs are included throughout this revised edition.

One section of this document that is substantially upgraded is the section on the Nature Center and the vegetation found there. The Nature Center, which unfortunately, like many other places in New Jersey, has been overrun by invasive plants. Substantial efforts have been investigated and implemented toward controlling these damaging plants, specifically the "goat project"—using the voracious appetites of goats to attack the invasive plants. The Commission will continue to address that issue into the near and far future. The consultant, Amy S. Greene Associates was contracted to examine the vegetation in and around the Nature Center and produced a report on the balance of native and non-native vegetation. That report, with accompanying maps, is incorporated into the revised ERI.

Recycling in the Borough has significantly changed as it has gone from a volunteer system to a curbside collection system.As to the basis and background and necessity of an ERI, the preface to the previous edition of the ERI explains it all. The reader is encouraged to review the 2007 preface below.

Gary W. Szelc, P.E., P.P.

Chair, Project Editor, Environmental Commission
Fanwood, New Jersey
November 2017

PREFACE (to the 2007 ERI)

Welcome to the third edition of the Fanwood Environmental Resource Inventory (ERI), produced by the Fanwood Environmental Commission. The ERI is a compendium of a community's environmental features - water bodies, soils, geology, open space, woodlands and vegetation, water supply and wastewater, noise, and related infrastructure and cultural features.

The Environmental Commission is an advisory body to the town in general and the Mayor, Council, and the Planning Board in particular. Municipalities are empowered under state law to create a Commission by passing an enabling ordinance. The mayor then appoints citizen volunteers to the commission (in Fanwood's case seven members and two alternates). Nearly two-thirds of New Jersey's 576 municipalities have Environmental Commissions. One of important first tasks of this group is to undertake the creation of an ERI. The New Jersey State Legislature in 1968 in the law which established Conservation Commissions, later Environmental Commissions, spell out this requirement:

> *"A....commission organized under this act shall have power to conduct research into the use and possible use of the open land areas of the municipality and may co-ordinate the activities of unofficial bodies organized for similar purposes, and may advertise, prepare, print, and distribute books, maps, charts, plans and pamphlets which in its judgment it deems necessary for its purposes. It shall keep and index of all open areas, swamps, and other wetlands, in order to obtain information on the proper use of such areas, and may from time to time recommend to the Planning Board, or, if none to the mayor and governing body of the municipality plans and programs for inclusion in a municipality plans and programs for inclusion in a municipal master plan and the development of use of such areas."*

The New Jersey Department of Environmental Protection in its *Handbook for Environmental Commissioners* regards an environmental inventory as top priority. The ERI is usually incorporated into the municipal Master Plan by the Planning Board as the conservation element

of the plan. An ERI also obligates the Planning Board to provide the Environmental Commission with development site plans and subdivision plans for review and comment.

Fanwood's first ERI (then known as the Natural Resources Inventory) was published in 1976 primarily through the efforts of the Commission in conjunction with the Borough's professional staff. Soon after its inauguration, the Fanwood Environmental Commission felt the need to put together a Natural Resources Inventory for the Borough. This Commission had received approval for matching funds from the DEP, but the program was cancelled before the grant was received. Consequently the Mayor and Council approved the request for $1,100 for the 1975 Borough budget. In 1976 the Commission received approval for federal funding in the amount of $1,500 from the Department of Housing and Urban Development to complete the study.

In 1991, the Commission received a grant from the New Jersey Department of Environmental Protection's Office of Environmental Services to update the ERI. A consultant, under the auspices of the Commission and the Borough Engineer, compiled the 1991 document. The Environmental Commission, in cooperation with the staff and members of other Boards and Commissions of Fanwood, and the Borough's Engineering consultant, have worked together to revise this 2007 edition of the ERI.

The 2007 ERI is a work of labor by each contributor who has put in many hours of research & thought. Individual members of the Commission selected portions of the 1991 ERI text for updating, editing, and incorporating supplemental data. Information was obtained from reports, the Master Plan, governmental websites, and interviews with members of the Borough staff, consultants, government agencies, and local citizens. The Commission has worked hard to ensure that all of the information presented here is accurate. However, if any errors or omissions are observed, please contact the Environmental Commission.

Because of the significant amount of work involved in performing a town-wide tree inventory, it was neither practical nor feasible to do an update at this time. However, the inventory from 1991 is included in this document as a point of reference as well as to provide the basis for future research and updating. The Historic Preservation Commission provided information regarding

historic properties in Fanwood, as well as a description of the recently formed Historic District for this 2007 edition of ERI.

In the 1991 ERI, one of the primary tasks of the Consultant was to update the resource maps and to provide new maps as required. One significant addition was the Land Use map, which is extremely important in understanding Fanwood's "current state of existence." While patterns of present day land use are not expected to change substantially in the future - who really knows? A hundred years ago, Fanwoodians probably had little idea on the extent of development in our Borough. A hundred years from now, who is to say how little or how much Fanwood might change again.

Several topics from the 1976 document were dropped from the 1991 revision (notably the tables on open space). These have been restored and updated for 2007 edition. Nearly all the sections from the 1991 edition have been expanded and/or rewritten, such as geology and soils, noise, drainage, water supply and wastewater, et al.

There are several new chapters in the 2007 edition. In particular these include, *Open Space* (including the Nature Center, parks and miscellaneous areas), the *Transfer of Development Rights* Program (TDR) for historic preservation, the voluntary *Recycling Center*, and the *Downtown Redevelopment District*. As the work on this ERI was being concluded, the Borough took action to suspend the TDR program. Please refer to *Chapter 14: Transfer of Development Rights* for more information.

Although an ERI has several advantages, it may still be questioned why a small and nearly completely developed community like Fanwood needs an Environmental Resources Inventory. Quite simply, the ERI stands as a benchmark document, in that it helps the community to know where it currently stands in relation to the developed and undeveloped lands within its boundaries and also where it has been and where it might be going. In this, it is fortunate that Fanwood has the 1976 and 1991 documents for comparison. Besides, this document also provides sufficient background information on the topics discussed above so that it can serve as an "Environmental Primer".

It is a source of information not only for the Environmental Commission, but also for the Mayor and Council, municipal workers, the Planning Board, Borough consultants, recreational enthusiasts, developers, and the public-at-large. Further, as documents that have captured Fanwood at a particular moment in time, we are bold enough to say that they are now part of Fanwood's diversity and culture, its history, and its sense of itself. We expect the third edition of the Environmental Resource Inventory to be used to inform, educate, and to serve as a decision-making reference. At some time in the future, it will be desirable to update the ERI once again. To that end, we hope that the 2007 edition will serve well up to that time, and that the Commissioners who undertake this task in the future will find this document to be a worthy platform on which to present their vision of Fanwood's environmental state of affairs.

Gary W. Szelc, P.E., P.P.

Chair, Environmental Commission
Fanwood, New Jersey
November 2007

CHAPTER 1

FANWOOD BASICS

NOTES:

The Natural Resources Inventory (now known as an Environmental Resource Inventory) of 1976 described natural and manmade environmental conditions in Fanwood. The Fanwood Environmental Commission with assistance from the Borough professional staff provided insightful recommendations in this valuable document supplemented by related maps describing local and regional conditions affecting the Borough environment.

The 1991 document provided revised and updated information as it examined the changes to the natural and built environment of Fanwood in the 15 years since the first NRI. In addition, the Borough needed the NRI maps in a uniform format that would be easier to reproduce and disseminated to the Borough professionals, staff, residents and other interested parties in the natural resources of the Borough. The 2007 edition used both the 1976 and 1991 documents as sources of base information as well as inspiration to continue the tradition of providing updated environmental information about Fanwood from local, state, and federal sources. For the 2007 edition, besides being aided by the Borough's staff as well as its then engineering consultant Kupper and Associates, which also made use of the internet for supplemental information.

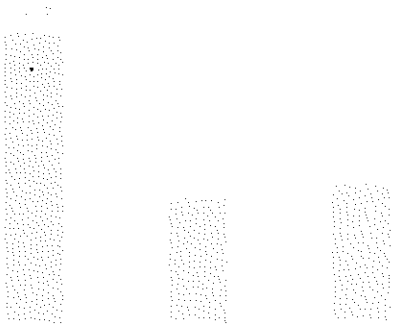
The 2017 edition has used more sources from the state and the Internet as well as review by members of the Commission. In addition, Amy S. Greene Associates was used to examine the Nature Center area in particular and to provide a plant inventory. Maps of different vegetative groups are included along with text.

1.1 LOCATION

Fanwood is located about 10 miles west of the Arthur Kill, 15 miles northwest of the Raritan Bay, about 25 miles west of the Atlantic Ocean and about 20 miles southwest of New York City in Union County, New Jersey. It is bounded on the north, east and south by the Township of Scotch Plains and on the west by the City of Plainfield. (Refer to Map 1 for Fanwood's Location Map.) The Borough of Fanwood was incorporated as a municipality in 1895, having separated itself from Fanwood Township (which later changed its name to Scotch Plains Township).

Fanwood occupies approximately 825.6 acres of land or about 1.29 square miles. Of this, most of the land (about 66%) is in single-family development. Public lands occupy about 40.8 acres (5%) that include public parks, a Nature Center, and the Municipal Complex. (Note: Other sources give Fanwood's land area as 1.31 square miles or 838.4 acres and another as 1.342 square miles or 858.9 acres.)

1.2 POPULATION (Update with 2010 information!)



As of the 2010 census, approximately 7,318 persons lived in Fanwood. The population density as of 2010 is 5,454 persons per square mile (US Census Bureau, 2010). This is a decrease since 1980 when the population was recorded as 7,767 and a further decrease from 1970 when the population was an all-time high of 8,920. Most of the population decrease between 1980 and 1990 (7.115) can be attributed to changing family demographics in that families are becoming smaller (e.g. grandparents living separately, fewer children etc.) The slight increase in population of more recent years reflects the fact that a number of the larger lots in Fanwood have been subdivided to provide additional residential housing in addition to new apartment units having been built in the downtown area. The Census Bureau has estimated that the 2014 population of Fanwood to be 7,657.

1.3 HOUSING

According to the 2010 Census, there were 2,615 occupied housing units in Fanwood. Less than 3% of these structures were built after 1990; 54% were built between 1940 and 1959 and almost 25% were built before 1939.

Most of the housing units (77%) are heated by natural gas, 20.7% use fuel oil or kerosene, 1% use bottle, tank or LP gas and 1.2% use electric for heating. No housing units are known to use solar, wood, geothermal, or wind exclusively for heating, although they supplement some housing units.

Maps 2 and 3 are basic line drawing maps for Fanwood in 1862 and 1887 (both from the 1976 NRI). Although simple maps, they illustrate the tremendous change experienced by Fanwood in the 20th Century. Map 4 is an aerial photo of Fanwood showing not only the present day town, but the changes in technology as well in that this dramatic view of Fanwood was obtained from the Internet through satellite imagery.

CHAPTER 2

CLIMATE

NOTES:

Fanwood is located in central New Jersey where the climate is affected by proximity to the Atlantic Ocean. The moderating effect of the ocean causes the climate of central New Jersey to be somewhat milder than that of inland areas of equivalent latitude in the U.S. There is perhaps some affect by the 400 to 500+ ft. high Watchung Mountains (a series of ridges to the north and northwest of Fanwood) as well. The average elevation of Fanwood is approximately 157 ft.

2.1 TEMPERATURE

The average temperature for 2005 was 55.4°F at the Weather Station at Newark Airport, which is operated under the auspices of the National Oceanic and Atmospheric Agency (NOAA). This station is located approximately 10 miles east of Fanwood. The normal average temperature for July is 77.4°F and in January 31.3°F. The growing season is approximately 191 days long with the last killing frost in mid-April and the first killing frost in late October.

Prevailing wind direction is southwest, although winter winds tend to be from the northwest. Average wind speed is just over 10 miles per hour at 10.2 mph. March is the windiest month averaging 11.9 mph and August is the least windy month at 8.7 mph.

Fanwood averages 93 clear days every year, 112 are partly cloudy, and 160 are cloudy. January is the cloudiest with 16 days on average and October is the "clearest" month with 11 cloudy days. Thunderstorms occur on an average of 26.1 days per year.

Table 1 below provides the average monthly temperature for the period 1991-2005. The hottest summer on record to date was June-August 2005. August and September 2005 combined were the warmest and driest on record. The temperature falls below 0°F on average in one winter out of four. Obviously, the concept of "normal" when it comes to weather is as much perception as it is statistical analysis. However, the consensus is that the weather is becoming somewhat more volatile in that there are more weather extremes being experienced. (See the section below on "Table 1: Average Temperature Data.)

TABLE 1 Average Temperature (For the period 1991-2000

MONTH	MEAN	HIGH	LOW
January	31.3	40.0	20.9
February	33.8	40.7	23.5
March	42.2	48.6	36.5
April	52.6	57.4	36.5
May	62.9	68.9	54.3
June	72.4	77.8	67.9
July	77.4	82.5	73.7
August	76.1	80.4	72.5
September	68.6	74.5	68.6
October	57.1	63.1	52.6
November	47.1	52	39.9
December	36.4	43.5	25.6

2.2 PRECIPITATION

Precipitation data is also collected at the Weather Station at Newark Airport. The average annual precipitation at Newark Airport is 43.51 inches, which includes both rainfall and the water-equivalent of snowfall. Precipitation is generally well distributed throughout the year, with slightly higher monthly averages in July and August. A considerable amount of precipitation occurs in the form of Northeasters off the Atlantic coast. These storms typically occur in fall and winter, last about 2 days and produce 1 to 2 inches of precipitation and are accompanied by sustained winds. Areas to the west of the airport, including western Union County may receive more rainfall. October 2005 was at the time the wettest month on record. Table 2 below provides the precipitation data for the period 1991-2005.

TABLE 2: Average Precipitation Data

(For the period 1991-2005)

MONTH	MEAN	HIGH	LOW
January	3.47	6.87	1.27
February	2.91	3.36	0.52
March	3.63	6.90	1.90
April	3.70	6.17	1.35
May	3.97	6.52	1.21
June	3.43	10.50	0.41
July	4.42	8.27	1.01
August	3.81	8.21	0.51
September	3.88	9.38	0.45
October	3.17	13.22	0.73
November	3.71	5.79	0.86
December	3.51	5.19	1.03

Localized thunderstorms can also produce significant rainfall amounts in a short time frame. Hurricanes (or the tropical storm remnants of them), which over the decades have not been very common in the Mid-Atlantic States, can produce both high winds and high levels of rainfall. (That having been said, a number of tropical storms and hurricanes have ravaged the eastern U.S. coast in the last several years.) For example, Hurricane Floyd in September 1999 dropped nearly 12 inches of rain in the Union County area and in other areas over 15 inches of rain. Hurricane Irene, considered in some areas to be the "storm of record" caused tremendous flooding in from the Carolinas and Virginia through New Jersey and up into New York and the New England states. The remnant of another hurricane, "Superstorm Sandy" by contrast discharged most of its rain in the far southern parts of New Jersey, but north of Atlantic City high winds and tidal surges devastated coastal areas and far inland. Broken branches and downed trees blocked roads, crushed cars, and damaged numerous homes in central New Jersey.

Although Fanwood was spared extensive flooding, damage from trees was widespread and numerous downed power lines caused power outages lasting from several hours to several weeks. More recently, on August 19, 2015 an extremely localized storm (centered it seems over Route 22 in Scotch Plains and next to the Watchung Mountains) dropped between six and seven inches of rain in less than two hours in the immediate vicinity of Scotch Plains and Fanwood. There was intense flooding and significant damage to vehicles and buildings in that immediate area. Parts of Route 22 were ripped apart and three to four foot deep gullies were cut into some of the hillside trails in Watchung Reservation, a county park in the Watchung Mountains.

Snowfall averages 27.2 inches per year, generally concentrated from December through March. Storms producing four or more inches of snow typically occur two to five times each winter. Storms producing eight inches of snow or more occur every other year. The winter of 1960-1961, 1977-1978, 1995-1996, 2002-2003, 2010-2011, and 2014-2015 were notable for several large storms, additional accumulation from smaller storms, long periods of cold temperatures, and long-lasting snow cover. The winter of 2004-2005 was the third consecutive year with above average snowfall over most of New Jersey. The winter of 2011-2012 was very mild by comparison with virtually no snow and only a few days of very cold weather, but the winter of 2013-2014 roared back with numerous storms and extended periods of below freezing temperatures. For the winter of 2014-2015 a series of small storms dropped several inches of snow or freezing rain in the area with February 2015 exhibiting some of the coldest temperatures of the season, and in some localities, the coldest in 20 years, if not setting new records.

Table 3 below provides snowfall data from Newark Airport from 1991-2005.

TABLE 3: Average Snowfall Data

(For the period 1991-2005)

MONTH	MEAN	HIGH	LOW
January	8.6	18.5	0.1
February	9.3	33.4	0.0
March	4.5	16.8	0.0
April	0.6	4.4	0.0
May	0.0	0.0	0.0
June	0.0	0.0	0.0
July	0.0	0.0	0.0
August	0.0	0.0	0.0
September	0.0	0.0	0.0
October	0.0	0.0	0.0
November	0.5	3.0	0.0
December	4.4	21	0.0

2.3 GLOBAL WARMING

The current big unknown about the future of climate change is "global warming." After years of debate most scientists do agree that this phenomenon is indeed happening. However, the question is why is it happening? Is it because day-to-day human activities are generating substantial quantities of "greenhouse gases" (e.g. Carbon dioxide, methane, etc.) or is it simply part of the natural climate cycle of the Earth? These "unnaturally produced" gases, primarily created by the combustion of "fossil fuels" (coal, gas, oil) and certain industrial processes, act like the glass panes of a greenhouse. Normally a certain percentage of solar radiation passes through the atmosphere where a certain fraction is absorbed by the ground, vegetation, and oceans, while the remainder is reflected back into space. With high levels of greenhouse gases, a

higher portion of the reflected radiation, mostly in the form of heat, does not escape into space but is trapped in the atmosphere. This in turn slowly raises the overall average temperature of the Earth. As is evident in recent years, just a few degrees change in temperature can have drastic consequences. The direst consequences would be the complete melting of the polar and Greenland ice caps. It has been speculated that such an occurrence would raise the level of the oceans by several tens to several hundreds of feet. The result would be catastrophic for civilization worldwide. Even a more modest rise of 10 to 30 feet would severely impact all coastal areas. As a long peninsula surrounded on three sides by water, New Jersey could find its outline changed and land area reduced. The costs would be staggering, as hundreds of thousands of people and thousands of businesses would be forced to relocate. Infrastructure would need to be relocated and/or replaced as well. Locally, much of eastern Union County is predicted to be submerged and rivers and streams would be tidally influenced much farther upstream. Coastal water supply wells would be negatively affected by salt and brackish water intrusion. (Interestingly, the remnants of native-American villages can be found several miles in the ocean off of our current coastline. Thousand of years ago, as today, many of the villages and towns would have been located near water—rivers, lakes, and the ocean. At that time, as the Wisconsin Ice Age was still widespread, the ocean levels were much lower because of the tremendous amount of the water locked up in the ice caps. As the continental glaciers melted (up to two miles thick it has been estimated) the rising ocean levels submerged those villages. Going back further in the geological record—the southern two-thirds of New Jersey—the Coastal Plain—are all marine (ocean bottom) sediments ranging from several million to nearly 100 million years old. Attesting to a time when the ocean levels were much higher than the present day.

There are other possible consequences from an average temperature increase of only a few degrees. Some areas presently under arid conditions may receive more precipitation and conversely, humid areas may face prolonged periods of drought conditions. This would in turn affect habitat so that some plants and animals would proliferate while others would become extinct. Just as ominous is the possibility that New Jersey could become suitable for a number of semi-tropical species including pests and carriers of various diseases currently kept at bay by our

freezing winters. Somewhat paradoxical, global warming in some climate change computer models could cause more extensive snowfall, as there would much more moisture in the atmosphere.

There have been various actions on a national and international level to study the phenomena and to develop programs to reduce the quantities of the manufactured gases released into the atmosphere. Some large corporations have also taken a lead to voluntarily reduce emissions either from manufactured products or from the way they conduct business (e.g. using more efficient lighting systems, adding solar panels to generate clean electrical energy, etc.). On a more local level, there is a nation-wide initiative by the Conference of Governors and Mayors for the states and municipalities to encourage direct reduction of government-generated gasses and to encourage residents to do the same. There is however, some political backlash on both the state and federal levels (in Congress) and by a number of special interests to slow the implementation of air pollution controls or to eliminate them completely. On one hand the Federal Environmental Protection Agency has recently established a new set of rules and timetables for reducing air pollution, including greenhouse gases. On the negative side, the state of New Jersey is working to remove itself from an initiative of the northeast states to work to eliminate these problem gases on a regional level. Please see also, Chapter 15: Observations & Suggestions.

CHAPTER 3

AIR QUALITY

NOTES:

3.1 AIR POLLUTANTS

The air we breathe in and around Fanwood directly affects our health more than any other environmental factor. The air quality in Fanwood and New Jersey as a whole is affected by several factors including:

- ✓ Automobile Emissions
- ✓ Industrial Emissions
- ✓ Home Heating Sources
- ✓ Weather
- ✓ Environmental Conditions (e.g., bare ground exposed to wind)
- ✓ Air Pollution in other areas of New Jersey and the Country

Air pollution tends to be more concentrated in urban centers where people work and live. Certain air pollutants can be toxic while others can harm the human respiratory system, particularly in the elderly or in people with chronic respiratory problems. High concentration of certain pollutants can harm plant life and affect the soil and water in our environment. The United States Environmental Protection Agency (USEPA or just EPA) considers the following six common air pollutants critical and has set criteria for their levels in the environment.

3.1.1 NITROGEN OXIDES

Nitrogen oxides or (-NO_x) are a group of gases that contain varying amounts of oxygen and nitrogen. NO_x are primarily formed by the combustion of fuel at high temperatures. The EPA studies indicate that in year 2003, 55% of the man-made NO_x present in the environment came from automobile exhaust.

NO_x are of concern since they are involved in the formation of ground-level ozone, can contribute to acid rain, can lead to increased nitrogen levels in surface water and impact and impair surface water quality, contribute to global warming, can react to form toxic chemicals, and can impact human health when they react with particles and volatile organic compounds (VOCs) in the atmosphere.

Since NO_x are highly reactive, and can travel long distances, they are often a problem far from their source. Many of the NO_x in New Jersey's air are from emissions by power plants and industrial facilities in the Midwest and Southeast.

In 2003 New Jersey NOx Emissions were 23 thousand tons, with the introduction of the Clean Air Interstate Rule (CAIR) the 2009 NOx Emissions were reduced to 11 thousand tons and are expected to have risen slightly to 12 thousand tons by 2015, but still a 48% reduction from 2003.

3.1.2 SULFUR DIOXIDE

Sulfur dioxide (SO_2) is present in many fuels such as coal and oil, and in many types of metal ores. SO_2 enters the atmosphere when these fuels are burned, when gasoline is refined from oil, and when certain metal ores are processed. Additionally, some locomotives and some non-road diesel engines that burn high sulfur fuel release SO_2. The EPA indicates that 65% of the SO_2 emitted to the atmosphere originates from electric power plants, primarily those that burn coal. Additionally, since SO_2 can travel long distances, it is often a problem far from its source.

SO_2 is of concern since it contributes to respiratory illness, particularly in children and the elderly, and aggravates existing heart and lung diseases, contributes to the formation of acid rain, thus making soils, lakes, and streams acidic. This directly impacts plant vegetation and can drastically affect aquatic life leading to a breakdown of the food chain.

The introduction of CAIR should reduce the New Jersey SO_2 emission from 51 thousand tons in 2003 to 26 thousand tons in 2017, a 49% reduction.

3.1.3 CARBON MONOXIDE

Carbon Monoxide (CO) is formed when fuel is not burned completely (incomplete combustion). The EPA indicates that 56% of CO emitted to the atmosphere originates from automobile exhaust. Additionally, the EPA has determined that in some urban areas, 85% to 95% of CO emitted to the atmosphere originates from automobile exhaust, and in 2008 over 96% of the Carbon Monoxide Emissions in Union County were generated by automobile exhaust.

CO is of concern since it can weaken the heart's contractions and lower the amount of oxygen carried by the blood. It can cause nausea, dizziness, headaches, and even death in high concentrations. When carbon monoxide reaches unhealthy levels, people with heart disease are most at risk. CO contributes to the formation of smog-level ozone, which can trigger serious respiratory problems.

Woodstoves, gas stoves, cigarette smoke, and unvented gas and kerosene space heaters are sources of CO indoors. The highest levels of CO in the outside air typically occur during the colder months of the year when inversion conditions are more frequent. The air pollution becomes trapped within cold air near the ground beneath a layer of warm air.

3.1.4 LEAD

Lead is a metal found naturally in the environment as well as in manufactured products. The major sources of lead emissions have historically been motor vehicles (such as cars and trucks) and industrial sources. Due to the phase out of leaded gasoline, processing of metals is now the major source of lead emissions to the air today. High levels of lead is still of concern in localized areas, especially in older buildings and structures that may contain layers of lead-based paints.

3.1.5 PARTICULATE MATTER

Particulate matter, also known as particle pollution or PM, is a complex mixture of very small solid or liquid particles components, including acids (such as nitrates and sulfates), organic chemicals, metals and soil or dust particles.

The size of particles is directly linked to their potential for causing health problems. The EPA is concerned about particles that are 10 micrometers in diameter or smaller because those are the particles that generally pass through the throat and nose and enter the lungs. Once inhaled, these particles can affect the heart and lungs and cause serious health effects. The EPA groups particle pollution into two categories:

1. "**Coarse Particles**", such as those found near roadways and dusty industries, range in size from 2.5 to 10 micrometers in diameter. These are referred to as PM10.
2. "**Fine Particles**," such as those found in smoke and haze, have diameters smaller than 2.5 micrometers; particles of this size are referred to as PM2.5. These particles can be directly emitted from sources such as forest fires, or they can form when gases emitted from power plants, industries and automobiles react in the air.

Union County in 2008 accounted for 4.8% of New Jersey's PM10 emissions and 6.1% of New Jersey's PM2.5 emissions.

3.1.6 OZONE

Ozone is a gas composed of three oxygen atoms. It occurs naturally in the stratosphere and is found in a layer 10 to 30 miles above the earth's surface where it protects us from harmful ultraviolet (UV) radiation.

At ground level, however, ozone, commonly known as smog, is a secondary pollutant formed by the interaction of volatile organic compounds (VOCs) and NO_x in the presence

of sunlight. Carbon monoxide can also contribute to the formation of ground level ozone. VOCs enter the atmosphere from such sources as automobile exhaust, gasoline vapors, and chemical solvents.

Ground level ozone irritates the lungs and breathing passages. Ground level ozone can cause coughing and pain in the chest and throat and may cause increased susceptibility to respiratory infections. Children and people with asthma and other respiratory ailments are more likely to be affected by ground level ozone.

3.2 ACID RAIN

Acid rain is another air quality concern in New Jersey. When a liquid is measured on the pH scale, a reading of "7" is neutral with decreasing values indicating progressively acidic conditions. The pH of rainfall is slightly acidic, about 5 to 5.6 because precipitation combines with carbon dioxide in the atmosphere to form a mild carbonic acid. pH values that fall lower than this level are considered to be "Acid Rain". Acid rain occurs when sulfur oxides and nitrogen oxides combine with water in the atmosphere to form sulfuric and nitric acids. New Jersey is an area of relatively high vulnerability to the effects of acid rain because of limited buffering capacity in the soils and rock. Acidic rainfall in high doses may harm vegetation and even change the pH of small lakes.

3.3 WEATHER CONDITIONS

Meteorological conditions are an important factor in the distribution and concentration of air pollutants. Emissions that do not normally cause violations of air quality standards may, under certain meteorological conditions, become a health or esthetic problem.

The prevailing winds from the west and south continue to move upwind pollution from power plants and other facilities in the Midwest and Southeast into both New Jersey and the Northeast. NJDEP indicates that all of New Jersey, Massachusetts, Connecticut, Rhode Island, and

Delaware consistently are EPA "non-attainment" areas for ground level ozone, due in part to those upwind sources. The EPA defines an area as "non-attainment" if it has violated, or has contributed to violations of the national 8-hour ozone standard over a three-year period.

Another effect that weather has on air pollution is temperature inversions. These occur when relatively cool air is trapped under descending warm air, which can result in the accumulation of pollutants within the trapped air. Pollutants can also build to levels that violate the applicable standards when a stagnant air mass persists in the area.

3.4 AIR POLLUTION STANDARDS

The Clean Air Act first enacted in 1970, with major amendments made in 1977 and 1990, charged the EPA with setting ambient air quality standards to protect human health. These standards are known as the National Ambient Air Quality Standards (NAAQS). The standards were most revised in 1997 for ground level ozone and particulate matter; these revisions were made to be more protective of human health. The most notable change to the ozone standard was the change to an 8-hour average standard, from a 1-hour average standard. The particulate matter standard was changed from a standard for Coarse Particle matter (PM10) to a standard for Fine Particle matter (PM2.5). Additional revisions were made to the standards in 2014 for certain industries. The current NAAQS are provided in Table 4 below.

Unfortunately as this document was being prepared, the current Federal administration has rescinded or slowed the implementation of air quality rules. It is hope that this backward trend can be reversed and air quality can once again be improved.

TABLE 4: National Ambient Air Quality Standards (NAAQS)

POLLUTANT	PRIMARY STDS.	AVERAGING TIMES	SECONDARY STDS.
Carbon Monoxide	9 ppm (10 mg/m^3)	8-hour[1]	None
	35 ppm (40 mg/m^3)	1-hour[1]	None
Lead	1.5 $\mu g/m^3$	Quarterly Average	Same as Primary
Nitrogen Dioxide	0.053 ppm (100 $\mu g/m^3$)	Annual (Arithmetic Mean)	Same as Primary
Particulate Matter (PM_{10})	Revoked[2]	Annual[2] (Arith. Mean)	Revoked[2]
	150 $\mu g/m^3$	24-hour[3]	Same as Primary
Particulate Matter ($PM_{2.5}$)	15.0 $\mu g/m^3$	Annual[4] (Arith. Mean)	Same as Primary
	35 $\mu g/m^3$	24-hour[5]	Same as Primary
Ozone	0.08 ppm	8-hour[6]	Same as Primary
	0.12 ppm	1-hour[7] (Applies only in limited areas)	Same as Primary
Sulfur Oxides	0.03 ppm	Annual (Arith. Mean)	-------
	0.14 ppm	24-hour[1]	-------
	-------	3-hour[1]	0.5 ppm (1300 $\mu g/m^3$)

[1] Not to be exceeded more than once per year.

[2] Due to a lack of evidence linking health problems to long-term exposure to coarse particle pollution, the agency revoked the annual PM_{10} standard in 2006 (effective December 17, 2006).

[3] Not to be exceeded more than once per year on average over 3 years.

[4] To attain this standard, the 3-year average of the weighted annual mean $PM_{2.5}$ concentrations from single or multiple community-oriented monitors must not exceed 15.0 $\mu g/m^3$.

[5] To attain this standard, the 3-year average of the 98th percentile of 24-hour concentrations at each population-oriented monitor within an area must not exceed 35 $\mu g/m^3$ (effective December 17, 2006).

(6) To attain this standard, the 3-year average of the fourth-highest daily maximum 8-hour average ozone concentrations measured at each monitor within an area over each year must not exceed 0.08 ppm.
(7) (a) The standard is attained when the expected number of days per calendar year with maximum hourly average concentrations above 0.12 ppm is ≤ 1, as determined by appendix H. (b) As of June 15, 2005 EPA revoked the 1-hour ozone standard in all areas except the fourteen 8-hour ozone nonattainment Early Action Compact (EAC) Areas.

Air quality is monitored for numerous pollutants throughout New Jersey by the NJDEP. The data is used by the EPA and reported daily on the EPA websites. The monitoring results are then compared to the applicable air quality standards to determine if any violations have occurred.

3.5 AIR QUALITY INDEX

In July 1999, the EPA released a program called the "Air Quality Index" or "AQI" as a marker for reporting daily atmosphere quality in relation to its potential to impact human health. The AQI replaced the earlier Pollution Standard Index (PSI). The AQI was developed in order to incorporate the 1997 revisions to the ozone and PM 2.5 NAAQS.

The AQI is measured on scale from 0 to 500 for each of the five major air pollutants regulated by the Clean Air Act: ground-level ozone, particle pollution (also known as particulate matter), carbon monoxide, sulfur dioxide, and nitrogen dioxide. AQI is calculated from data collected at different air monitoring stations at different locations throughout the state. The nearest station to Fanwood is located in adjacent Plainfield.

3.6 TRENDS IN RECENT AIR QUALITY

3.6.1 OZONE

The 2003 NJDEP Bureau of Air Monitoring Report indicates that ozone levels have improved since the 1970's and that "*maximum 1-hour concentrations have not exceeded 0.20 ppm since 1988, and the last time levels above 0.18 ppm were recorded was in*

1990." The report further indicates that improvements in ground level ozone may have plateaued," *especially with respect to maximum 8-hour average concentrations.*" Ground level ozone concentrations are shown in Table 5 below.

TABLE 5: Historical Ground Level Ozone and Carbon Monoxide in NJ

YEAR	GROUND LEVEL OZONE		CARBON MONOXIDE
	Exceedances of the 1-hour Standard (1)	Exceedances of the 8-hour Standard (2)	Exceedances of the 8-hour Standard (3)
1988	45	61	0
1989	18	49	1
1990	23	50	1
1991	26	68	2
1992	9	34	2
1993	18	61	0
1994	7	36	5
1995	14	36	2
1996	6	33	0
1997	10	36	0
1998	4	47	0
1999	10	46	0
2000	4	19	0
2001	11	35	0
2002	16	44	0
2003	4	20	0
2004	0	14	0
2005	5	22	0

(1) Beginning in 1997, the USEPA 1-hour ground level ozone standard (0.100 ppm) was replaced by the more conservative 8-hour standard; the 1-hour standard is still calculated and is used to ensure that there is no delay in notifying the public when peak ozone levels are occurring
(2) The USEPA 8-hour ground level ozone standard (0.080 ppm) was released in 1997; the data for the 8-hour standard prior to 1997 was calculated by NJDEP and presented here for comparison purposes
(3) The USEPA 8-hour standard is 9 ppm

3.6.2 CARBON MONOXIDE

The 2004 NJDEP Bureau of Air Monitoring Report indicates that carbon monoxide has not exceeded the health standard in New Jersey since 1995. The USEPA deemed that New Jersey was "*officially declared*" as having self attained the CO standard on August 23, 2002.

3.6.3 NITROGEN DIOXIDE

The 2004 NJDEP Bureau of Air Monitoring report also indicates "*monitoring for nitrogen dioxide (NO2) began in 1966, concentrations have never exceeded the NAAQS in New Jersey.*"

3.6.4 SULPHUR DIOXIDE

The 2004 NJDEP Bureau of Air Monitoring report indicates that SO_2 has not exceeded the NAAQS since 1980. The overall SO_2 levels decreased during the years from 1975 to approximately 1995, and have remained fairly even since. The 2004 report further indicates "*although there has not been a measured exceedance of the NAAQS in over two decades, there is still a small area of New Jersey that is classified as a non-attainment area for SO2.*" This area is located within a small portion of Warren County.

3.6.5 PARTICULATE MATTER

The 2003 NJDEP Bureau of Air Monitoring Report indicates that particulate matter steadily decreased in New Jersey from 1970 to 1997, as measured by a "*smoke shade used as a surrogate for particulate matter.*" The particulate levels, for both course particles (PM10) and fine particles (PM2.5) appear to have leveled off in 1997, based on the data presented by NJDEP.

3.6.6 AIR QUALITY INDEX

The 2003 and 2004 NJDEP Bureau of Air Monitoring Reports indicates the following trends in the air quality index readings:

"In 2003 there were 148 "Good" days, 189 "Moderate days", 24 days were rated "unhealthy for Sensitive Groups", 2 days were considered "Unhealthy", and 2 were rated "Very Unhealthy". This indicates that air quality in New Jersey is considered good or moderate most of the time, but that pollution is still bad enough to adversely affect some people on about one day in thirteen.

In 2004 there were 136 "good" days, 211 were "Moderate", 18 were rated "Unhealthy for Sensitive Groups", 1 was considered good or moderate most of the time, but that pollution is still bad enough to adversely affect some people on about one day in nineteen.

3.7 AIR MONITORING LOCATIONS

Air quality is monitored at numerous stations throughout New Jersey. The 2004 Report prepared by the NJDEP Bureau of Air Monitoring indicates that 43 Ambient Air Monitoring Stations were operational in New Jersey. In Union county, the only two air monitoring stations are located in Elizabeth and Rahway. The former stations in Linden and Plainfield are no longer in operation.

The NJDEP website provides extensive data on air quality at http://www.state.nj.us/dep/airmon/. Currently, the data is used by the USEPA to prepare Air Quality Index (AQI) forecasts on a daily basis for cities around New Jersey. The nearest city for which a daily AQI forecast is prepared is Plainfield.

3.8 DIESEL SOOT REDUCTION

In September 2005, the State of New Jersey enacted the Diesel Risk Reduction Law aimed at reducing diesel exhaust from diesel-fueled vehicle such as trucks and buses. Diesel exhaust poses health risks since they release fine particles smaller than 2.5 micrometers (PM2.5) and various gases into the air. Diesel exhaust can worsen symptoms of asthma and can adversely affect those individuals with heart or lung disease.

NJDEP regulations limit idling of diesel powered vehicles to 3 minutes, with certain exceptions (N.J.A.C. 7:27-14, 15). The September 2005 Diesel Risk Reduction Law indicates that local police now have authority of enforce NJDEP's idling regulations, including the 3-minute limit on idling on all vehicles. The NJDEP indicates that idling penalties are now consistent among local, county and NJDEP enforcement authorities. The critical component to this law, however, is enforcement. Obviously police officers would have to constantly patrol a certain area, observing vehicles, timing the running time, and so forth—a substantial investment in time and resources. Targeted enforcement at "high potential" areas (proceeded perhaps by an information campaign—idling information handouts, verbal warnings, etc.) at train stations, convenience stores, and such could be helpful and more effective.

The September 2005 Diesel Risk Reduction Law also imposed deadlines for retrofitting diesel vehicles with emission controls by 2007. Funding for implementation of retrofitting diesel vehicles was provided by a statewide November 2005 ballot initiative.

3.9 AIR POLLUTION REDUCTION TIPS

The following are tips presented by the EPA to reduce air pollution:

- ✓ Car pool, use public transportation, bike or walk when possible.
- ✓ Avoid extended idling of automobile.
- ✓ Ensure tires are properly inflated.
- ✓ Keep car, boat, and other engines properly tuned; repair or replace engines that generate smoke or operate inefficiently.
- ✓ Consider hybrid or alternative fuel vehicles.
- ✓ Use environmentally safe paints and cleaning products whenever possible.
- ✓ Some products that are used in homes or offices are made with smog-forming chemicals that can evaporate into the air when used. Follow manufacturers' recommendations for use and properly seal cleaners, paints, and other chemicals to prevent evaporation into the air.
- ✓ Conserve electricity. Consider setting the thermostat a little higher in the summer and lower in winter. Participate in local energy conservation programs. Look for the ENERGY STAR label when buying home or office equipment.
- ✓ Consider using gas logs instead of wood. In case of wood-burning stove or fireplace insert, make sure it meets EPA design specifications. Burn only dry, seasoned wood.
- ✓ Mulch or compost leaves and yard waste.

Days when ozone is expected to be high:

- ✓ Conserve electricity and set air conditioners at a higher temperature.
- ✓ Choose a cleaner commute. Share a ride to work or use public transportation. Bicycle or walk to errands when possible (though it might pose a health risk for a certain percentage of the population).
- ✓ Refuel cars and trucks after dusk.
- ✓ Combine errands and reduce trips.
- ✓ Limit engine idling.
- ✓ Use household, workshop, and garden chemicals in ways that keep evaporation to a minimum, or try to delay using them when poor air quality is forecast.

Days when particle pollution is expected to be high:

- ✓ Reduce or eliminate fireplace and wood stove use.
- ✓ Avoid using gas-powered lawn and garden equipment.
- ✓ Avoid burning leaves, trash and other materials.

3.10 ADDITIONAL SOURCES OF INFORMATION

NJDEP BUREAU OF AIR MONITORING WEBSITE	**PROVIDES HISTORICAL AIR DATA REPORTS, EDUCATIONAL INFORMATION**	**HTTP://WWW.STATE.NJ.US/DEP/AIRMON**
USEPA Air Now	Provides daily Air Quality Index (AQI) Forecasts, Educational Information, Publications, Contacts, Tips on Reducing Air Pollution	http://www.airnow.gov
USEPA National Ambient Air Quality Standards (NAAQS)		http://www.epa.gov/air/criteria.html

CHAPTER 4

GEOLOGY

NOTES:

4.1 GENERAL GEOLOGY

New Jersey is generally considered to have four major geological (or physiographic) provinces. They are:

1. Valley and Ridge (considered to be the beginning of the Appalachian Mountains).
2. The Piedmont (sometimes called the Triassic Lowlands)
3. The Highlands (sometimes called the Pre-Cambrian Highlands)
4. The Coastal Plain (usually divided into the "Upper" [or Inner] and the "Lower" [or Outer] coastal plain).

Each province is typified by unique rocks and landforms.

Union County is located in the Piedmont physiographic sub province. The Piedmont sub province encompasses nearly one fifth of the area of New Jersey. It extends from the Hudson River towards the southwest between the Highland sub province and the Coastal Plain Province all the way to the Delaware River. The Piedmont is generally lowland of rolling hills and wide valleys although ridges and hills rise as much as 400 feet above the lower lands. Union County includes two distinct topographic areas. To the west, the county contains a portion of the Watchung Mountains, which are three prominent ridges (and several smaller outcrops) consisting of erosion-resistant basalt traprock oriented parallel to the northwestern county boundary. These ridges were derived from three separate igneous extrusions (lava flows) during the Triassic Era about 142-202 million years ago. Erosion over time has removed the surrounding "softer" rocks, exposing the hard basalt as ridges. To the east of the Watchung Mountains, the county generally exhibits the characteristics of the Piedmont of rolling hills and wide valleys. Farther to the east, igneous intrusions form the Palisades, which are composed of a rock called diabase. (The Palisades, which form prominent cliffs in Bergen and Hudson counties, is not visible at the surface in Union County.) Both basalt and diabase are relatively hard rocks, are resistant to erosion, and are quarried for crushed stone for construction (for example, the basalt Weldon Quarry on New Providence Road in nearby Watchung). The county generally slopes from elevations of 100 to 150 feet above sea level at the base of the mountains to sea level at its eastern boundary at the Arthur Kill and Newark Bay. The highest elevation in the county is 553 feet on the Second Watchung Mountain in Berkeley Heights. The lowest elevations are found in

the tidal marsh lands bordering the Arthur Kill and Newark Bay to the east of Fanwood (USDA 1991).

The general geology and topography of Fanwood is shown in Maps 5-1 to 5-6.

4.2 GEOLOGY OF FANWOOD

Although the bedrock can slowly weather in place to form residual soils, the most significant factor affecting surficial soils and geology in Union County was the impact of continental glaciers. Geology and topography throughout much of the Piedmont region retain the effects of the last glacial episode (of four major periods events) in northern New Jersey—the Wisconsin Glaciation. The "retreat" (that is, the glacier ice melted faster than it formed (starting about 22,000 years ago) and the ice melted faster in the southern latitudes) of the glacier deposited a terminal moraine which at it farthest extent traverses the county in a roughly north-south direction from Plainfield to Summit. (The terminal moraine is an irregular accumulation of clay, sand, gravel, and a boulder that is pushed in front of the slowly moving glacial ice like a giant bulldozer and marks the glacier's farthest extent.) The overlying glacial deposits complicate determining the delineation of subsurface geology in Union County, which in places that glacial sediment can be several hundred feet thick. In other parts of the county, the glacial material is shallow, particularly where stream action has occurred. These deposits are apparent in the low, irregular hills of unsorted boulders, gravel, sand and fine material found throughout Union County, including Fanwood (USDA, 1991).

Geologists and earth scientists generally agree that most of the county is underlain by the sedimentary sandstone and shale of the Passaic Formation, part of a larger accumulation of rock sometimes referred to as the Brunswick Group within the overall structure of the Piedmont Physiographic Province. (A "formation" is a mass of sediment, usually consolidated into rock; was formed in prehistoric times; has common characteristics throughout its extent; and can be differentiated from the "formations" above and below it). The Passaic Formation reaches a thickness of 11,480 -11,810 feet below Union County (USGS, 1996). In Fanwood and other

parts of Union County, The Passaic Formation is covered by about 70 feet of unconsolidated terminal moraine deposited by the last glacial retreat from the area.

Before the Wisconsin glaciation, streams and rivers carved deep channels into the Passaic Formation. One of these channels occurs in the Scotch Plains area underlying Ashbrook Swamp and Goodman's Crossing (called the "Buried Rahway Valley"). These channels are now buried with glacial sediment, but in some areas, the high percentage of sands and gravels make them excellent aquifers—water bearing formations.

There were several advances and retreats of continental glaciers during the Wisconsin Glacial Stage. The last advance and then retreat occurred approximately between 22,000 to 12,000 years ago respectively. The final retreat of the glacier deposited terminal moraine and ground till that now forms the predominant surficial deposit covering most of Union County including Fanwood. The swamps found in Union County, and which once formed much of the northern portion of Fanwood, are the result of ice age "sculpting" and the undulating rock surface from the post-Triassic erosion of the Passaic Formation. Many present day swamps were formed over the clays of old lake bottoms. (Nearly all the natural lakes in North America were formed by the glaciers and are generally found north of the terminal moraine.) Depressions gouged by glacial ice and dams of sediment pushed by the ice or left behind by the retreating glaciers created many long-lasting or temporary lakes (for example, the Great Swamp in Morris County is a remnant of the Glacial Lake Passaic). Any geological area that has numerous swamps indicates "disorganized drainage" (sometimes referred to as "undetermined channelization of streams"), which is a common characteristic of "recently" glaciated terrain (the Green Brook and Cedar Brook are two nearby examples). The former "swampland" (which would now be referred to as "wetlands") in the northern section of Fanwood was partly filled by the Central Railroad of New Jersey between 1838 and the late 1860's when the railroad bed was laid along what is now Midway Avenue. Excavations for sewer lines and other information from old maps and publications reveal that the original soil surface was several feet below the present elevation.

Additional information about the geology of Fanwood and New Jersey can be viewed on the New Jersey Department of Environmental Protection Geoweb Map Geology Website at http://www.state.nj.us/dep/gis/imapnj_geolsplash.htm#

CHAPTER 5

SOILS

NOTES:

The several soil types found in Fanwood were largely formed from the sedimentary glacial till underlying the Borough. The United States Department of Agriculture, Natural Resources Conservation Service published various draft soil surveys for Union County; current information on soils can be found at the agency's website: www.nrcs.usda.gov/wps/portal/nrcs. This section is based on information from that site and other sources. Map 6 provides a map of soils in the Borough.

5.1 PREDOMINANT SOIL TYPE IN FANWOOD

The predominant soil in Fanwood is the Boonton-Urban Land-Haledon Association (BuB). This soil complex includes gently sloping to moderately steep, moderately well drained Boonton soils that have a firm or very firm loamy subsoils. This unit typically contains about 45% Boonton soils, 25% Urban land, 20% Haledon soils, and 10% other soils. The Boonton Soils typically consist of a very dark grayish brown gravelly loam about 3 inches thick, which is underlain by brown gravelly fine sandy loam about 12 inches thick. Below this is another 12 inches of reddish brown loam to a depth of about 60 inches. (A loam is a soil containing a variable mixture of sand, silt, and clay.)

Urban land is defined as areas that include more than 80% buildings or pavement. These structures alter or obscure the underlying soil to an extent that identification is not feasible.

The Haledon soils have a surface layer composed of dark grayish brown loam about 9 inches thick. The subsoil is yellowish brown loam about 7 inches thick, which is underlain by about 12 inches of yellowish brown mottled silt loam. The lower portion of the subsoil is a fragipan of firm, reddish brown mottled sandy loam about 16 inches thick. (A fragipan is a loamy, brittle layer, which may be at the surface or within lower soil layers that may restrict percolation of water. It is low in clay content, but high in silt and/or a very fine sand—the particles adhere tightly, almost appearing to be cemented together and as such, even when wet, breaks apart rather than crumbling.)

The soils in this complex have a slowly permeable fragipan that restricts vertical water movement and root penetration. Runoff from the Boonton soils is medium and available water capacity is moderate. After heavy rains and in winter and early spring, a perched water table may be found at a depth of 18 to 72 inches below the surface. In the Haledon soils, a perched water table is at 6 to 18 inches from winter through late spring. In both soils, water may move laterally along the fragipan producing seeps in the sides of hills.

As in other parts of Union County, this soil is found in an area that has undergone extensive development for residential, commercial, or industrial purposes. The earliest residential development generally occurred on the better drained, sloping portions of this soil unit, which are mostly underlain by Boonton soils. More recent development has taken place on the nearly level areas of the county including the Haledon and other soils.

5.2 OTHER SOIL TYPES IN FANWOOD

The next most common soil type in Fanwood is the Haledon-Urban land-Hasbrouk Complex. This unit consists mostly of somewhat poorly drained Haledon soils, areas of Urban Land, and poorly drained Hasbrouk soils. Haledon soils are on both convex and nearly level slopes of 0-8%. Hasbrouk soils are found in depressions and along drainage ways on slopes of 0-2%.

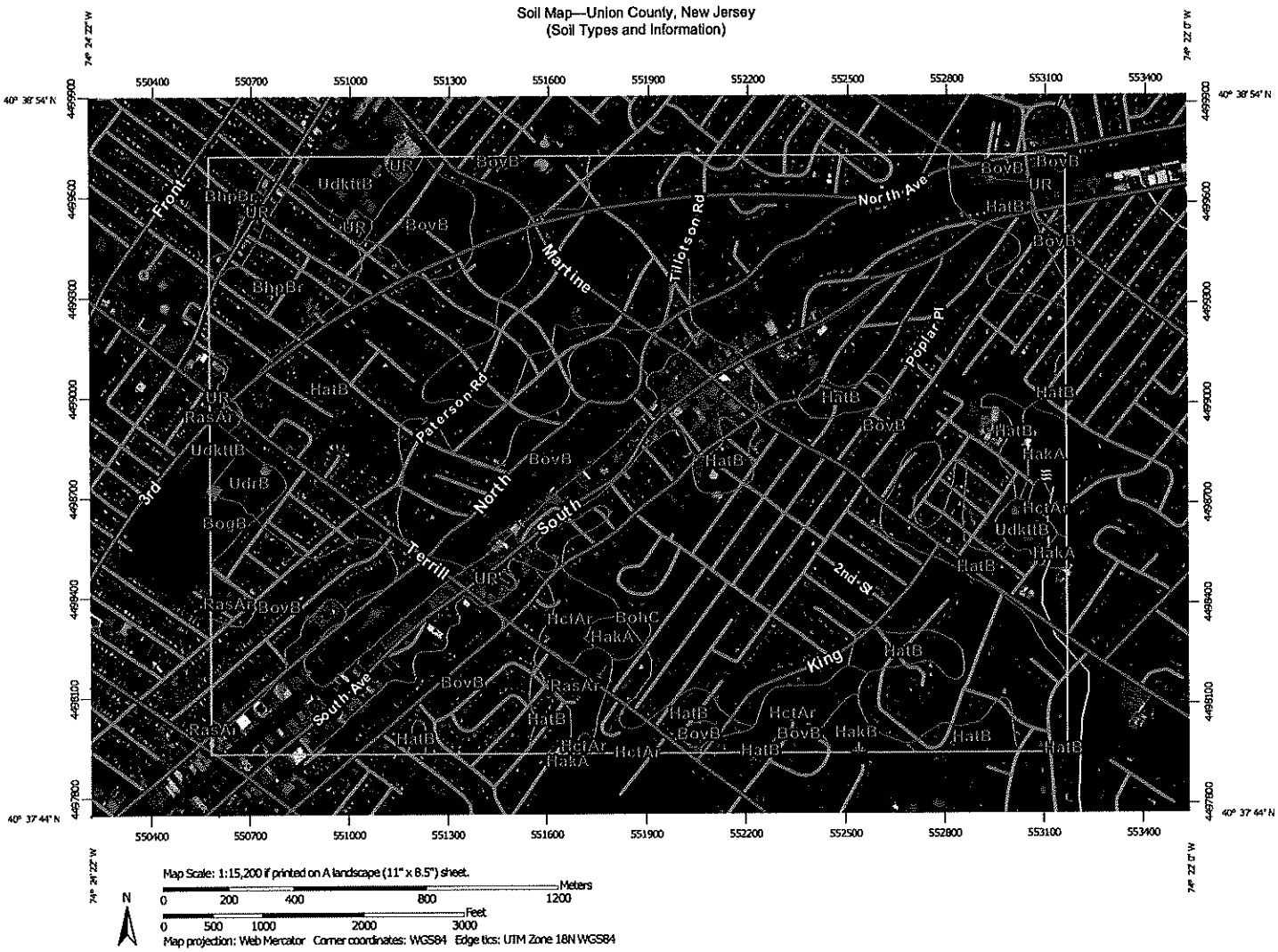
The Haledon soil is composed of loam, which becomes a silty loam in the subsoil. The lower subsoil consists of a fragipan of sandy loam about 16 inches thick. The Hasbrouk soils typically consist of silt loam grading to sandy loam. The subsoil is loam, underlain by clay loam and fragipan of loam about 22 inches thick.

Others soils in the unit include the Boonton, Amwell, Raritan, Passaic, and Dunellen soils, and Udorents, which are also "loamy." These minor soils make up about 10% of this unit.

The soils in this unit have a slowly permeable fragipan, which restricts vertical movement of water and penetration by roots. This causes a perched water table at 6 to 18 inches in the

Haledon soil and from the surface to 6 inches in the Hasbrouk soil. In the Haledon soil, the perched water table is generally found from winter through late spring while in the Hasbrouk soil such a perched layer is found from fall through early summer. The Haledon soils have hydric inclusions while the Hasbrouk soil is hydric (which means it is indicative of wetland-like conditions) if hydrologic; (this usually allows conditions that are conducive to vegetation found in wetlands).

Soil Map for Union County, New Jersey



Map Unit Legend

Union County, New Jersey (NJ039)			
Map Unit Symbol	**Map Unit Name**	**Acres in AOI**	**Percent of AOI**
BhpBr	Birdsboro-Urban land complex, 0 to 6 percent slopes, rarely flooded	48.3	4.2%
BogB	Boonton loam, 3 to 8 percent slopes	4.0	0.3%
BohC	Boonton moderately well drained gravelly loam, 8 to 15 percent slopes	0.9	0.1%
BovB	Boonton-Urban land-Haledon complex, 0 to 8 percent slopes	648.5	56.4%
HakA	Haledon loam, 0 to 3 percent slopes	12.7	1.1%
HakB	Haledon loam, 3 to 8 percent slopes	5.9	0.5%
HatB	Haledon-Urban land-Hasbrouck complex, 0 to 8 percent slopes	271.8	23.6%
HctAr	Hasbrouck silt loam, 0 to 3 percent slopes, rarely flooded	27.8	2.4%
RasAr	Raritan-Urban land-Passaic complex, 0 to 3 percent slopes, rarely flooded	13.4	1.2%
UdkttB	Udorthents, loamy substratum, 0 to 8 percent slopes	19.0	1.6%
UdrB	Udorthents, refuse substratum, 0 to 8 percent slopes	6.5	0.6%
UR	Urban land	91.5	8.0%
Totals for Area of Interest		1,150.4	100.0%

MAP LEGEND

Area of Interest (AOI)
- Area of Interest (AOI)

Soils
- Soil Map Unit Polygons
- Soil Map Unit Lines
- Soil Map Unit Points

Special Point Features
- Blowout
- Borrow Pit
- Clay Spot
- Closed Depression
- Gravel Pit
- Gravelly Spot
- Landfill
- Lava Flow
- Marsh or swamp
- Mine or Quarry
- Miscellaneous Water
- Perennial Water
- Rock Outcrop
- Saline Spot
- Sandy Spot
- Severely Eroded Spot
- Sinkhole
- Slide or Slip
- Sodic Spot
- Spoil Area
- Stony Spot
- Very Stony Spot
- Wet Spot
- Other
- Special Line Features

Water Features
- Streams and Canals

Transportation
- Rails
- Interstate Highways
- US Routes
- Major Roads
- Local Roads

Background
- Aerial Photography

MAP INFORMATION

The soil surveys that comprise your AOI were mapped at 1:24,000.

Please rely on the bar scale on each map sheet for map measurements.

Source of Map: Natural Resources Conservation Service
Web Soil Survey URL: http://websoilsurvey.nrcs.usda.gov
Coordinate System: Web Mercator (EPSG:3857)

Maps from the Web Soil Survey are based on the Web Mercator projection, which preserves direction and shape but distorts distance and area. A projection that preserves area, such as the Albers equal-area conic projection, should be used if more accurate calculations of distance or area are required.

This product is generated from the USDA-NRCS certified data as of the version date(s) listed below.

Soil Survey Area: Union County, New Jersey
Survey Area Data: Version 7, Dec 3, 2013

Soil map units are labeled (as space allows) for map scales 1:50,000 or larger.

Date(s) aerial images were photographed: Mar 19, 2011—May 1, 2011

The orthophoto or other base map on which the soil lines were compiled and digitized probably differs from the background imagery displayed on these maps. As a result, some minor shifting of map unit boundaries may be evident.

Table 6 describes the characteristics and development limitations of the soils found in Fanwood.

TABLE 6: Soil Characteristics and Development Limitations

SOIL SERIES	MAP SYMBOL	SLOPE	LIMTATIONS FOR ENGINEERING USE
Boonton-Urban Land-Haledon Complex	BuB	Undulating (0-8%)	Limitations for other engineering uses due to building sites and wetness; may need drainage improvements. Limitations for lawns, gardens, trees and shrubs due to wetness. No wetland potential.
Haledon-Urban Land-Hasbrouk	HuB	Undulating	Severe limitations for urban use because of perched water. Above the fragipan, ponding of surface water and rare flooding. Drainage measures are needed to protect against structural damage. Landscaping limited by wetness. Haledon soil has hydric inclusions while Hasbrouk is a hydric soil.
Birdsboro-Urban Land Complex	BeB	3-8%	Suited for most urban uses. No wetland potential.
Boonton Gravelly Loam	BoC	8-15%	Severely limited for urban use by Slope and presence of the fragipan. Severely limited for lawn and landscape site development by slope. May be droughty during extended dry periods.
Haledon Silt Loam	HaA	0-3%	Limited for urban use by slow permeability in the fragipan. Seasonally perched water table and frost action potential. Severely limited for lawn and landscaping due to wetness. Hydric inclusions.
Hasbrouk Silt Loam	Hv	0-3%	Severe limitations for urban use by slow permeability in the fragipan, perched water table, frost action potential, and flooding and ponding hazard. Severely limited for lawns and landscaping by wetness. Hydric soils.
Parsippany Urban Land Association	PM	Nearly	Severe limitations for engineering, level and landscape use because of wetness.
Urban Land	UL	NA	NA

SOURCE: U.S. Department of Agriculture, Natural Resources Conservation Service, for Union County, NJ

Overall though, the intensive development of Fanwood over the many decades and the importation of soils to fill in wetlands have greatly altered the surficial soils. For most purposes, construction or conservation, it would be necessary to conduct a soils analysis of any particular location to correctly gauge the nature and type of soils present. Where larger development projects use the services of a geotechnical engineer a similar profession, it is requested that the results of any abundance sorts investigation (test pits, ect) be shared with the borough and the Environmental Commission.

CHAPTER 6

HYDROLOGY & WATER QUALITY

NOTES:

6.1 GENERAL CONCEPTS – GROUNDWATER & RUNOFF

The process by which water is continuously cycled from the oceans to the land and back to the sea is known as the Hydrologic Cycle. The process is "solar powered" in that the heat of the sun evaporates water from the surface of the ocean. As the water in a gaseous state collects in the atmosphere, it condenses into water vapor, forming clouds. When the clouds reach a saturation point, the water vapor collects into drops and then falls to the ground in the form of rain or snow.

In forested areas, the rain (or snow) falls onto leaves and branches. Part of the rain drips off the leaves and falls onto the ground where it seeps into the soil. A small portion of the rain remains on the leaves, which then evaporates back into the atmosphere. Of the precipitation that seeps into the groundwater, the roots of trees and other vegetation absorb a portion. This is further divided as the plant for growth uses some of the absorbed water and some is transpired through the leaves back into the atmosphere. The remaining water not used by the plants then becomes groundwater. In response to gravity, water in the ground moves vertically, then horizontally in spaces between the soil particles (faster in gravel and coarse sands, slower in silts and clays). The water may be in the ground moving slowly for hours, days, weeks, or months until it intersects a water body (stream, river, lake or ocean). In some cases, depending on the terrain, distance to water bodies, depth of permeable soils or fractured bedrock, the groundwater may be "stored" in deep aquifers for many centuries.

Very often the duration and intensity of a rainstorm exceeds the ability of a soil to infiltrate the water. Consequently, the precipitation not absorbed into the ground runs over it (now called "runoff"); first in the form of sheet flows, then in rills, gullies, and eventually streams and rivers. As the type of land cover changes so does the relative percentage of precipitation that becomes groundwater, or evaporates, or runs off. Forested areas tend to allow the most ground infiltration and the least amount of runoff. As the overall number and density of trees is reduced (usually due to development), there are fewer leaves to break up the force and to slow down the raindrops. In a meadow the dense growth of various types of plants can produce fairly low rates of runoff, but a compacted lawn area can produce surprisingly high runoff volumes. Heavy clay

and silt soils will have higher runoff rates than gravelly, sandy soils. At the far end of the ground cover spectrum are impervious surfaces, which may include bedrock exposed at the surface, but is more likely to be manmade surfaces such as sidewalks, roads, buildings, parking lots, etc. The more runoff implies more drainage and flood control in the form of pipes, culverts, ditches, bridges, detention/retention basins, levees, and other structures. Obviously, it is in a community's best interest to maintain as much tree cover as possible and to encourage landscaping schemes for new developments that discourage simple lawn areas while promoting more intense planting in the form of trees and shrubs.

Other factors to consider are that natural depressions that may temporarily store rainwater are often eliminated as a consequence of development. Also, water travels faster over impervious surfaces than it does through forested or heavily landscaped areas. These factors combine to significantly affect peak flow times and runoff volumes. To counter the increase in impervious cover and the loss of natural holding areas, the last forty years or so has seen the implementation of more and more strict stormwater management practices. In particular, in most new development projects artificial holding areas such as detention basins (which temporarily store runoff water and control the discharge rate), retention ponds (a permanent pond in which the level will temporarily rise in response to runoff, also with controlled discharge), and underground pipes (that also temporarily storm runoff water and have a discharge control structure like the ponds) are installed. Although the increase in impervious cover **increases the overall volume** of runoff from a particular project site, the discharge control structures **reduces the rate** of runoff from the site so that downstream drainage facilities are not overwhelmed.

Current practice emphasizes "natural" (or "best management practices"—BMPs) for storm water management. Leaving part of a project site forested (or planting many new trees), installing rain gardens, creating infiltration basins, providing bands of "meadow-like" curb-less islands in large parking lots, and similar features are favored over structural solutions (e.g., underground storage pipes). Zoning, the type of development, soils, and the size of the project area all play a part as to what type of management system can be used.

Regulations often require that the post-development runoff rates be less that the pre-development rate for particular size storms. However, these relatively "new" practices cannot make up for 200 plus years of unregulated development, and consequently flooding is endemic in many areas of New Jersey.

6.2 GROUNDWATER

The groundwater in Union County occurs in aquifers composed of both rock and unconsolidated sediments. The major aquifer is the Passaic Formation of the Newark Group, which supplies the greatest quantity of groundwater for public supply in Union County. The Passaic Formation is composed of consolidated rock so that the groundwater is stored in the cracks, open joints, fractures, and bedding planes of the rock (as well as in the overlying soils that have a high percentage of granular material—sands and gravels—in them).

Replenishment (or "recharge") of the groundwater in Passaic Formation occurs through infiltration of precipitation through overlying soils down into the bedrock. The amount of recharge is dependent on the land use and soil conditions in the area. Conversion of land use from forested to residential tends to reduce the amount of recharge because of the increased amount if impervious land cover, which increases runoff and reduces the potential for infiltration. As noted above, current practice is to encourage infiltration into the groundwater wherever feasible. In the lowland portions of Union county, the Passaic formation is overlain by thick, unconsolidated glacial deposits. In those areas where the unconsolidated material consists largely of silt and clay, water trying to flow downward to the underlying Passaic aquifer is impeded, whereas gravel and sandy soils promote infiltration.

As precipitation infiltrates into the ground it passes through the upper layers of soil known as the "unsaturated zone". It eventually reaches that portion of the soil layer (or fractured bedrock) where the spaces between soil particles (or cracks in the rock) are almost always filled with groundwater—known as the "saturated zone". The top of this zone is commonly called the "water table". The water table may be found several inches to many feet below the ground

surface. The elevation of the water table may also vary up and down numerous feet during the course of the year depending on precipitation, extent and duration of frozen ground, the elevation of natural outlets (lakes, streams), changes in ground cover, the pumping rate of wells, and related factors.

Under certain conditions a permeable layer of soil (an aquifer) may dip down below the ground surface and be overlain by an impermeable soil layer (silts and clays, called an "aquitard"). This confining layer can keep the water at a level lower than it would normally rise under unconfined conditions. If a well penetrates the confined aquifer, the water will rise to its "normal' level. Under certain topographic conditions, the "normal" level may be above the ground surface in which case the groundwater will actually flow up out of the well hole. This is commonly called an "artesian well." Contrary to popular belief, water from an artesian well is no more or less pure than water from any other well. Confined aquifers receive recharge water from two sources. Since many soil and rock formations dip downward from the horizontal surface, most confined aquifers will outcrop at some point at the surface where recharge can occur. Recharge can also occur through slow leakage of infiltrating water from the unsaturated zone through the confining layers. Groundwater resources are susceptible to quantity and quality problems. Over pumping of groundwater may lead to depletion of the supply or the intrusion of lower quality groundwater into the aquifers. Along the coast over pumping of wells can draw in brackish or saltwater, contaminating the wells and extremely difficult to reverse. Point (such as at the end of a pipe) and non-point (for example, sheet runoff from a parking lot or a golf course that uses high levels of fertilizers, herbicides, etc.) source discharges of pollutants can significantly affect groundwater quality. Another major source of contamination is from leaking underground storage tanks. Remediation and cleaning of underground aquifers is a costly and time-consuming process.

6.3 SURFACE WATER

The potable water for Fanwood is supplied primarily by surface water although groundwater is sometimes used as a supplement. The town's water is supplied by the former Elizabethtown Water Company, which is now part of the New Jersey American Water Company.

Union County lies primarily within two drainage basins—the Rahway River and the Raritan River. The two major watercourses in the northwestern portion of Union County are the Passaic River, which forms part of the boundary with Morris County, and Blue Brook, which follows the northeast to southwest alignment of the Watchung Mountains. Blue Brook flows through the Watchung Reservation and then joins Green Brook and then into the Raritan River in Middlesex County, which in turn empties into Raritan Bay at the Atlantic coastline. The Passaic River flows into Newark Bay.

The other major watercourses in the County, the Rahway and Elizabeth Rivers, flow from the base of the Watchung Mountains to the Arthur Kill and Newark Bay respectively. The 24 mile long Rahway River and its tributaries drain the largest portion of Union County—about 46.4 square miles, which is approximately one-half of the total Rahway River 83-square mile watershed. (The Rahway River originates in the Watchung Mountains in Essex County). The Robinsons Branch, a tributary of the Rahway River originates partially in the Fanwood Nature Center and partially from the town's storm drainage system. Fanwood Borough is a member of the non-profit Rahway River Watershed Association – an organization dedicated to preserving the river system and its watershed.

The Borough of Fanwood includes the ridgeline—a high point—, which separates the Raritan River Basin in the northwest from the Rahway River Basin in the southeast. (Map 7 shows the local and regional drainage patterns.) Runoff and drainage flow from the northwestern portions of Fanwood are transported to Cedar Brook in neighboring Scotch Plains and Plainfield, which

then flows into the Bound Brook River. Further, the Bound Brook then combines with Green Brook and enters the Raritan River along the boundary of the Boroughs of Bound Brook and Middlesex. Although these two rivers do not directly affect Fanwood, they are both notorious for flooding problems elsewhere in Union, Middlesex, and Somerset Counties.

The Raritan River Basin is the largest river basin located entirely within New Jersey. The River is tidally influenced upstream to the Fieldsville Dam above New Brunswick. Land use in the lower watershed is primarily urban/suburban with numerous industrial and commercial centers. Flows in the Raritan River are partially controlled by two upstream reservoirs—Spruce Run and Round Valley and by diversions by the former Elizabethtown Water Company, now part of New Jersey American Water, upstream of Bound Brook. Water from Fanwood is generally transported through the storm drainage system.

6.4 WATER QUALITY

Water quality is monitored at Queens Bridge in South Bound Brook, just upstream of the confluence with Green Brook. No current monitoring is done on the tributary streams, including those streams closer to Fanwood.

At South Bound Brook, the Raritan River has "fair" water quality, which worsens in the summer. Water quality has improved since 1981 when "very poor" water quality was found during low flow periods. At that time, the dissolved oxygen concentrations were very low and nutrient levels were very high. Nutrients concentrations, although still elevated, are about one-third to one-half what they were in the early 1980s. Fecal coliform levels were problematic in the mid 1980s. Certain types of toxic substances were also found in the waters and sediment of the Raritan River. In this portion of the river, the Fishery Resource were said to be "moderately degraded" (NJDEP, 1988). However, in response to significant government intervention in the form of new laws and billions of dollars in funding, wastewater treatment plants have been and continue to be upgraded and other pollutant sources are diverted or are pre-treated, water quality in the Raritan River and other water bodies will continue to improve.

The Raritan River is affected by point sources (e.g. direct discharge from a pipe) and non point sources (e.g. general overland runoff from parking lots, streets and golf courses, etc.) of pollutants. On the tributaries in the Fanwood area, non-point sources of pollutants are the major contributors to degraded water quality. Runoff from urban surfaces, storm sewers, and roadways are all believed to be an increasing problem in the watershed. Between 2004 and 2006 the New Jersey Department of Environmental Protection enacted a series of storm water management rules designed to counter the effects on non-point pollution sources.

Flows from the southeastern part of Fanwood enter the Robinson's Branch of the Rahway River (the Robinson's branch being one of the main tributaries of the Rahway). The Rahway River then flows into the Arthur Kill of the New York Harbor complex near Linden. The Rahway River drains an area of about 46 square miles and is tidal downstream of the Pennsylvania Railroad Bridge in the city of Rahway. The watershed of the Rahway River contains generally densely populated areas with residential, commercial, industrial and other uses, although a number of parks border or are near the river.

Currently, water quality in the main stem of the Rahway River is monitored at two locations: Springfield and Rahway. The Springfield station is upstream of the confluence with Robinson's Branch. At this location the Rahway River has at times its worst monitored water quality. Although overall water quality is considered fair, it can be poor during the late spring/early summer. The major problems include elevated fecal coliform counts and high total phosphorus concentrations. Periodically, low dissolved oxygen levels coupled with high total dissolved solid levels have been found. Dissolved oxygen levels often have fallen below 4/mg/l in the summer (NJDEP, 1988). Although the Robinsons Branch is not monitored in Fanwood it can be expected that the water quality is "fair" at best. While it does support some aquatic life—minnows, insects, and a few other species—the water to the Branch is largely supplied by an outfall drainage pipe coming from LaGrande Avenue. In addition to trash thrown in the streets (which is often washed into storm sewer inlets), the drainage system picks up oils, grease, metal particulates, grit, fertilizers and herbicides washed from lawns, fecal matter from animals

including pets, and miscellaneous other detritus. This material is discharged into the open channel of the Branch near the edge of the Fanwood Nature Center. Depending on the type of material, some gets deposited into the sediments and banks; other material remains suspended in the water to pollute downstream areas. Plastic bags and similar material are often snagged on branches, creating at best a visual blight, and at worst a danger to wildlife. (Each year at Fanwood's Earth Day/Clean Communities Day, a cleanup event is conducted in and around the waterway.)

Conditions improve somewhat downstream at the Rahway station. This station is located just upstream of the confluence of the main stem with the Robinsons Branch. Fecal coliform and total phosphorus levels are still elevated, although they are lower than in Springfield. The warm water fish community is considered moderately degraded in the Rahway River. The Rahway River is not of swimmable quality; nor is it considered a trout production stream, though it partially meets the fishable goal (NJDEP, 1988).

The water quality of the Rahway River reflects its character as an urban stream. The degraded water quality is likely the result of both non-point sources and municipal/industrial point sources of pollutants. Though portions of the river flow through parkland, the urbanization of the Rahway River basin has caused degradation of water quality, habitat destruction, and flood control problems.

Hurricane Floyd in September 1999, Hurricane Irene in 2011, and "Superstorm" Sandy in 2012 caused widespread flooding and damage along the Rahway River and its tributaries.

A local non-profit organization—the Rahway River Watershed Association—has been energetic and persistent in watching over the river. Their work has centered on both flooding and pollution issues and they have produced a number of educational programs, workshops, seminars, presentations as well as hands-on work to further those goals.

6.5 STORMWATER & RUNOFF IN FANWOOD

Because Fanwood contains a drainage divide (i.e. A "ridge" in which water flows to either one side or the other), it receives no flow from outlying areas, with the exception of the railroad bed where some flow enters from Scotch Plains. Therefore, all water generated in the Borough is from precipitation on Fanwood's lands. As noted in *Chapter 2: Climate*, average precipitation is about 43 inches per year as measured at the closest weather station. Much of this water is intercepted by impervious land surfaces and then directed into storm sewers. The storm sewer system is Fanwood is shown in Map 8. If the increased flows from new development are uncontrolled, the incidence and severity of flooding in downstream areas may also increase. At the same time, stream flows may be reduced during dry weather periods due to less infiltration, which decreases the groundwater discharge to streams. In response to greater storm flows, stream channels may erode their banks and widen. The increased sediment load, eroded from the banks as well as from the developing upland areas, changes the channel substrate as it slowly moves downstream and causes ponds and lakes along the waterway to fill up with silt. This "filling in" of ponds and lakes reduces their recreational and ecological value, as well as their ability to store excess runoff. Previously, many of these impacts were thought to be controlled through the use of engineered structures. These structures (detention or retention basins, outlet control orifices, etc.) are designed to control the storm water flow from the site to ensure that post-development runoff rates are no greater or even less than pre-development runoff rates. Such controls are commonly required in all new construction, building additions, parking lot expansions, and other work that increases impervious cover. Although, structures such as detention basins can be used to control existing storm water flooding problems, the availability of sufficient land area and the cost of the same can be a problem. Other ways to reduce storm water flow, such as the creating a "rain garden" to intercept rainwater before it can enter the storm sewers, will become more important as Fanwood and other municipalities contribute to the improvement of storm water management in New Jersey. In the past decade "non-structural" means of storm water control have gained favor. Besides rain gardens, other "natural" designs include grass/groundwater strips, new landscaping, sand/gravel infiltration trenches, and preserving existing wooded areas.

As in much of northern New Jersey, residential development, for many decades before storm water controls were implemented in Fanwood, resulted in wetlands and small ponds being filled in, while at the same time impervious cover was increasing substantially. This has resulted in periodic flooding of local streets and in some instances homes. In some areas of town, homeowners require continual use of sump pumps to keep basements dry. Fortunately though, Fanwood does not suffer the widespread flooding sometimes seen along portions of the Rahway River or Green Brook.

Unfortunately there has been a push by some communities to be allowed to dredge, channelize, and "straighten" out streams and rivers to eliminate flooding in their particular area. Although chronic flooding with few readily available solutions is exceedingly frustrating to property owners and elected officials alike, these simplistic actions are actually more damaging. Many water systems are akin to "living organisms" in that doing any of the aforementioned "fixes" changes the energy dynamics of the water system. This in turn would create different patterns of erosion, sediment deposition, and even flooding. A community that temporarily "solves" its flooding problem in one area of town may find significant erosion that deposits sediments elsewhere in the water system creating flooding problems elsewhere. Changes to any water system must be carefully thought out, analyzed, and implemented with great care.

6.6 STORMWATER MITIGATION IN FANWOOD

As noted above, many of these impacts from storm water runoff were controlled through the use of engineering techniques, when the only thought was to get the storm water away from built-up areas as quick as possible; hence the use of pipes, culverts, ditches, and bridges. Design philosophy changed to make the use of detention (temporary storm water storage) ponds and retention (permanent water storage) ponds to slow the rate of runoff. These storm water storage facilities can either be on the surface (as an excavated depression or a small dam between two hills) or underground (using perforated pipe, crushed stone, and/or drywells).

The detention/retention basin works by accepting more flow into the basin than is allowed to flow out through a "discharge control (orifice) structure." The idea is to keep the post-development **rate** of runoff the same or less than the pre-development rate of runoff from any particular project site. The overall **volume** of runoff may increase, but since the runoff rate is controlled, the runoff will continue to flow off the site for a longer period of time than it does under non-developed conditions.

More recently (starting in 2004 and amended several times since) the State of New Jersey has enacted a series of strict storm water management regulations that emphasizes non-structural means of controlling runoff. The rules generally affect projects that create a quarter-acre or more of new impervious cover or that disturbs more than an acre of land. The non-structural components stress retaining existing vegetative cover (especially wooded areas), directing sheet flow across other vegetative areas, and creating new landscaped areas for runoff to pass through. Directing the runoff through vegetative areas helps meet the requirements for two other important aspects of the new rules, namely, promoting groundwater recharge and removing high levels of total suspended solids to limit the degradation of downstream water quality. (Runoff flows much slower through vegetative areas than on pavement thus giving time for the water to percolate into the ground. Also, small particles drop out of the flow or are captured by the vegetation.) The NJDEP storm water management website provides spreadsheets with information to assist the designer with determining groundwater recharge requirements and volumes, soil types, infiltration rates, and related data. Other factors affecting the types of techniques or devices used are the nature of the project, surrounding land uses, existing local drainage system, and land availability. If it is not possible or practical to use vegetative cover for runoff management, there are a number of products on the market that can mechanically reduce suspended solids and promote groundwater recharge.

The Borough does have in place a model storm water management ordinance that requires detention facilities and other controls for new construction. For its part, the Planning Board and Borough Engineer have been adamant in requiring these facilities in almost all building projects.

The Board even requires single-family construction, new driveways, and home expansions to use such devices as stone trenches, drywells, and rain gardens. Other ways to reduce storm water flow, such as the planting of "rain gardens" to intercept rainwater before it can enter storm sewers, will become more important as Fanwood and other municipalities continue to do their part to help improve the overall water quality of surface and groundwater in New Jersey. In 2005 the Environmental Commission was successful in getting a demonstration rain garden planted on the grounds of the Borough Library. The basic idea of rain gardens is to direct runoff from an impervious area (e.g., downspouts and leaders from a roof) toward a slightly depressed area in the ground that is densely planted with aesthetically pleasing, water-tolerant, and native species of plants. Rain gardens are not people-made wetlands, but do provide an opportunity for runoff to slow down to allow infiltration into the ground and to remove suspended particles.

More recently a second demonstration rain garden was installed in front of the Borough Town Hall. Through the efforts of the Environmental Commission with the Rahway River Watershed Association (through which a grant was obtained), the Rutgers Extension service, and other agencies the garden was completed by volunteers under the direction of the Commission. The Fanwood Public Works Department excavated the pond outline and donations for gravel, topsoil, plants, and other items were obtained from local garden and building supply vendors. Other rain gardens may be installed elsewhere in town (e.g. by the First Aid squad buildings) as the opportunity and funding permits. It is also noted that these gardens do require maintenance (weeding, pruning, occasional plant replacement).

It is also important that storm water management techniques be protected "down the road." That is, a property owner who builds or expands a facility may put in a rain garden. However, subsequent buyers of that property may see the rain garden as a "patch of weeds" and may simply replace it with a lawn or worse, impervious cover. Education helps, but it may be necessary to protect these natural storm water management methods with deed restrictions and/or conservation easements.

In October of 2015, the Rutgers Cooperative Extension Water Resources Program produced the draft version of *Impervious Cover Reduction Action Plan for Fanwood Borough, Union County, New Jersey*. The document briefly discusses drainage in Fanwood (including the dismaying statistic that 96.6% of Fanwood is considered "urban" and that 35.9% of Fanwood has impervious cover). It then goes on to discuss a number of "green infrastructure" techniques (e.g., disconnected downspouts, pervious pavements, rain gardens, downspout planter boxes, and so forth). A significant portion of the document describes eleven different locations in town where various green infrastructure projects can be implemented. Notably if an existing development site in town has difficulty achieving storm water management goals, it might be possible to develop an "exchange" program where implementing one of the eleven proposals could provide a positive benefit for the town (so long as the project and off-site green infrastructure project are in the same watershed). (Additional information and copies of the report can be obtained from: www.raritan.rutgers.edu.

6.7 FLOODING CONCERNS IN FANWOOD

Of particular concern in developed areas is the potential for flooding and property damage in the floodplains along streams and rivers. Flooding occurs when the carrying capacity of a stream channel are exceeded by the inflow of runoff from upstream and the water rises up over the stream banks to inundate relatively flat land known as the floodplain on either side of the channel. Floodplains occur in areas of relatively level terrain and may be from several feet to hundreds of yards wide (or even miles depending in the surrounding topography). However, because there are very few open streams in or adjacent to the Borough, the areas of flooding potential are Cedar Brook along Fanwood's northwestern border with Scotch Plains, the Robinsons Branch as it flows through the Nature Center, and Green Brook in nearby Plainfield.

Many local street and area flooding problems in the Borough have been alleviated by the construction of new and/or larger storm sewers. Obviously, such construction is expensive and time-consuming besides being very disruptive during the actual construction process. Certain

areas of Fanwood still have some flooding problems. The following is a discussion of some of the problem areas that have been solved and other that will be the subject of future rebuilding programs.

6.7.1 RAILROAD STATION

This area is no longer susceptible to continuous flooding. The construction (cut) for the railroad alignment altered the natural drainage patterns in part of Fanwood. The railroad tracks were constructed below the existing grade and so acted as a drainage channel transferring storm water from the Rahway River drainage basin in the east to the Raritan River drainage basin to the west. The excess storm water resulted in constant flooding of the Railroad Station and street flooding along Fanwood Place (Manfra Way) and North Avenue. To alleviate this flooding problem, two projects were undertaken. The first was construction of a by-pass storm sewer, which would capture the Railroad drainage and eliminate the transfer of storm water from the Rahway River Basin to the Raritan River Basin. The second project included reconstruction of the Railroad Station at a higher elevation. However, when the Station was rebuilt the bypass sewer was never connected to the Railroad Station drainage. Therefore, although flooding of the Railroad Station was alleviated by reconstruction at a higher elevation, storm water is still being transferred from the Rahway River Basin to the Raritan River Basin.

6.7.2 FANWOOD PLACE

Storm sewers previously backed up on North Avenue near Fanwood Place. New drainage facilities were installed in this area, which eliminated the problem on North Avenue. However, during extremely heavy rains, the storm sewer in the public works yard on Fanwood Place / Manfra Way, backs up for a short period. This minor flooding does not impact any of the structures or operations in the public works yard.

6.7.3 RUSSELL & WATSON ROADS

Previously an area of flooding concerns, storm sewers along both roadways were reconstructed, eliminating problems along both streets.

6.7.4 MIDWAY CIRCLE

Minor street flooding occurs. A detention basin was proposed to alleviate this problem but cost has prevented implementation. (The Midway Circle property is owned by the Borough and constitutes a small part of Fanwood's open space.)

6.7.5 BYRON COURT

Street flooding occurs in this vicinity due to an undersized storm water pipe that discharges to a tributary of Cedar Brook. The detention basin proposed to alleviate flooding in the Midway Circle area also would have relieved some of the problem in this area. Again, the cost of implementation has prevented construction of the basin.

6.7.6 TERRILL ROAD NEAR MIDWAY AVENUE

In this area a stream is channelized into two twin circular pipes. The openings to these pipes are covered with a grate system to catch debris and other material. Fanwood shares responsibility for maintenance of this structure with the Township of Scotch Plains. This does not represent a current flooding problem, but the potential for flooding exists if the system becomes blocked with debris or otherwise malfunctions. To ensure that the grate does not become blocked, Public Works personnel from either municipality are dispatched on a rotating basis to keep the grate clear of debris. The safety of the workers is of great concern during storm events when debris removal is required. Several years ago it was proposed by the Commission to purchase a vacant parcel of land next to Cedar Creek along the border with Scotch Plains on Beverly Court to preserve open space and

to provide a natural flood storage area. However, funds were not available and the parcel was subsequently developed for residential housing, although storm water management techniques were incorporated into the project.

6.7.7 WESTFIELD ROAD

Minor street flooding occurs periodically along a few locations along Westfield Road because of pipe restrictions.

6.7.8 GLENWOOD ROAD AREA

Major flooding occurred in this area during the 1973 storm. The flooding was corrected through construction of a bypass storm sewer system. Minor street flooding persisted downstream of the bypass system most likely due to a downstream pipe constriction. The entire system on Glenwood Road was recently reconstructed.

Other areas of minor street flooding or wet basin basements occur in various locations throughout Fanwood. The 1976 Natural Resource Inventory identified three causes of structural flooding which were:

1. The location of the structure in the Floodplain;
2. Poor construction practices such as location of driveways and foundations below street level;
3. High water table.

At that time storm water management was not widely applied and depended much on the particular type of development, the existing land use development requirements, and the astuteness of local officials.

CHAPTER 7

VEGETATION & WILDLIFE

NOTES:

For the current edition of the Environmental Resource Inventory, the services of the Amy S. Greene Consultants firm was contracted to provide an update as well as additional information on the Fanwood Nature Center. The Center was last examined in detail in 1994 as an extension of the 1991 ERI. Representatives of the consultant visited the Fanwood Nature Center several times to evaluate the changes in vegetation and the general nature of the property as follows:

1.0 INTRODUCTION

The Fanwood Nature Center is an approximately eight-acre municipally owned forested plot in the Borough of Fanwood, Union County along the municipal southwesterly border with Plainfield City. The forested tract is located immediately north of Terrill Road (County Road 611) between LaGrande County Road 601 to the northwest and Cray Terrace to the southeast. The forest area is bordered by an early succession vegetated and maintained power line right-of-way (Public Service Electric & Gas--ROW) to the north and single family medium density residences to the south, east and west (see Appendix A, Figure 1). The forest is utilized by the public for passive outdoor recreation and contains a small well-defined trail system.

The Nature Center's surrounding land use is primarily medium-density single unit residences. The forest plot is isolated on all sides by development. There are, however, several additional forested patches in adjacent communities within a one-mile radius of the Nature Center, including an approximate 32-acre wetland forest approximately 600 feet south of the Nature Center in the City of Plainfield.

Topography of the Fanwood Nature Center is gently sloping from 160 feet above mean sea level (AMSL) along parts of the eastern end of the site to approximately 138 feet AMSL in the central and southern portions of the site. The Fanwood Nature Center is bisected by a small stream considered by some to be the beginning of the Robinsons Branch, which eventually becomes a major tributary to the Rahway River (see Figure 2).

There are four soil types found in the Fanwood Nature Center. The dominant soils are hydric loams typically found on level grounds and would be expected to be associated with the lowland red-maple sweet gum forests found onsite. Figure 1 in Appendix A of this special report illustrates the boundaries of these soils. The soils are as follows:

□ ***Boonton Moderately Well Drained gravelly loam 8-15% slopes (BohC)***. This is a non-hydric soil found in the sloping and elevated portions of Area 1 on the map.

□ ***Haledon Loam 0-3% slopes (HakA).*** This hydric soil is found throughout much lowland forest dominating the eastern half of the Nature Center.

□ ***Hasbrouck silt loam, 0-3% slopes rarely flooded (HctAr)***. This hydric soil is found throughout the northern and western portions of the Fanwood Nature Center. Associated communities include the lowland forests of Area 3 as well as the riparian areas and wetland areas associated with Areas 4, 5, and 6.

□ ***Raritan –Urban Land Passaic Complex 0-3 % slopes rarely flooded (RasAr)***. This soil is a mix of hydric soils Raritan and Passaic and urban land. Urban land soils are soils that have been disturbed through human development and lack distinguishing characteristics. This soil is found in a small area in the southern portion of Area 2.

The Fanwood Nature Center is comprised of primarily lowland deciduous forest comprised of mixed hardwoods of multiple stages of growth and slightly varying levels of dominance. Canopy coverage over much of the site is greater than 50% with recent open breaks in the canopy caused by downed trees from "Superstorm" Sandy. The parcel also contains remnants of oak dominated upland forest, particularly along its sloping eastern end (Area 1) and secondary successional forest, particularly along its edges. Aerial photos from 1930 confirm that much of the Nature Center Forest (approximately 80%) was cleared of trees, which is consistent with the types and age of forest trees onsite. One large oak observed in the field that fell as a result of "Superstorm" Sandy appeared to be approximately 85 years of age. The Nature Center contains

many types of exotic/or and invasive plant species, some of which may have been planted or naturalized from plantings on adjacent properties. Invasive plant and wildlife species present onsite (such as earthworms - Lumbricus terrestris) may also have an impact on the onsite diversity and relative abundance of native flora and fauna. A list of the most highly invasive species is included in Section 3 of this Report. All plants identified as exotic contain an "E" after their binomial name in the text.

Amy S. Greene Environmental Consultants, Inc. (ASGECI) visited the Fanwood Nature Center on June 23, 2013 and briefly again on September 19, 2013 to evaluate vegetation and wildlife, and to review the site relative to existing general forest community mapping created in 1994. For this report, ASGECI reviewed the existing material and described the vegetated communities observed in the field. There is major species overlap among the community areas described in Section 2. The areas identified in this report do not always have discrete boundaries that are easily observable in the field and therefore determining precise boundaries can be somewhat subjective. For example, lowland maple-sweet gum forest areas have some shrub successional or upland secondary successional forest components or species (such as black locust - Robinia pseudoacaia) interspersed in it. These boundaries may be further complicated by monocultures of invasive species such as Japanese stiltgrass (Microstegium vimineum) that span across most of the plant communities. Boundaries are generally determined by subtle varying levels of tree dominance (such as red maple or sweet gum) and specific characteristics that define the area, such as riparian habitat or open wetlands. Wetland delineation was not performed for this report, although hydric soils are one of the main indicators of wetlands.

The original parcel division of communities on the parcel map created by Najarian Associates (1994) and the dominant species identified are generally accurate. However, some community boundaries were changed on the mapping associated with this current report based on ASGECI field observations and for convenience of description. Particular changes include the removal of a community boundary between Community V and Community I, which are very similar in forest structure and dominance, and the creation of a riparian area (Area 4) and an additional

secondary successional forest area (Area 7). Both of these Areas are characterized in part by a more open (patches less than 50%) canopy and the presence of dense secondary successional shrub or young tree species. To facilitate understanding of the forest communities' onsite, particularly in relation to the map provided, the vegetation characteristics and key features of each identified area are described in detail in Section 2.

2.0 DOMINANT VEGETATION COMMUNITIES

Included in this section are descriptions of the vegetated areas onsite (Areas 1-6 on Figure 2). The dominant generalized community type within that area broadly categorizes these areas. These generalized types include a primarily upland secondary successional forest with an oak component; a lowland forest dominated by mature and sub-mature red maple and sweet gum; open successional shrub areas; and herbaceous or shrub wetlands. Riparian areas which correlate with the stream corridor (in Areas 4 and 5) are also identified on the corresponding Figure 2.

Although Areas 1-6 are categorized by the dominance of a particular community, components of more than one of these communities may occur within in one defined area.

2.1 OAK and UPLAND SECONDRY SUCCESSIONAL FOREST

Much of the edges of the Fanwood Nature Center Forest are dominated by a mix of opportunistic native and exotic successional shrub, vine and tree species. In addition, many of the dominant forest tree species onsite including red maple (Acer rubrum), black cherry (Prunus serotina), sweet gum (Liquidamabar styraciflua), and black locust are typical indicators of past clearing. The few upland oaks that are present provide an indicator of the oak dominant forest type that may have been more common onsite and adjacent to the site prior to initial site disturbance.

AREA 1

Area 1 is a small sloping section of upland deciduous forest in the northeast quadrant of the Fanwood Nature Center. This area is characterized by remnants of mature oak forest mixed with secondary successional species (see Photos A and B). Area 1 contains a canopy of several mature red oak (Quercus rubra) or black oaks (Quercus velutina) as large as approximately 36 inches diameter at breast height (DBH) on its southern sloping end in its central portions. There are also some large pin oak (Quercus palustris), sweet gum, red maple and an isolated tulip poplar (Liriodendron tulipifera) in this section. Area 1 and other areas contain multiple forest canopy openings and increased light penetration from recently downed trees resulting from "Superstorn" Sandy (see Photo C).

Area 1 contains components of a more disturbed secondary successional forest with a dense understory, particularly along its eastern and northern edges (Photo C). Forest edges often have a greater disturbance-oriented community due to the increased exposure to wind, sunlight, encroaching exotic species, deer foraging, trash piles, and other elements.

The disturbed secondary successional forest is dominated by black locust to approximately 12 inches DBH, with lesser amounts of black cherry generally ranging from 4-12 inches DBH. Examples of invasive Norway maple (Acer platanoides) were also identified along the eastern edge of this community. Portions of the northern boundary of the Nature Center (Area 1 and Area 5) contain mature black walnut (Juglans nigra).

The understory of Area 1 successional forest edge contains a dense patch of invasive Japanese knotweed (Polygonum cuspidatum) along its northern edge (Photo D). Other areas are dominated by sub-mature or stump sprouting black locust to approximately four feet in height. Dominant vines include common greenbrier (Smilax rotundifolia), poison ivy (Toxicodendron radicans), Virginia creeper (Parthenocissus cinquefolia), and blackberry (Rubus alleghensis). These vines, particularly the greenbrier, form some dense thickets, particularly near the Nature Center forest entrance. Other understory components of the upland forest include several isolated

small (under 8 inches DBH) American beech (Fagus grandiflora) and sassafras (Sassafras albidum) trees.

Some portions of the forest floor in Area 1 are dominated by herbaceous species. Very dense monocultures of Japanese stilt grass (Microstegium vimineum) occur on the forest floor in portions of Area 1 and other locations (described below –see Photo C). Other herbaceous plants observed in lesser cover amounts include goldenrod (Solidago spp.), white snakeroot (Ageratina altissima), pokeweed (Phytolacca americana), deer tongue grass (Dichanthelium clandestinum), garlic mustard (Alliaria petiolata), periwinkle (Vinca sp. - E) yellow woodsorrel (Oxalis stricta), and Asiatic dayflower (Commelina communis - E). Similar successional vines, shrubs, and herbaceous species are found throughout the Nature Center, particularly where there are canopy breaks, trails, and forest edges.

2.2 LOWLAND RED MAPLE –SWEET GUM FOREST

The mixed hardwood lowland forest at the Fanwood Nature Center is a predominantly red maple-sweet gum dominant forest. These species along with pin oak and several other minor species occur throughout most of the Nature Center "forests" with varying levels of dominance. These species are typical components of the previously disturbed Piedmont lowland, wetland, and floodplain forests of Northern New Jersey. It is possible that portions of these forested areas may contain the correct hydric soils and hydrology to qualify as wetlands; however, a wetlands delineation was not conducted during this evaluation.

AREA 2

Area 2 is a large area of forest dominated by sweet gum, red maple, and pin oak (see Photos E and F). Most of the northern and central portions of Area B are dominated by mature sweet gum (12-18 inches DBH) and lesser amounts of red maple and some large (20- 24 inches DBH) pin oak. Understory shrubs are sparse in the northern portion of Area 2 and contains large breaks from fallen trees with monocultures of Japanese stiltgrass common on the forest floor (see Photo

G). Dense monocultures of Japanese stiltgrass have developed in the northern portion of this area. There are also patches of Japanese knotweed identified within this community primarily near the southern boundary (near the Terrill Road Chapel). This patch was originally identified in the 1994 plan of the Nature Center. A sparse understory of woody shrubs and smaller 4-10 inches DBH trees that occur in Area 2 include black gum, northern arrowwood (Viburnum dentatum), and black cherry. Additional understory trees in this area include American beech (Fagus grandifolia), white oak (Quercus alba), American elm (Ulmus americana), and sweet pepperbush (Clethra alnifolia). These additional tree species occur as isolated observations and do not comprise a substantial component of the forest community. Major trail edges through this area (particularly on the western boundary of Area 2) contain some of the herbaceous and vine components described in Area 1. The eastern edge of area 2 contains a patch of encroaching bamboo (Bambusa sp.-E) and Japanese spurge (Pachysandra terminalis –E).

The southern-central portion of Area 2 contains a mix of some larger red maple (10-30 inches and mostly 10-18 inches DBH), pin oak, sweet gum, and black locust. One lower portion of Area 2, identified as Area 2-A, contains a slight depression that appears to seasonally hold water. Some trees in this area are buttressed and the floor is one of the few larger areas devoid of Japanese stilt grass. The shrub understory in this area remains sparse with isolated or sparse occurrences of shrubs or small (8 inches or less DBH) trees including spicebush (Lindera benzoin), highbush blueberry (Vaccinium corymbosum), American holly (Ilex opaca), and flowering dogwood (Cornus florida).

AREA 3

Area 3 is the community that comprises the majority of the Nature Center to the west of the stream. It is a red maple-sweet gum dominant forested area similar to Area 2 with fewer canopy breaks and slightly greater ratio of red maple to sweet gum (see Photo I). The area also contains a component of mature 18+ inches DBH pin oak. The red maples in Area 3 generally range from 8-24 inches DBH with most trees ranging from 12-18 inches. Much of the forest floor in this area lacks a shrub component and, as with many other portions of the Nature Center forest floor,

contains monocultures of Japanese stiltgrass. Very minor amounts of native herbaceous species including soft rush (Juncus effusus), fox sedge (Carex vulpenoidea), yellow fruited sedge (Carex annectens), and several other Carex species were observed near the near the trail on the northern end of Area 3 (see Photo H). Some invasive Asiatic lady's thumb (Persicaria longiseta -E) is also found in this herbaceous layer.

2.3 SHRUB SUCCESIONAL HABITATS

Within the Fanwood Nature Center, this generalized community type incorporates a variety of successional conditions with many species both native and non-native. These conditions include forest edges dominated by dense vines, forest canopy breaks that include a mix of young opportunistic trees such as black locust, and shrubby trail edges, and open shrubby portions of the riparian corridor. In all situations, these areas are generally dense with a thick woody understory and have less than 50% canopy closure.

AREA 4

Area 4 contains the riparian corridor of the Robinsons Branch tributary that intersects the Nature Center. The stream itself is a generally shallow (one inch to about one foot in depth) and three to six feet wide stream at the channel bottom with a silt, stone, and cobble bottom. Wetland herbaceous species including clearweed (Pilea pumila) and spotted jewelweed (Impatiens capensis) were observed directly within the stream corridor. Other herbaceous wetland species such as various native or nonnative smartweeds (Polygonaceae) would be expected along the banks of the stream with varying cover dominance at varying times of the year.

The canopy of Area 4 contains substantial breaks from fallen trees. Dominant tree species include black locust, sweet gum, and red maple. Large silver maple trees (40+ inches DBH) were identified immediately adjacent to the stream bank in the northern portion of this area. (One of these silver maples has since fallen and portions removed for safety reasons.) The understory along the top mix of bank is dominated by a dense growth of primarily wetland or

upland shrubs and vines dominated by multiflora rose (Rosa multiflora - see Photo J). Other shrubs or vines identified near the stream top of bank in include highbush blueberry, Southern arrowwood, Tartarian or Japanese honeysuckles (Lonicera spp. – E), and oriental bittersweet (Celastrus orbicularis -E - see Photo J). Other exotic species, including Japanese barberry (Berberis thunbergii -E) and Forsythia sp. - E, were identified in this area, but do not appear to be dominant species. A small patch of lily-of-the-valley (Convallaria majalis) was identified on the southern end of Area 4, but likewise does not appear to be a dominant floor component. Eastern portions of Area 4 (near the boundary with Area 2) are dominated by dense amounts of sprouting black locust. Wisteria (Wisteria sp.) is dominant in this location as an understory species and is invading the canopy. A monoculture of hay-scented fern (Dennstaedtia punctilobula) was identified along the main trail in this location and into the western end of Area 2 as well.

AREA 5

Area 5 is a generally open shrub-dominant disturbed successional community (see Photo L). Edges of the Area and its riparian corridor contain some trees. While Area 5 contains some of the successional species common to other locations, there are some distinct differences in plant composition. While the western portion of Area 5 is strictly disturbed successional upland, the eastern half of this area is an ecotonal gradient between wetlands (predominantly in Area 6) and successional uplands. As a result it contains a mix of both wetland and upland shrub and herbaceous species.

A variety of opportunistic vines and shrubs were identified in Area 5 including hedge bindweed (Calystegia sepium), grape (Vitis sp.) wineberry (Rubus phoenicolasius - E), multiflora rose, arrow leaved tearthumb (Polygonum sagittatum) and some trumpet vine (Campsis radicans) growing on trees along the ROW boundary. There are minor amounts of native shrubs including spicebush (Lindera benzoin), arrowwood, common elderberry (Sambucus canadensis), and indigo bush (Amorpha fruticosa). Herbaceous species identified in this area include patches of dense honewort (Trinia glauca), spotted jewelweed, lemon balm (Melissa officinalis- E), and

dock (Rumex sp.). The southernmost portion of this area contains open canopy breaks and dense amounts of young black locust.

2.4 SHRUB SCRUB and HERBACEOUS WETLANDS

A small portion of groundwater-fed herbaceous wetlands was identified onsite in the same relative location as reported in the Najarian study. These wetlands also contained some shrubs. These wetlands were not delineated, but clearly visible through the presence of hydrophytic vegetation, the presence of rivulets or puddles of groundwater, and the presence of mud or muck soils. Vegetation in these areas includes multiple wetland sedges and grasses as well as non-woody broad leaved plants and some facultative wetland shrubs. Herbaceous wetland components were also identified in very small amounts in Areas 3 and Area 4 within the stream corridor.

AREA 6

The northeast portion of the Nature Center contains a small (0.5 acre or less) partially groundwater-fed herbaceous wetland with a shrub component and some canopy trees typical of other locations (see Photos M and N). Shrubs include arrowwood and multiflora rose. Herbaceous species that intersect this area include sensitive fern (Onoclea sensibilis), reed canary grass (Phalaris arudenacea), spotted jewelweed, fowl manna grass (Glyceria striata), grasses, soft rush (Juncus effusus), jack–in-the-pulpit (Arisaema triphyllum), and Polygonaceae family of smartweeds including Oriental lady's thumb. This wetland area also contains encroaching Japanese stiltgrass.

3.0 INVASIVE SPECIES

Twelve species considered highly invasive in New Jersey (NJDEP 2009) were identified during the Fanwood Nature Center forest survey conducted by ASGECI. It appears that Japanese stiltgrass is the most widespread in terms of cover. Black locust, Japanese knotweed, and multiflora rose are also very dominant. Although black locust is native to the United States, it is not native to New Jersey. It is considered invasive due to its aggressiveness in successional areas as it outcompetes native successional species, potentially drops species diversity, and depletes soil nutrients due to its nitrogen fixing properties. It is also likely that the onsite wisteria species is Wisteria foribunda - E, an additional highly invasive species.

There are multiple exotic species at the Nature Center (marked with an "E" after their binomial name) considered to be potentially invasive in certain communities. Bamboo (Bambusa sp.-E) encroaching from an offsite residence in the lower portion of this area near point A-6, periwinkle, pachysandra, and Oriental lady's thumb are examples of these species.

3.0.1 INVASIVE SPECIES CONTROL

Controlling invasive species under most circumstances is highly difficult and eliminating them once established is often nearly impossible. Early detection and response is the most effective measure. The conditions at Fanwood Nature Center make invasive species control extremely complicated in spite of the forest's relatively small size. Many compounding environmental issues such as patch size and adjacent offsite introductions; impacts and selection by deer; soil disturbance; and climate change collectively present a challenge to successfully maintaining a functioning native forest over the long term. All potential issues must be considered and a well planned approach must be established before any control activities are implemented. Otherwise any invasive species control efforts may be costly and ineffective.

Certainly some species that occur in very low densities onsite, such as Japanese barberry or wineberry, may be easily manually removed and perhaps eliminated. Hand removal for well-

established and widespread species, such as Japanese stiltgrass, would require a large amount of time and resources for their initial removal. A large and dedicated volunteer or scout group may be essential. Systematic seasonal follow-up would be certainly required to prevent reestablishment of seed banks. In addition, some viable whole plants or fragments of plants (such as root systems that may regenerate) would likely remain after treatment, based on the volume of certain invasive species.

Various herbicides are often considered required in similar conditions, often in conjunction with manual removal. Tricolpyr and glyphosate are the most common general herbicides used. Herbicides are typically sprayed with a special low drift sprayer (on species such as stiltgrass) or may be injected directly (for example, with Japanese knotweed). For woody species, the trunk is typically slashed or cut and the herbicide is applied to the stump or wound. There are obviously many concerns with using herbicide. Herbicides can be potentially dangerous to humans and non target wildlife and plant species. Herbicides need to be applied very carefully by a licensed professional who uses the correct formulation under the appropriate conditions. Repeated seasonal applications would be expected to be required, which may result in a time consuming and costly process.

3.0.2 THE "GOAT" PROJECT

In 2013 and 2014 the Environmental Commission spent significant time discussing and researching options for limiting and/or eradicating invasive species. As noted above, it is a difficult and complicated process. The herbicide option was debated at length and licensed individuals and firms were contacted for further information. However, for the reasons cited above—not to mention the presence of the Robinson's Branch tributary—as well as expense this option was given a low priority. Another firm that would have actually hand-pulled invasive species (in addition to removing poison ivy encroaching on the trails and several bridges) was interviewed, but with an open-ended fee structure and no practical time estimate, this would have been an extremely expensive method.

However, several members of the Commission came up with another alternative—goats. Several news articles described the use of goats at Sandy Hook, New Jersey and elsewhere to remove extensive stands of poison ivy and other noxious plants including invasives. (Apparently goats are not affected by the poison ivy oil in the least and consider it a delicacy of sorts.) The goat herder, from Rhinebeck, New York, was contacted who provided several proposals and the Borough Council ultimately provided funding.

In the summer of 2015 the goats were brought to the Nature Center. The project was divided into two phases. In the first phase the goat herder sectioned off the northerly half of the Nature Center with a short, "mild" solar-powered electric fence to contain the goats and a second, four-foot high mesh fence to protect the public from touching the electric fence. The goats roamed this section of the Nature Center from the end of July to the end of September and did an impressive job in reducing the number and extent of invasive plants. (Their least favorite plant apparently though was Japanese barberry as several of those were only lightly browsed.) Please refer to the select "before" and "after" photos in this chapter.

The goats were brought back in the spring of 2016 to do a follow-up of the northern part of the Nature Center as the invasive plants attempt to recover from their shock of being grazed to the ground. The goats were then moved to the southern half of the Nature Center during mid-summer to the fall. They were brought back again in the spring of 2017 to do a follow-up of the southern part of the Nature Center. Once the goats have been moved, the next part of the project will be to plant a variety of native plants in the grazed areas. It is proposed that the plants selected would be—if not deer-resistant—the least palatable to the deer. Some thought has been given to fencing at least part in the Nature Center to keep the local deer away from the new plantings, but there is the high initial cost of installing a suitable fence as well as maintenance.

Obviously since the Nature Center has been overrun by non-native, invasive plants once, it can happen again. With continued vigilance it should not be necessary to have to bring the goats back again. For example, small patches of Japanese stiltgrass are easily removed by hand

(before it goes to seed though) and susceptible to "smothering" by covering the plants with at least eight inches of mulch. (a test area was conduced with college student volunteers in 2016). Other undesirable plants can be hand-sprayed with a "natural" solution (e.g., a mixture of vinegar and salt). This is a long-range, but exciting project for the Commission and Fanwood.

The Fanwood Nature Center

after the goat project

BEFORE AFTER

Table 1: Highly Invasive Species identified at Fanwood Nature Center

COMMON NAME	SCIENTIFIC NAME	AREAS*
Japanese Knotweed	Polygonum cuspidatum	1, 2
Japanese Stiltgrass	Microstegium vimineum	All
Garlic Mustard	Alliaria petiolata	1, 2
Multiflora Rose	Rosa multiflora	4, 5, 6
Oriental Bittersweet	Celastrus orbicularis	1, 4, 5
Wineberry	Rubus phoenicolasius	5
Norway Maple	Acer platanoides	1, 2
Black Locust	Robina pseudoacaia	All
Honeysuckles Shrub & Vine	Lonicera spp.	4, 5
Japanese Barberry	Berberis thunbergii	4
English Ivy	Hedera helix	1

*Species identified as I1(highly invasive) by NJ Invasive Species Council. Strategic Management Plan (2009). * Species were identified in the specific Nature Center Areas (1-6) by ASGECI. Species may occur in other areas in lesser amounts – particularly in dense successional edges.*

4.0 WILDLIFE

In spite of the impacts of invasive species resulting from fragmentation and/or disturbance, small forest patches in a regional context have wildlife value, particularly for more mobile or migratory species. The Nature Center's proximity (less than 2 miles) to forested tracts of the Watchung Mountains increases its likelihood of being used as a "habitat island" for migratory bird species moving along the Atlantic Flyway in the spring and fall. The value of these patches may increase if there are established connections, such as linear riparian corridors, linking multiple habitat patches. These connections allow for the migration and recruitment of wildlife.

The Nature Center stream corridor is listed by NJDEP Landscape mapping as "Rank 2" (Presence of a Rare or Special Concern Species) as documented forging habitat for great blue heron. Great blue heron will utilize a wide variety of wetlands and open waters, including disturbed areas, for foraging. ASGECI did observe forage species for wading herons in the creek including small fish (likely Cyprinid species) and a bullfrog. During the visit, a heron species (likely green heron) briefly observed in the stream corridor's open water (Area 3). This bird was likely foraging. The general conditions for blue heron foraging habitat are met by this stream corridor.

Other resident bird species that would be expected at the Nature Center consist of common suburban, disturbance-tolerant habitat generalist species. Field observations made by ASGECI (see list below) support this determination. Species such as common woodpeckers would be expected to nest in cavities of dead or dying trees onsite. Disturbance tolerant songbirds that prefer shrubby edge habitats, such as robins or catbirds, would be expected to nest onsite. Based on the relatively small size of the Nature Center Forest and the amount of breaks and disturbance, it is unlikely that the site would support substantial nesting populations of forest-interior bird species. Several owl species have been observed from time to time as well.

Some common forest-nesting species, such as wood thrush and red-eyed vireo occasionally utilize highly fragmented forested tracts for nesting. Nest success of these species; however, drops rapidly on smaller forest tracts (such as sites under 20 acres). The increased presence of paths and edges for brood-parasite cowbirds is thought to be a primary cause for this small-patch nest failure. It would be expected that some rarer or less expected migrants, such as various thrushes, vireos or warbler species, might periodically use the site for resting and foraging during migration, particularly during April and May.

While some herptiles (reptiles and amphibians) such as green frogs and bullfrogs would be expected in the Nature Center, less mobile and widespread species such as box turtles or various snakes would be less likely to occur onsite based on site isolation. Red-backed salamanders, a typical component of healthy Northeastern deciduous forests, sometimes occur in disturbed and fragmented forest environments. ASGECI did not observe this species onsite. Recently fallen trees onsite will provide a variety of microhabitat structure for invertebrates and potentially herptiles. However, the site's high density of invasive earthworms, indicated by numerous burrows, casts and direct observation, may be depleting the soil of micronutrients and impacting the invertebrate diversity and salamander presence.

A forest depression in Area 2 lacks herbaceous ground cover appears to seasonally collect and hold water. As a result, it appears this location contains some characteristics indicative of a vernal pool habitat. Vernal pools are wetlands that seasonally retain fishless standing water and provide breeding habitat for a variety of wildlife, particularly certain frogs and salamanders. Due to the lack of supporting forest surrounding this area, common generalist frog species such as green frogs (Lithobates clamitans) and spring peeper (Psuedacris crucifer) would be the species most likely species to utilize this type of habitat at the Fanwood Nature Center. Relatively less common (obligate) vernal pool breeding amphibians that typically utilize larger forested tracts would not be expected at the Nature Center. These species include wood frog (Lithobates sylvaticus) and spotted salamander (Ambystoma maculatum)

White-tailed deer (Odocoileus virginianus) adults and young were also observed in the Nature Center forest. As with other similar locations in Northern New Jersey, deer may be impacting forest Nature Center's community structure by avoiding for invasive species and slecting native vegetation first and potentially suppressing native tree seedling growth. The predominance of certain invasive species (such as Japanese stiltgrass) may in part be the result of deer selection. To determine deer impact on seedling growth and plant composition, some fenced study plots could be established onsite and may be maintained and perhaps studied as part of school study project.

Table 2: Fanwood Nature Center Wildlife Species (terrestrial vertebrate) Observed by ASGECI

Common name	Scientific Name
American robin	*Turdus migratorius*
Starling	*Sturnus vulgaris*
Red-eyed vireo	*Vireo olivaceus*
Red bellied woodpecker	*Melanerpes carolinus*
Northern flicker	*Colaptes auratus auratus*
Cooper's hawk	*Accipiter cooperii*
Green heron	*Butorides virescens*
Cedar waxwing	*Bombycilla cedrorum*
Downy woodpecker	*Picoides pubescens*
Common grackle	*Quiscalus quiscula*
Northern cardinal	*Cardinalis cardinalis*
Carolina Wren	*Thryothorus ludovicianus*
Ruby-throated hummingbird	*Archilochus colubris*
bullfrog	*Lithobates catesbeianus*
White-tailed deer	*Odocoileus virginianus*
Gray squirrel	*Sciurus carolinensis*

One of the distinctions that can separate the character of different towns is the presence or absence of vegetation. Given a choice, most people would feel more relaxed, more at ease, and

harmony in a town with tree-lined streets than one with endless asphalt and concrete. A community with gardens, parks, and green space is eminently more desirable than one without.

Although esthetics is perhaps the first and most obvious impact of landscaping, vegetative cover provides numerous other benefits. Green spaces help reduce air and noise pollution, reduce glare, moderate temperatures, and help prevent soil erosion and topsoil loss, limit dust, and very importantly, help reduce storm water runoff. Trees and shrubs are also used as "living fences," create a sense of space, and buffer different land uses from one another (e.g., an industrial zone from a residential neighborhood).

Of course, Fanwood, like most of New Jersey, was once covered by forests and wetlands. Portions of the 825-acre Borough were originally cleared for small homesteads and then for the Central New Jersey rail line. More development followed the tracks and a number of new homes and supporting facilities were built in the vicinity of the new train station. Wetlands were filled in and numerous building lots were completely cleared of vegetation. However, many trees from the original forest in the northwest area of the town were untouched. The researchers for the 1976 NRI used an increment borer and determined that many of those trees were over 200 years old. Significantly, six different species of those trees were discovered to be the "largest examples of their kind in the state." For a municipality the size of Fanwood, that was an amazing statistic. Sadly, because of age and disease and additional development, several of these trees have since succumbed, although at the time of the 1991 NRI it was believed that at least two, and possibly three of the record trees were still living.

The record trees as noted in the 1991 NRI are listed in Table 9:

TABLE 9: Record Trees in Fanwood (from 1991 ERI)

Beetree (White) Linden (*Tilia Heterophulla*)*	Fifty-Three Inches In Diameter, Nearly 14 Feet In Circumference
Weeping Linden (*Tilia petiolaris*)*	Almost 33 inches in diameter
Pear, Domestic (*Pyrus communis*)*	Nearly 30 inches in diameter
Northern Catalpa (*Catalpa speciosa*)	Located at 185 Westfield Road – nearly 41 inches in diameter
European Oak (*Quercus cerris*)	Located at 40 Forest Road – estimated to be 180 years old
Black Willow (*Salix nigra*)	Located at 79 North Avenue – 63.5 inches in diameter, nearly 17 ft. in circumference

* All three of these were on the "Slocum Property" which was purchased in the early 1970s for the new Borough Town Hall.

The famous "Fanwood Oak", which sadly has since succumbed to time and disease, was estimated to be over 400 years old. Its diameter was nearly 62 inches with a circumference of over 16 feet.

7.1 IMPORTANCE OF VEGETATION

7.1.1 STORM WATER MITIGATION

As mentioned in Chapter 6: Hydrology and Water Quality, forested areas have the lowest rates of runoff. Leaves and branches, grooved bark, root systems, and the natural mulch created by fallen leaves and twigs all work together to slow down the force of falling raindrops, which in turn slows the rate of flow at the ground surface and increases the rate of water absorption into the underlying soils and aquifers. Nearly half of all precipitation that falls during the growing season is put back into the atmosphere through the process of transpiration – the evaporation of water exuded from leaves. In some

studies, if the supply of water to the plant is not restricted, the rate of evaporation has been found to be the same as that from a free water surface such as a pond or lake. This evaporation is a function of the surface area of the leaves.

All leafy plants transpire at about the same rate during the growing season. Research also seems to indicate that the rate of transpiration stays relatively constant and does not appreciably drop by a decrease in the soil moisture until the "wilting point" (the moisture content at which plants can no longer extract sufficient water for growth) is reached. This indicates that the depth of a root system is an important component of the overall hydrological cycle. Thus those plants with large deep root systems are overall more effective in the promotion of transpiration and helping to decrease runoff potential. (Lawn areas, because of the compactness of the plants and dense, shallow root systems can have surprisingly high runoff rates on heavy clay soils.)

7.1.2 BETTER AIR QUALITY

Another important aspect of plants – again particularly trees – is in helping to purify the atmosphere through "oxygenation" and "air washing." It is well known that through the process of photosynthesis, leafy plants use the energy from sunlight to produce new cells and growth from water and nutrients absorbed through the root system. In this process the trees "inhale" carbon dioxide and "exhale" oxygen. (During forest fires the process is somewhat reversed as the fire takes atmospheric oxygen and produces carbon dioxide and various noxious gases.) With "air washing", the leaves on the trees either trap or slow down the movement of air-born dust. In some studies it has been noted that 10,000 to 12,000 particles of dust in a liter of air can be found in areas with few trees, and about 3,000 dust particles/liter of air in testing sites with numerous trees.

7.1.3 NOISE REDUCTION

A few studies have been done to determine the effectiveness of noise reduction by planting tree filled buffer zones. Foliage does absorb some sounds while 20 to 50 foot wide plantings reduce the decibel level. A two-foot thick cypress hedge can reduce the noise level by four decibels.

7.1.4 WET SOIL CONDITION INDICATOR

Vegetation may also be used to indicate wet soil conditions. It is interesting to note the Boonton soil, the better drained soil in Fanwood, has stands of trees associated with wet uplands, e.g. white oak, black birch, mochernut, flowering dogwood, tulip poplar. Floodplain vegetation and plants that can tolerate poorly drained soil include Swamp White Oak, American Elm, Black Willow, Sycamore, Eastern Cottonwood, and Shagbark Hickory. This vegetation is typical in those areas of Fanwood underlain by the Haledon and Wilbraham soils. The Fanwood Nature Center and Hunter Avenue between Midway Avenue and Paterson Road are the best remaining examples of this type of vegetation. Those plants just mentioned and others known to need or tolerate large amounts of water on a year round basis are called hydrophytes. The abundance of water results in a scarcity of oxygen since the soil pores are continually filled with water; hence hydrophytes have developed alternate ways for air storage. Under such seasonal high water table conditions, not only is air not available to plants through their roots, but soil bacteria are limited, decomposition of humus is retarded, and the soil becomes highly acidic.

In addition to their ecological worth, trees and shrubs are important economic factors to the individual homeowner. A recent survey reports that trees enhance the value of property as much as 20%, with the average increase between 5% and 10%. (Local realtors confirmed this.)

7.2 VEGETATION INVENTORY FROM 1991 ERI

The vegetation of Fanwood was inventoried during the summer of 1991 (August and September), by a qualified field botanist/wetland ecologist from the offices of Najarian Associates, L.P. The inventory was conducted by reviewing National Wetlands Inventory maps, U.S. Geological Survey (USGS) maps, County Soil survey maps, the NRI prepared in 1976 and through field investigations.

7.2.1 UPLAND FOREST

Typical upland forests in the Borough consist of the following species of trees as in Table 10 below. Until recently three lots remained in Fanwood with this typical vegetation. All three were between Midway and Forest Road.

TABLE 10: Typical Upland Forest Tree Species in Fanwood

Quercus Alba - White Oak	*Betula Lenta* - Black Birch
Carya Tomentosa - Mockernut Hickory	*Cornus Florida* - Flowering Dogwood
Liriodendron Tulipifera - Tulip Poplar	*Robinia Pseudo-acacia* - Black Locust

7.2.2 FLOODPLAIN VEGETATION

Floodplain vegetation in Fanwood occurs on areas underlain with poorly drained soils. The dominant species are listed in Table 11 below:

TABLE 11: Dominant Floodplain Tree Species in Fanwood

Quercus Palustris - Pin Oak	*Quercus Bicolor* - Swamp White Oak
Acer ruburm - Red Maple	*Liquidambar styraciflua* - Sweet Gum
Ulmus americana - American Elm	*Salix nigra* - Black Willow
Platanus occidentalis - Sycamore	

There is also a dense forested area on a lot on North Avenue west of the Recycling Center.

7.2.3 OTHER TYPES OF VEGETATION

Two parcels of land owned by the Borough must be mentioned for the variety of vegetation that may be seen in them: the Fanwood Nature Center (8 acres), fronting Terrill Road and accessed from Cray Terrace exhibits mesic, upland vegetation, adjacent to the PSE&G right of way and lowland vegetation in the floodplain along the Robinson's Branch. More than 50 species of trees, shrubs, and vines have been identified along with well over 100 species of wild flowers.

7.3 VEGETATION ON FANWOOD MUNICIPAL BUILDING GROUNDS

The municipal building is located on property formerly know as the Slocum property. Mrs. Clarence Slocum was a past resident of the N.J. Federation of Garden Clubs and during 44 years of ownership by the Slocums, a variety of tree species were planted at the site. Three trees on the site were listed as the largest of their species in Fanwood. With the construction of the municipal building some of the trees were cleared from the property, but most species are still represented. Table 12 provides a list of vegetation species that were found on the municipal building property.

Table 12: Tree Species found on Municipal Building grounds

LATIN NAME	COMMON NAME
Abies balsame	Balsam fir
Acer atropurureum	Japanese red maple
Acer nigrum	Black maple
Acer platanoides	Norway maple
Acer rubrum	Red maple
Acer saccgrubum	Silver maple
Acer saccharum	Sugar maple
Aesculus hippocastium	Horse chestnut
Carya cordirormis	Bitternut hickory
Carya tomentosa	Mockernut hickory
Catalpa bignonioides	Catalpa
Cornus florida	Flowering dogwood
Cryptomeria japonica	Temple cedar
Fraxinus Americana	White ash
Gleditsia tricanthos	Honey locust
Ilex sp.	Holly
Liquidambar styraciflua	Sweetgum
Liriodendron tulipifera	Tulip poplar
Magnolia acuminate	Cucumbertree
Malus sp.	Apple
Morus rubra	Red mulberry
Picea abies	Norway spruce
Picea pungens	Blue spruce
Pinus resinosa	Red pine

LATIN NAME	COMMON NAME
Pinus strobes	White pine
Platanus occidentalis	Sycamore
Prunus avium	Sweet cherry
Orunus serotinum	Black cherry
Pyrys cinnybus	Pear
Quercus alba	White oak
Quercus palustris	Pin oak
Quercus rubra	Red oak
Quercus velutina	Black oak
Sassafrass albidum	Sassafrass
Taxdium distchum	Bald cypress
Taxus drevifolia	Western yew
Thujua occidentalis	Aborvitae
Tilia heterophylla	White linden
Tilia petiolaris	Weeping linden
Tsuga Canadensis	Eastern hemlock

Individuals of most tree species that existed on the site before the construction can still be found, but several species are no longer represented on the site. Two of these species, Black Walnut and Swamp White Oak are native to New Jersey and found elsewhere in the Borough. The others are non-native landscaping trees, which may not be found elsewhere in the Borough.

These are listed in Table 13:

TABLE 13: Vegetation found on Fanwood Municipal Building Grounds

LATIN NAME	COMMON NAME
Halesia carolinia	Silverbell
Juglans nigra	Black Walnut
Magnolia macrophylla	Big Leaf Magnolia
Oxydendron arboretum	Sourwood
Ouercus Bicolor	Swamp White Oak
Sophora japonica	Chinese Scholar Tree

Two species not previously listed as on-site vegetation are Catalpa – *Catalpa bignoniodes* and the Cucumber tree – *Magnolia acuminate*. The Catalpa are small saplings along the edge of the property and the Magnolia appears to have been planted.

The White linden (*Tilia heterophylla*) was on the property in 1991 although it was declining in health. Other trees on the property appear to be in good health.

7.4 VEGETATION IN OTHER PARTS OF FANWOOD

Appendix A provides a list of known vegetation species found in Fanwood as reported in the 1991 ERI.

Like many areas in central and northeastern New Jersey, the variety and numbers of wildlife species within Fanwood has been drastically reduced since the Borough was first settled. The increased human occupation and the present lack of habitat has reduced many species that were probably common at one time. Many of the species that remain are those that are adaptable and are able to co-exist with humans. Appendix A lists species that were either observed or are expected to be found within the Borough.

No rare, threatened or endangered wildlife or plant species for the State of New Jersey (NJ's Threatened Plant Species, NJDEP-Division of Parks and Forestry, 1984, and Endangered and Threatened Wildlife in New Jersey, NJDEP-Division of Fish, Game and Wildlife, July 20, 1987) were observed within the Borough of Fanwood during the field investigation by Najarian Associates, L.P. There are also no reported listings for rare, threatened or endangered species within the New Jersey Natural Heritage Foundation's database for the Borough.

7.5 NATURE CENTER

As might be expected, the Nature Center contains the most "natural" habitat for a variety of species. This is discussed below.

The following copy is largely based on the special 1994 Environmental Report that centered on the Nature Center.

7.5.1 VEGETATION IN NATURE CENTER

The Borough of Fanwood lies in the glaciated section of the former Oak-Chestnut Forest Region (Braun 1950, and Vankat 1979). Due to loss of habitat during the last few centuries and the Chestnut Blight at the turn of the century, little of this forest region remains intact. Of the remaining forests, most have been significantly altered by activities such as clearcutting and farming. Today, very little of the original plant community can be found in the Borough of Fanwood and nearly none of it is present in the Fanwood Nature Center. Except for a few isolated lots and small sections of LaGrande and Forest Road Parks, the most significant forested area in town is the Nature Center.

Appendices A, B and C contain lists of all the specimen trees, vegetation and wildlife found in Fanwood.

The Nature Center may be divided into five major plant communities based on the association of dominant tree species as shown on Map 11.

Examples of Vegetation:

7.5.1.1 OTHER NOTEWORTHY VEGETATION

The plant communities at the Nature Center are remnants of the secondary growth forests that used to dominate the area and are worthy of preservation. Although Black Locust is common in many areas (including Europe where it was imported from North America in the late 1600's), the occurrence of mature stands is now rare in this area of New Jersey. Further, the groupings of plants, either natural or planted, is unique and offers a great opportunity for public education.

There were a number of tree specimens and association of special interest. A Pin Oak located near the utility right-of-way measured 3.18 feet diameter at breast height or 9.99 feet in circumference. This is one of the largest specimens of this species in the Borough and is estimated to be about 160 years in age. Along the brook there were two specimens of Silver Maple of particular importance. A large multiple trunk Silver Maple extending from a single base is located at the footbridge. The base of this tree (one foot above the ground) measured 3.97 feet in diameter or 12.47 in circumference. Towards Terrill Rd. another large Silver Maple measuring 3.02 ft. dbh or 9.48 ft. in circumference was found. Although the exact age of the Silver Maples was not determined, the size of the trees indicates that both are probably in the range of about 100 to 150 years in age. *(Editor's Note: The silver maple by the footbridge has since fallen over and has been removed as it posed a safety hazard.)*

In addition to the large specimens of trees, some of the shrubs are worth noting. Indigobush was common in many areas of New Jersey, however, habitat destruction and colonization by exotic species has limited its occurrence in recent years. Therefore, the stand of Indigobush at the Nature Center is rare for the Fanwood area. Another unique aspect of the flora is the presence of a submergent aquatic plant near the culvert at the head of the brook. Although it is difficult to identify these plants without flowers, (when this study was conducted) it appears that this plant belongs to the pondweed family (*Potamogetan sp.*). Pondweeds are common in many lakes, ponds and streams, however, they are less common in highly urbanized brooks such as these.

Review of the *Nature Center Trail Guide* during this investigation revealed some changes in the vegetation [Note: due to the seasonal variation in the flowering and survival of herbaceous dicots, wild flowers listed in the *Trail Guide* were not inventoried in the 1991 or 1994 reports]. American holly and Red Spruce (*Picea rubens*) are not listed in the guide, but specimens are present at the Nature Center. In

contrast, Chestnut (*Castenea dentata*), Sycamore (*Platanus occidentalis*) and Hawthorn (*Cretaegus sp.*) are listed in the *Trail Guide*, but living specimens were not found. It is evident throughout the Nature Center that many species have been imported to the site either through plantings or from escaping seeds. For instance, Japanese Knotweed (*Polygonum cuspidatum*), an exotic herbaceous plant with bamboo-like stems, has formed a mid-sized stand on a site recently occupied by a pile of soil near the church. Although common in the Nature Center, multiflora rose is an introduced species naturalized from east Asia and is considered an invasive species.

7.5.2 WILDLIFE IN NATURE CENTER

Utilization of both the Nature Center and the Midway Circle Property by wildlife appears to be limited. Very little scat was found, few burrows were noted and a small amount of species were observed on the site. At the Nature Center, six burrows were found, which judging by their size, probably belong to woodchucks and other small rodents. Squirrels and rabbits were seen at the Nature Center and only squirrels were observed at the Midway Circle site. Evidence of deer browsing is obvious at the Nature Center. Red foxes have been observed in the vicinity of the railroad embankment and local streets and may visit the Nature Center from time to time. Birds were the most abundant animals at both sites. Birds observed at the Nature Center include crows, starlings, robins, yellow warblers, red and gold finches, house sparrows and downy woodpeckers. A red-tail hawk and a turkey vulture were observed circling over the utility right-of-way. At the Midway Circle site, crows, robins and starlings were present. Red-ail hawks are observed circling over the Nature Center and elsewhere in Fanwood. Several owl species can be heard from time to time in the more wooded areas of the town.

Typically, small isolated urban wooded lots such as these would not support a highly diverse wildlife population. This is particularly true of the Midway Circle property as its

isolation and intensity of disturbance limits wildlife utilization to birds and typical urban species. In recent years red foxes have proliferated in the Fanwood area.

At the Nature Center, however, wildlife utilization may be greater than expected because of its proximity to a utility right-of-way, which may act as a corridor for migrating species (i.e. deer). Since the utility right-of-way extends to the Watchung Mountains, there is a potential that many animals may utilize the site on a temporary basis as they move along the right-of-way. No reptiles or amphibians were noted on either site. The Midway Circle Property does not contain sufficient area of the habitat to support reptiles or amphibians, whereas the Nature Center does have both sufficient area and habitat to support reptiles and amphibians. However the presence of culverts would tend to limit the movement of amphibians to the site. Common box turtles and an occasional snake may visit the Nature Center, but no evidence of breeding population was found.

7.5.3 LAND-USE HISTORY OF NATURE CENTER

No flints, flakes, arrowheads or other artifacts were found at the Nature Center. Native Americans may have hunted on the site, however, due to a lack of natural shelter and the size of the brook, it is doubtful that they directly inhabited the property. The size of the trees at the Nature Center suggests that much of the site had been clear-cut within the last 100 years, although some areas have been cut more recently. No building, wall or other structures were found on-site, suggesting that the land was used for agriculture rather than direct occupation. Currently the only structures at the Nature Center are benches, a bird blind, boardwalks (throughout wet areas), an outdoor "classroom" area with benches and boardwalks, and two footbridges. There is a caretaker for the Nature Center who performs cleanup and maintenance orders, and who coordinates group visits and service projects.

In 2004 and 2005, the *Nature Center Guide* was revised and new guide numbers placed in the Center. Since then, hundreds of copies of the Guide have been distributed to libraries, schools, and interested citizens.

7.6 THE MIDWAY CIRCLE PROPERTY

The Midway Circle property is a highly disturbed urban wooded lot. Red Maple saplings and a few scattered Apple trees dominate the trees present on the parcel. The remainder of the property is dominated by dense stands of Ragweed (*Ambrosia artemisiifolia*), Goldenrod (*Solidago spp.*) and Japanese Knotweed. Although the site would not be classified as a jurisdictional wetland, there are indications that water collects on the site. Jewelweed (FACW) is found mixed with the Goldenrod, Red Maple (FAC) is the dominant woody species; and Pin Oaks (FACW) and American Elms (*Ulmus americanus*) (FACW) are present on the adjacent properties.

If the Midway Circle Property is considered an individual parcel of land, then its ecological value is limited due to the isolation of the site and the extent of disturbance on-site. However, the property is not an isolated parcel and borders an area, which does contain valuable habitat. The private lots adjacent to the Borough's property along Paterson and Midway Avenues contain mature stands of Black Walnut (*Juglans nigra*), Pin Oaks, White Pine (*Pinus strobes*), and White Oak. Indeed one of the White Oaks and Pin Oak at the site represent some of the largest specimens in the Borough. Although only the White Oak has been dated (about 220 years in age), the size of the remaining trees strongly suggests a similar range in age (150 to 250 years old) as well. The Midway Circle Property is serving a valuable function as a buffer to development between the large trees and the houses along Russell Road and Midway Avenue. Any decision to use the property in the future should consider the potential impacts on the trees located on the adjacent properties. *(Editor's Note: The Midway Circle property was acquired by the Borough with the thought of making it a detention basin for stormwater management, but that plan was not implemented and the site remains a small, but important "natural" area.)*

OTHER NATURE CENTER ACTIVITIES

Butterfly Gardens

In the fall of 2007, the Fanwood Environmental Commission began exploring the possibility of establishing a Monarch Butterfly Waystation at the Fanwood Nature center to address the predicament of the dwindling monarch population. It was determined that creating such a garden would be of sufficient magnitude and work that it would qualify for scouts needing a project for the higher ranks (e.g., Eagle in the case of Boy Scouts, and the Gold Award for Girl Scouts).

Under the direction of the Environmental Commission a Boy Scout created the first official town butterfly garden in 2008. The success of this butterfly garden inspired a girl scout to create a second monarch garden adjacent to the first garden in the shape of a peace sign in 2009. Although the monarchs face a number of problems (e.g., habitat loss, indiscriminate spraying of insecticides, etc.) both gardens were instrumental in bringing monarch butterflies to Fanwood and continue to do so. The work involved selecting a site (the PSE&G right-of-way near the Nature Center), eliminating undesirable plants (using the "lasagna" method of alternating layers of newspaper and mulch to "smother" the undergrowth), soil improvement, selecting suitable plants (in particular milkweed species—the only plant the monarch caterpillar uses to feed), obtaining donations (plants, garden items, etc.), investigating the migration patterns of monarchs, and coordinating the work of volunteers (other scouts and parents) to complete the work. It should also be noted that although the garden is directed toward monarchs, a host of other insects (bees, moths, and others) could also use the garden for feeding, pollination, and so forth.

In 2009 the Fanwood Environmental Commission applied for an environmental achievement award for the creation of the butterfly gardens, through ANJEC. The Commission received an

award, one of seven in the state of New Jersey and was presented with a certificate at the 36th Annual Environmental Congress held at Rutgers University.

The gardens contain over 20 butterfly host plants and meets all the requirements for Monarch Waystation certification, which is recorded as Monarch Waystation #2189 by the organization Monarch Watch. The criteria under which it was certified includes:

Milkweeds (Monarch Host Plants):

Butterfly Milkweed (Asclepias tuberosa), Common Milkweed (Asclepias syriaca), Swamp Milkweed (Asclepias incarnata), Tropical Milkweed (Asclepias curassavica); Annual/Biennial Plants: Cosmos (Cosmos spp.), French Marigold (Tagetes patula), Thistle (Centaurea and Cirsium sp.), Zinnia (Zinnia spp.); Perennial Plants: Bee Balm (Monarda spp.), Black-Eyed Susan (Rudbeckia hirta), Coreopsis (Coreopsis spp.), Goldenrod (Solidago spp.), Joe-Pye Weed (Eupatorium purpureum), Purple Coneflower (Echinacea purpurea); Plant Density (Shelter): 2-5 milkweed and nectar plants per square yard; Sustainable Management: Amend the soil; Eliminate the use of insecticides; Manage the density of the plot by thinning; Mulch around the base of plants to reduce the growth of weeds and retain water; Remove dead stalks, etc. before the next growing season by mowing, burning, or by hand; Remove invasive species from the site; Use natural compost for fertilization; Water the plot as needed to maintain growth

Plants used in the second garden include:

Butterfly weed (Asclepias tuberosa); Tropical Milkweed (Asclepias curassavica); Swamp Milkweed (Asclepias incarnata); Turtlehead (Chelone lyonii); Black-eyed Susan (Rudbeckia); Bee balm (llonarda); Joe Pye Weed (Eupatoriwn maculatum); Purple coneflower (Echinacea purpurea); Obedient plant (Physostegia virginiana); Goldenrod (Solidago); Thyme; Dill; Lemon Verbena; Snapdragon; Marigold; Pink Yarrow; Thistle; Daisy; Yellow Foxglove; Zinnia; Fennel; Cosmos; Alyssum; Coreopsis; Russian Sage; Parsley; Yellow Yarrow .

The gardens were quite successful in attracting monarchs, who laid eggs, which then produced a

number of caterpillars. The overall process was well documented and publicity through local newspapers, the community television station, as well as the Environmental Commission's website, garnered widespread interest in the community.

However, beautiful and worthwhile as the gardens are, they require significant maintenance. Although they are in an ideal location in that they are adjacent to the Nature Center and in an area that the power company maintains as a meadow (which contains other useful flowering plants), the site is somewhat isolated and there is no readily available source of water. In 2015 it was decided that the gardens should be re-established in front of town hall. The advantages include the ability to more readily maintain the gardens and to place them in an area more visible to the public. Also noted is the Commission created a rain garden at Borough Hall and supervised another Girl Scout who established a pollinator garden in the front yard of the municipal complex. The Borough Hall butterfly gardens were established in 2016 as another Boy Scout Project. Some plants were transplanted from the current gardens; however, the remainder of the original butterfly gardens was allowed to go "fallow." While those plants have to compete with other meadow plants, it is expected that some of them would propagate and "hold their own," and would continue to provide pollinator benefits into the future.

NATURE CENTER SIGN

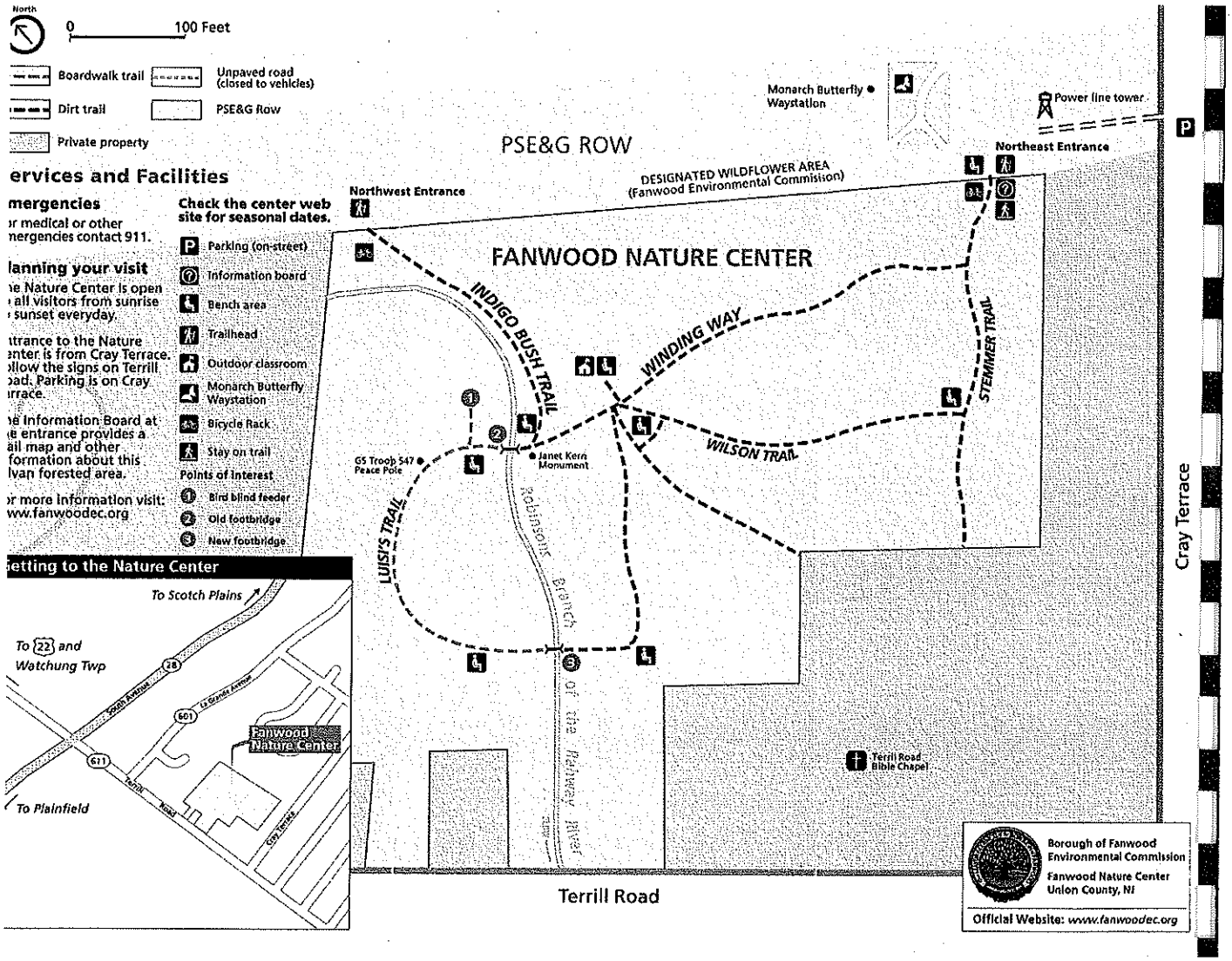
Another Boy Scout project was to construct a new Nature Center sign just outside of the main trail entrance near Cray Terrace. Made of wood products, it blends in nicely with the local environment. Part of the Scout's project also including lining the trails with fallen branches and logs to better define the trails and to place wood chips on the trails.

BAT BOXES

A more recent Boy Scout project was to erect several "bat boxes"—wooden boxes of a specific shape and size that local bats find suitable for nesting. The Scout had to research box design, acquire materials, build the boxes, and then to install them in the Nature Center. Although it was thought that it might take many months for bats to find their way to these particular boxes, it

appears that within a few weeks of their installation that bats began using the boxes for roosting and protection. With their voracious appetite for insects, they form a natural means of pest control.

Below is a map of the Nature Center circa 2010:



CHAPTER 8

POTABLE WATER

NOTES:

8.1 SOURCE OF POTABLE WATER IN FANWOOD

Clean, plentiful drinking water is essential to life. This essential element may be imperiled by degradation of water quality or by limits on water quantity. The residential, commercial, and industrial development of New Jersey have degraded many of our existing and potential surface and subsurface water supplies. Periodic droughts in New Jersey have demonstrated the importance of water supply and conservation.

Public drinking water in Union County is typically from surface water, although some groundwater supplies are also used. In other parts of New Jersey, particularly the southern portion of the state within the Coastal Plain, groundwater is the major potable water source.

8.2 SUPPLY & MONITORING OF POTABLE WATER

For much of Fanwood's history, the Plainfield-Union Water Company supplied public water from groundwater wells. Since the wells were drilled deep into the bedrock, the water required no treatment other than chlorination for disinfection. As the population of the area increased in the early 1950's, the Plainfield-Union Company exceeded its well pumping capacity and began to purchase surface water pumped from the Raritan River, the Delaware and Raritan Canal, and the Millstone River from the Elizabethtown Water Company. In 1961 the Plainfield-Union Company was purchased by Elizabethtown, and in 2004, Elizabethtown was purchased by New Jersey American Water.

Today, New Jersey American Water supplies all of the potable water to Fanwood residents. In 2006, the total water usage for Fanwood was approximately 125 gallons per day per capita for a total of about 2,502 households. (Matthews, 2006). Maps 9A and 9B show the main water service lines within Fanwood.

Currently 90% of the potable water pumped to Fanwood is derived from the Raritan Millstone Treatment Plant located in Bridgewater Township. Water entering the Raritan Millstone plant

comes from the Raritan River, Millstone River, and the Delaware Raritan Basin Canal. The supply is controlled by the New Jersey Water Supply Authority (Matthews, 2006).

The water quality at the plant is carefully monitored to meet or exceed State and Federal requirements for chemicals, heavy metals, pathogens, and other substances. Water is monitored 24 hours a day for chloride, fluoride, pH, and turbidity. (However, the water delivered to Fanwood residents is not fluoridated). The water is tested four times a day for bacteria, color, and turbidity levels. Screening for the presence of volatile organic compounds is conducted monthly. The water is tested for heavy metals and twice a year for pesticides and polychlorinated biphenyls (PCBs) (Matthews, 2006). The treated water quality from the plant is generally quite good. The raw water coming into the plant also is of good quality with low levels of radon, heavy metals, and organic compounds. The raw water quality is tested periodically (Matthews, 2006).

There have been times in the past that, the water supply to Fanwood has failed in terms of quality and quantity. The first mention of this is made in the Borough Council minutes from 1921. In 1923 the Borough Council declared that the water supply was inadequate and unsafe (even while petitioning the State Attorney General against a rate increase). Rapid population growth in the late 1940s and early 1950s in western Union County compromised the water company's ability to deliver adequate and safe water. In 1954 water levels in the supply wells went to danger levels and the Plainfield-Union Company contracted with Elizabethtown Water Company for the purchase of water for the first time.

8.3 WATER CONSERVATION

As of March 2007, most drought status indicators were near or above normal, with groundwater levels classified as being about or slightly above "normal" for that time of the year, according to the New Jersey Department of Environmental Protection's website. While water supply is currently adequate, in all likelihood, future droughts can be anticipated. As such, prudent water

use is recommended and the Borough should be prepared to implement water conservation methods and have drought management plans in place in conjunction with the water provider.

Locally, rain gardens and infiltration facilities can help replenish groundwater stores, although this does not directly affect the water supply source of the water company. However, water conservation measures can have significant positive impact on water supplies. Such techniques as low-flow shower heads, shutting off the water during brushing or shaving, and many others have been well publicized—it is just a matter of getting the public to use them. Thus, periodic publicity campaigns should be encouraged to this end.

CHAPTER 9

WASTEWATER

NOTES:

9.1 CURRENT WASTEWATER FLOW

All wastewater generated in Fanwood flows through underground sanitary sewers to a treatment plant for treatment and disposal. The Borough of Fanwood owns and operates a collection system that eventually discharges to either the Middlesex County Utilities Authority (MCUA) or the Rahway Valley Sewerage Authority (RVSA) systems.

Because most sanitary pipe systems flow by gravity, they generally follow the local topography and the drainage divides. Most of the collection system is found beneath the local roadways. In a few locations the underground pipes go through utility easements on private property.

Three separate drainage basins indirectly discharge to the MCUA system:

1. The majority of the Borough is tributary to a metered connection to the Plainfield Area Regional Sewerage Authority (PARSA), (previously known as the Plainfield Joint Meeting), a conveyance authority operating a regional interceptor system that discharges to MCUA.
2. A small area in the southwestern corner of Fanwood flows unmetered into the Plainfield collection system. Plainfield's collection system discharges to the PARSA interceptor system.
3. The area along Westfield Road in the northeastern portion of Fanwood connects to the Scotch Plains system that is served by a metered connection of PARSA.

There is also an area in the south central portion of the Borough that flows unmetered into the Scotch Plains system. This portion of the Scotch Plains system flows to the RVSA system.

The Borough's collection system consists of more than 21 miles of sewers ranging from 8 to 18 inches in diameter. Portions of the system date to 1931 and most of the system is at least 50 years old. The majority of the system is constructed of vitrified clay pipe.

The Borough has in the past conducted closed circuit television (CCTV) inspection program over a number of several years. The CCTV inspections have revealed protruding laterals, root intrusion and cracked pipes. Extraneous water getting into the sanitary system either through

damaged system components (e.g., broken pipes) is known as infiltration; water that gets in from direct sources (e.g., openings in manhole covers or an illegal sump pump connection) is called inflow—collectively known as I/I (or I & I).

The most serious problems occur on the Borough's main trunk lines in Midway and LaGrande Avenues. However some 8 inch collection lines have also exhibited problems. The Borough anticipates a need to reline and/or reconstruct these lines as part of a long-term capital improvement program (Joseph Pryor, Borough of Fanwood Engineer, 2006). Map 10 provides the location of the main sewer lines in Fanwood.

Over the last two decades numerous techniques have been developed to repair and/or rehabilitate sanitary sewer lines in place without having to excavate the roadway and completely replace pipes. Although the viability of using these techniques depends on a number of factors (e.g., access, condition of existing pipe, sewage flow, and so forth) and can be expensive, they do eliminate the need to close down large portions of the roadway and to replace the pipe network completely.

Broken sanitary lines above the water table (besides creating conditions conducive to blockages) can leak sewage into the surrounding soil and contaminate groundwater and create health hazards. Damaged sanitary sewers below the water table will allow groundwater to infiltrate into the pipeline system. This can cause the pipe to eventually flow full, thus impeding the flow into the system from other connecting pipes creating backups and unhealthy conditions. Further, the amount of flow to the treatment facility is now greatly increased and results in the unnecessary treatment of relatively clean water (i.e. the infiltrating groundwater). This in turn adds to the treatment costs, wastes valuable resources, and creates environmental problems with regard to treatment and disposal.

CHAPTER 10

NOISE

NOTES:

10.1 INTRODUCTION

To paraphrase Shakespeare, "Noise by any other name, would sound just as bad." Noise is a sound and sound is defined as a 'measurable quantity of energy released by vibrating or moving bodies.' Noise then is defined as "unwanted sound." Thus, while sound is measurable, noise is more subjective. For example, a lawn mower or leaf blower on a Saturday morning may be music to the ears of the commercial landscaper, but to the person trying to sleep late it is exceedingly obnoxious. Prolonged exposure to excessive sound has been shown to cause physical and psychological damage. Noise may be a source of mental stress and may affect the general well-being of individuals.

In urban and suburban areas some level of noise is common and often unavoidable. Exterior noise of common concern includes traffic, low-flying aircraft, power tools, construction equipment, and lawn mowers and backpack leaf blowers. With general prosperity and technological advances, more and more "noisy" power equipment have become available, and overall, noise levels are increasing in duration and intensity. Residents of Fanwood expressed concern about noise during investigations for the 1976 NRI. Noise from automobile and truck traffic, lawnmowers, and power saws were the sources cited most frequently.

Sound is measured in decibels (where decibels express the relative difference in intensity; based on a "10 times the common logarithm" of the ratio of the two different intensity levels- that is an increase in one decibel means the sound level has increased 10 times). The environmental effect of noise depends not only on the total energy emitted, but on the sounds of pitch or frequency. Noise typically is composed of a variety of frequencies, although among all the possible sound frequencies, only a certain range is audible to humans. See Table 12 for sound levels and human responses to them.

TABLE 14: Sound Levels and Human Response

COMMON SOUND	NOISE LEVEL (DB)	EFFECT
Carrier deck jet Operation Air raid siren	140	Painfully loud
	130	
Jet Takeoff (20ft) Thunderclap Discotheque	120	Maximum Vocal Effort
Auto Horn (3 ft.). Pile Drivers	110	
Garbage Truck	100	
Heavy Truck (50 ft) City Traffic	90	Very annoying Hearing damage (8 hrs.)
Noisy Restaurant Freeway Traffic Man's Voice (3 ft)	70	Telephone use difficult
Air Conditioning Unit (20 ft.)	60	Intrusive
Light Auto Traffic (100 ft.)	50	Quiet
Living Room Bedroom Quiet office	40	
Library/Soft Whisper	30	Very quiet
Broadcasting Studio	20	
	10	Just audible
	0	Hearing begins

The" A-weighted scale" is most commonly used to measure sound in a way that combines the effect of multi-frequency noises in a manner that simulates the sensitivity and response to the human ear. This scale uses a unit of measurement known as the dBA (decibel – A scale).

10.2 SOURCES OF NOISE IN FANWOOD

In Fanwood, the most common regular source of noise (besides landscaping equipment) is likely to be traffic on local roadways. Such noise levels would be greatest during the morning and evening rush hours on heavily traveled streets (South Avenue, North Avenue, Martine Avenue, Terrill Road). Noise measurements undertaken as part of the 1976 NRI during the 9:00 am hour and the 4:00 pm hour revealed noise levels as high as 89 dBA at Martine and South Avenues as a heavy tractor trailer passed by this same sound source dropped to 49 dBA along Russell Road at a point 300 feet south of Midway. The high end of these noise levels would be very annoying and could cause hearing damage after prolonged exposure.

Another common source of noise in Fanwood is generated by low flying aircraft passing overhead. The implementation of the Expanded East Coast Plan by the Federal Aviation Administration (FAA) in the 1980's dramatically changed flight patterns to and from Newark Airport. The Plan was designed to expand capacity and reduce delays at Newark Airport. The success of the plan in this regard has been questioned. This was the largest aircraft route change adopted in aviation history without an Environmental Impact Study. The United States Congress required the FAA to conduct such an Environmental Impact Study by May 1991.

Prior to implementation of the Expanded East Coast Plan, most flights from Newark Airport initially flew over the industrial corridor on the eastern edge of Union and Middlesex counties. Although some residential areas were affected, the aircraft were generally at altitudes of 8,000 to 12,000 feet when flying over primarily residential areas. Under the new plan, the planes immediately turn west flying over Union County at altitudes of 2,000 to 6,000 feet according to local data. Up to 300 flights a day pass over Union County including Fanwood.

Subsequently, in early 2000's the FAA again proposed more modifications to the flight patterns over the New Jersey metropolitan area. This time the FAA was required to produce an Environmental Impact statement. As might be expected, both the Interim and the Final Reports generated much in the way of criticism and controversy. A main finding in the report was that

changing the flight patterns would "reduce air traffic delays" and that in turn would "save fuel" and reduce pollutants. Critics in turn charged that the projected time savings have been calculated only to be a few percent at best and were not guaranteed. There are two other important considerations with the proposed flight changes. One is that the proposal introduces the concept of "fanning" – that is, instead of departing flights from Newark-Liberty following a few select, but rigorously deferred flight paths, they would now take multiple flight paths. The end result would be that a much larger percentage of the population in Central New Jersey (and especially Union and Essex Counties) would be subjected to higher levels of aircraft noise.

Another important aspect of the attempt to "reduce flight delays" is that the FAA does not regulate the number of flights in and out of airports. The inference is obvious— if the new flights patterns do reduce air traffic delays, the airline industry would probably be encouraged to schedule more flights into the metropolitan area. That in turn would push flight delays back up. Port Authority data indicate that average noise levels in the Scotch Plains-Fanwood area have increased by 6dBA since the implementation of the Expanded East Coast Plan, one of the largest increases in the State. Noise measurements at a residential backyard area indicated levels of 34 dBA to 87 dBA according to the Port Authority data. Higher values have been recorded by local citizens. As shown in Table 12, noise levels over 80 dBA are annoying and may cause hearing damage after prolonged exposure. The noise from these planes can interfere with conversation out of doors and can rattle windows (Cummings, 1991).

10.3 NOISE MITIGATION IN FANWOOD

A group of Fanwood and Scotch Plains citizens had organized a group called Scotch-Plains-Fanwood Citizens Against Aircraft Noise (now known as the Union County Citizens Against Aircraft Noise of UCCAAN) to protest the Expanded East Coast Plan and require the FAA to do an Environmental Impact Study for the route change. In addition to aircraft noise, the group was also concerned about air pollution from low flying aircraft and safety issues at Newark Airport and in the surrounding area. UCCAAN was very active at the height of the flight pattern

controvery and pushed for positive change with regard to aircraft flight paths and noise pollution. Another group, created by Union County is the Union County Aircraft Advisory Board, which is composed of volunteers from participating Union County municipalities and had met monthly to discuss aircraft noise issues and actions that the town can take.

Interior noise levels from all exterior sources are mitigated to some extent by the effects of buildings and windows. Nearly all buildings provide at least a 10 dB reduction in noise levels, while a light frame building with ordinary sash windows will provide a 20 dB reduction, which increases to 25 dB if storm windows are also closed. A masonry building with double glazed windows will provide a 35 % reduction in noise (Papacostas, 1987).

Mitigation measures are possible for noise. However, these are typically undertaken only in situations in which noise levels are intolerable or may cause physical hearing loss.

Examples include the noise walls used along freeways near residential areas (e.g. Interstate 78, about 3 miles from the center of Fanwood has an extensive network of sound barriers as it passes through Union County). Sound proofing measures for schools located near airports have been installed, although the effectiveness has been questioned.

CHAPTER 11

OPEN SPACE

NOTES:

11.1 WHAT IS OPEN SPACE?

There are many different definitions of "open space." There are those people who feel that any piece of undeveloped land, whether public or private, can be considered to some extent as open space. Others believe that only those parcels of land that are protected from development, such as parks, should be considered as such. But even that requires further explanation as there can be "developed" open space (e.g., parks with playing fields, tennis courts, etc.) and "undeveloped" open space (e.g., wildlife refuges designated to remain in a natural state).

11.2 PROTECTING OPEN SPACES

There are numerous ways of acquiring and protecting open space areas. The most secure means is outright purchase by a government agency or a non-profit conservancy organization. Alternatively, a conservation easement can be obtained in which the ownership of the land itself does not change, but where the owner gives up certain rights to develop the land (or a portion of the land) in exchange for some "consideration" (usually monetary). The boundaries of the easement and the restrictions imposed (e.g., no building, no cutting of vegetation, no excavating and filling, and so forth) are described in a written agreement and "run with the land," that is, even if the land is sold numerous times, the easement remains in force. Such easements can be contiguous over numerous individual lots. Deed restrictions can also impose limitations on the use of a specific lot.

A relatively new means of providing some protection to land parcels is the "Transfer of Development Rights" (TDR). By way of example, say a person owns a 100,000 sq ft. building lot in a neighborhood that is zoned for 25,000 sq ft. lots. The owner could then legally and easily subdivide the lot into four 25,000 sq ft. lots. However, if a TDR program is in place the owner could agree to place the "right to subdivide the property into a TDR bank" and receive a "credit" for the theoretical number of new lots that could be created from the single lot. As part of the TDR program, higher density development is usually targeted for a different area of the town

where growth is encouraged. A developer may be interested in building a mixed-use facility on a lot in the growth area where say, six apartment units on top of retail, might be allowed. By purchasing a "development right" from the TDR Bank, the developer could then construct seven or eight dwelling units, which provides the incentive to build in the growth area. The property owner who originally transferred the development right would then be compensated and the single large lot would in turn be deed restricted against being subdivided. For more details about TDR, please refer to *Chapter 14: Transfer of Development Rights*.

Not all public land is protected of course. Big lawns or woods may surround the town hall and other municipal facilities, but unless the land is protected in an easement or other means, it could be used for other municipal projects (firehouses, pump stations, senior citizen centers, etc.) Similarly, board of education lands could be extensive with lawn areas and playing fields surrounding schools, but as needs change they are subject to development as well.

11.3 OPEN SPACES IN FANWOOD

Under the State law enabling the creation of Environmental Commissions, one of the specific duties of a commission outlined in the legislation is the task of maintaining an inventory of open space. As part of this ERI, a list of all Borough owned properties was obtained from the tax office. They are available in Table 15 below:

TABLE 15: List of Borough Owned Properties as of April 2006

BLOCK	LOT	ADDRESS	LOT SIZE	COMMENTS
12	3.01	MIDWAY CIRCLE	0.726 Ac	POTENTIAL DETENTION AREA
15	8	FOREST ROAD	7.133 Ac	FOREST ROAD PARK
26	65	TOWER PLACE	0.039 Ac	STORM SEWER R.O.W.
32	4	75 N. MARTINE	3.771 Ac	MUNICIPAL COMPLEX
33	22	130 WATSON RD	0.755 Ac	PARKING AREA/PARK
36	1	20 TILLOTSON RD	0.505 Ac	PUBLIC LIBRARY
42	19	BIRCHWOOD TER	0.036 Ac	SANITARY SEWER R.O.W.
43	19	BIRCHWOOD TER	0.047 Ac	PUBLIC WALKWAY
44	34	BIRCHWOOD TER	0.018 Ac	RIGHT-OF-WAY
44	39	BIRCHWOOD TER	0.048 Ac	RIGHT-OF-WAY
50	22	OAK COURT	0.058 Ac	PUBLIC WALKWAY
61	4	SOUTH AVENUE	1.193 Ac	PARKING AREAS
63	1	230 NORTH AVE	2.522 Ac	COMMUNITY HOUSE/PARKING
64	6	SOUTH & LAGRANDE	0.562 Ac	PARKING AREA
64	5.01	LAGRANDE AVE	1.213 Ac	PARKING AREA
67	4	NORTH & FANWOOD	0.434 Ac	PUBLIC WORKS BUILDING
68	1.01	FANWOOD PLACE	0.202 Ac	PUBLIC WORKS BUILDING
68	31	536 NORTH AVE	1.770 Ac	RECYCLING CENTER
77	40	SHADY LANE	0.010 Ac	RIGHT-OF-WAY
78	23	487 TERRILL ROAD	6.750 Ac	NATURE CENTER
78	25	499 TERRILL ROAD	1.310 Ac	NATURE CENTER
81	23	VINTON CIRCLE	0.027 Ac	STORM SEWER R.O.W.
83	7	LAGRANDE & 2ND	8.020 Ac	LAGRANDE PARK
94	16	474 SOUTH AVE	0.316 Ac	VACANT CORNER

116	31	SHADY LANE	0.007 Ac	RIGHT-OF-WAY

These properties can be grouped into several categories: parks and recreation; municipal facilities; right-of-ways; and miscellaneous. The three major "open space" areas of the Borough are the Nature Center, LaGrande Park, and Forest Road Park.

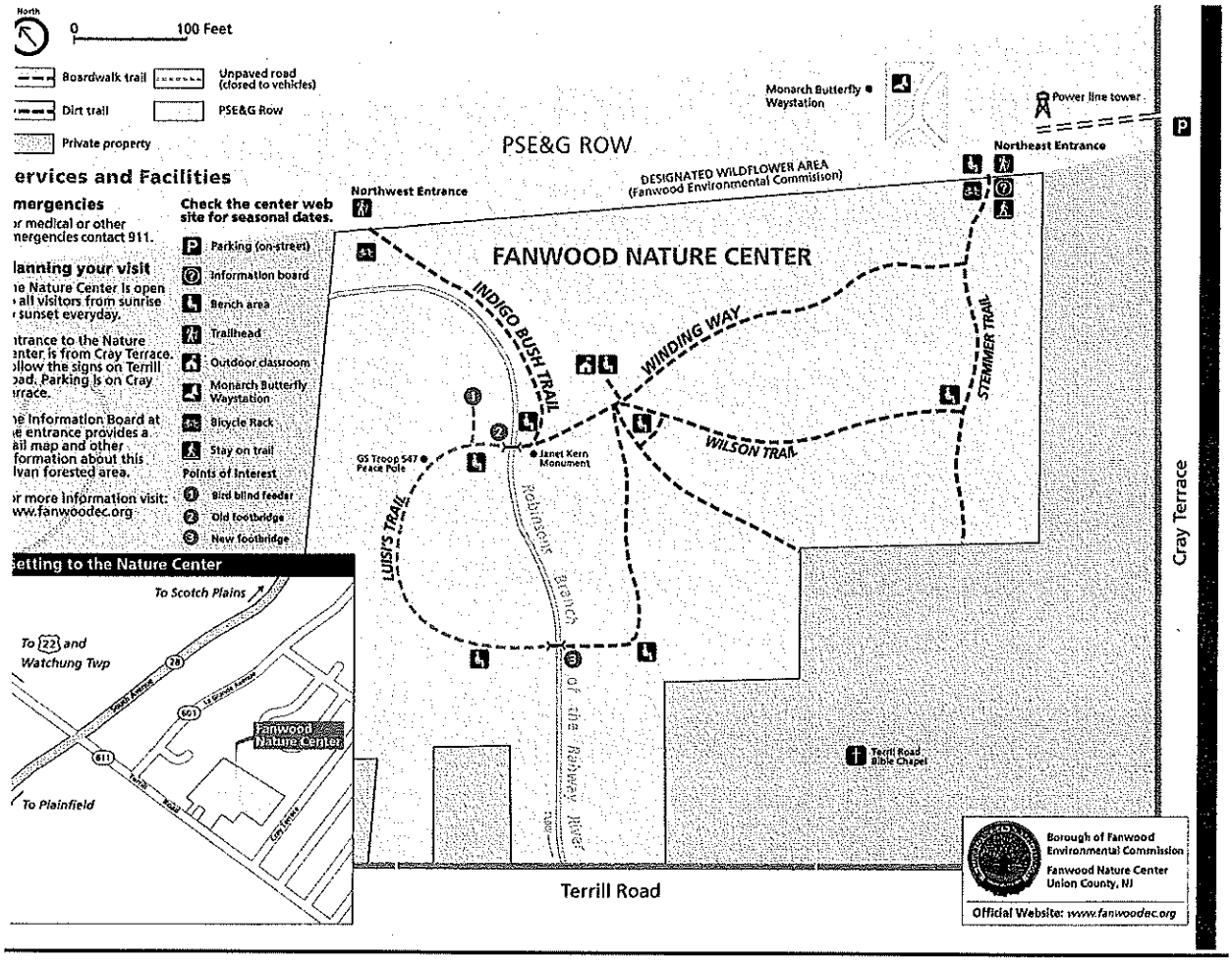
11.3.1 THE NATURE CENTER

The **Nature Center** is a completely protected open space. In 2005, the Environmental Commission was successful in getting the Borough to place a restrictive conservation easement over the entire Center. This easement is designed to keep the Nature Center as "natural" as possible, making it an area for hiking, bird watching, photography, and other low-impact outdoor activities. The easement allows the maintenance of existing facilities (e.g. boardwalks, bridges, trails, and bird blind), the removal of trees and vegetation that block or fall on trails or that might endanger adjacent private properties. Non-native, invasive vegetation can be removed and replaced with native plants. The Center is composed of two parcels – one measuring 6.75 acres and another 1.31 acres that total 8.06 acres in size.

The Nature Center's northeasterly edge is adjacent to the PSE&G right-of-way. The northwesterly and southeasterly sides are bordered by private single-family homes while the southwesterly side borders several residences, a church, and Terrill Road. There are several different plant communities within the Center including forested uplands, lowlands, and wetlands. Please refer to *Chapter 7: Vegetation & Wildlife* and the special discussion of the Nature Center for more details. At the northern corner of the Center a storm drainage pipe discharges into a small creek that is the beginning of the Robinson's Branch which is a tributary of the Rahway River. There are several trails that meander throughout the Center, two bridges over the Robinson's Branch, several benches, boardwalks through wetlands, a bird blind, and an "activity" area with a series of benches for small groups. A user's guide to vegetation and other features of the Nature Center was

revised and several hundred copies printed in 2005. (A future project is to revise this booklet and print it in full color.) These have been distributed to schools, youth groups, libraries, and interested citizens. A natural area like Fanwood's Nature Center is a rather uncommon community amenity in highly developed urbanized areas. Thus, the Borough is extremely fortunate to have this unique feature as part of its open space.

Nature Center Map 2010



11.3.2 RECREATIONAL PARKS

The two major recreational facilities in Fanwood are **LaGrande Park** (8.02 acres) and **Forest Road Park** (7.13 acres), both of which are developed as active use areas. Although each park has several stands of trees, shrubs, and grassy areas, there are no natural areas to speak of. The parks are developed with playing fields, playgrounds, tennis courts, paved walkways, restrooms, community meeting rooms, and ancillary facilities. Except for the fact that the municipality owns these parks, they are not known to have any specific protection from development. However, because demand for recreation facilities is very high in Fanwood, it is unlikely that they would ever be sold off for development or drastically changed from their present uses. Possible changes to these sites might involve enlarging or modifying a particular playing field, creating multi-use facilities, or having other recreational amenities added or removed. According to the 1998 Master Plan, the Borough meets the recommendations of the National Recreation and Park Association for "recreational acreage" (a minimum of 2.5 acres of neighborhood park land for every 1000 individuals living in the area). Nearby schools with recreational facilities, although located in adjacent Scotch Plains, are considered part of shared services and available for use by Fanwood residents. At the William McGinn School, the actual school building is located in Scotch Plains while its associated playground is located in Fanwood.

11.3.3 OTHER MUNICIPAL LANDS

The Borough owns several other small parcels of land as part of its open space system. One parcel of 0.726 acres is located at **Midway Circle**. It is essentially surrounded by residential development on Russell Road, Midway Avenue, Martine Avenue, and Paterson Road. Access to the site is from the unpaved Midway Circle right-of-way that runs between Russell Road and Midway Avenue. There were proposals in the past to develop this property as a neighborhood stormwater detention area. However, because of

budget constraints and other concerns this has not happened. Because of its location and size, it appears unlikely that this parcel would ever be developed for any type of active use. Its primary function presently is to serve as a mini, undeveloped park with minor use by wildlife (small mammals and birds), though it also retains value as a detention area, if necessary.

Near the Municipal Complex is the **Carriage House Park** of about 0.97 acre with a small parking lot. This "pocket" park is on Watson Road opposite the Patricia Kuran Cultural Arts Center. This area is mostly lawn with a mix of trees and a few shrubs and a brick walkway. The Borough's annual Arbor Day celebration usually takes place here. The parcel seems unlikely to be developed, although it could potentially be used for some other municipal purpose.

At the **eastern end of LaGrande Avenue**, where it intersects South Avenue, the municipality owns a wooded third of an acre. Basically a small knoll, it contains a number of tall trees, shrubs and vines, and a small area of grass. Because of its shape, size, and location this parcel is unlikely to be developed in any fashion. However, because of its location at the eastern "gateway" to Fanwood on a state highway (Route 28/ South Avenue), it is a unique "welcome" entry point to the town. A Boy Scout project under the direction of the Environmental Commission resulted in an attractive "Welcome to Fanwood" sign with low growing landscaping at the base..

The 3.7 acre **Municipal Complex** sits on the former Slocum Property, once the site of a homestead and hotel. The facilities here include municipal offices, parking, the fire and first aid station, police department, courtroom, and other supporting amenities. Located next to Borough Hall is the Patricia M. Kuran Arts Center, a historical structure that hosts a number of cultural events including music, art, and the Carriage House Poetry Series. The complex is located in a park-like setting with a number of large trees and lawn area. At one time there were quite a few unique specimen trees at the site, including several

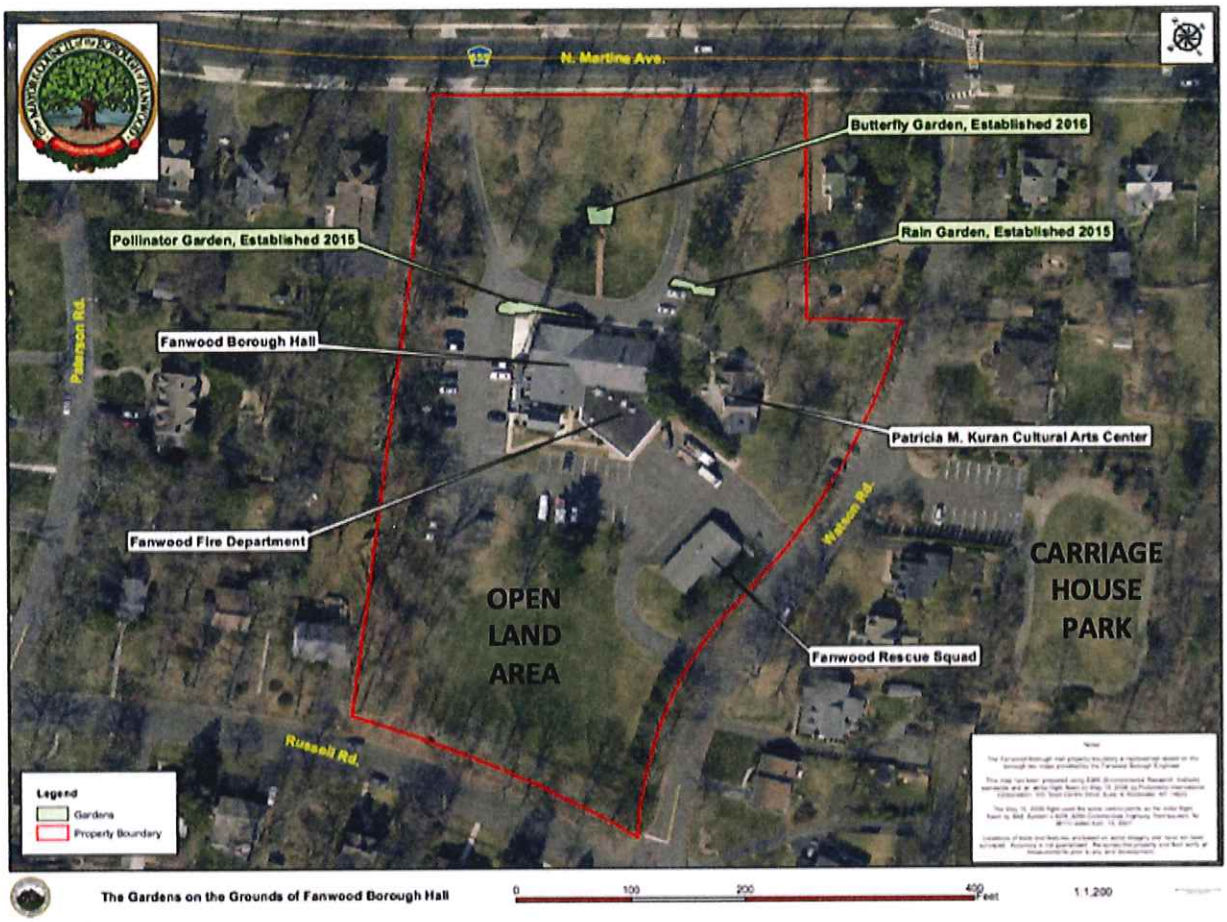
state record trees, most unfortunately have been lost to time. Behind the First Aid/Fire station building is an area designated as a detention area, which is currently lawn area surrounded by trees (and potentially the site for a rain garden.) At the present time there does not seem to be a need to expand the municipal complex and thus the landscaped grounds can be expected to continue to function as open space. In 2015 a Girl Scout project (with the guidance of the Commission) produced a pollinator garden in front of the municipal building. Also that year, the Environmental Commission, with a grant from the Rutgers Cooperative Extension, generous donations from area businesses, and the Fanwood public works department created a rain garden that receives runoff a small parking area and driveway.

The **Community House** is the former classic Victorian train station building (one of the last of its kind in New Jersey) and is within the Borough's newly created Historic District. Located on 2.52 acres at the intersection of Martine Avenue and North Avenue, this site also contains landscaped areas, the Borough's "Holiday Tree" (a large evergreen annually decorated with lights), parking areas, and access to west-bound trains of the Raritan Valley Line. Similar to Borough Hall, this striking building is in a park-like setting that works to increase the ambience of the overall surroundings. The building is currently used as a meeting place by municipal agencies and organizations (including the Environmental Commission). The first floor has been converted into the "Fanwood Museum", open to the public on first Sunday of the month from October-June 2:00-4:00pm. The outside grounds are not protected by a restrictive easement as is the Nature Center and could possibly be used for other purposes. (e.g., Previously there was an effort underway to bring a refurbished railroad caboose to a location adjacent to the building to promote the historical aspects of this area). Because of the previous work in the 1990's to expand the southern parking lots of the "new" train station, it is not anticipated at this time that the Community House property will be significantly altered for other purposes.

The **Recycling Center** is a 1.77-acre clearing fenced and bounded by some trees, the Raritan Valley train tracks, commercial and residences, is located on North Avenue near the border with Scotch Plains. The site of the Borough's successful and admired volunteer recycling program (see *Chapter 12: Recycling*), is partially paved and partially hard-packed soil. However, in September 2016 the Borough switched to a curbside collection system run by the Plainfield Municipal Utilities Authority. There are a number of large bins on-site for separating glass, metals, and plastics as well as several trailers and storage sheds for paper, cardboard, books, and miscellaneous other items. A small portion of the site was retained for stockpiling mulch materials for use by town residents.

The Borough owns various other properties, the most significant of which are parking lots such as those servicing the train station and the downtown shops along South Avenue and Martine Avenue. Other municipal properties include miscellaneous right-of-ways predominantly for pedestrian access and utility lines (e.g., storm sewers). One other parcel of property is off Fanwood Place (near Martine and North Avenues) and is home of the Borough's Public Works Garage and its associated parking and support facilities.

FEC Gardens on the Grounds



11.4 FUTURE OPEN SPACE

Obviously in a small, nearly completely developed town like Fanwood, with limited financial resources, the opportunities to acquire new open space are limited as well. There are virtually no large vacant lots in town or other open tracts of land not already being used for some designated use. However, there are some options for the Borough to seriously consider.

11.4.1 BIKE PATH PROPOSAL

The largest section of land in the Borough that is not totally developed is the PSE&G right-of-way. This 50-ft. wide swath of land on the western side of Fanwood, going from border to border with Scotch Plains, contains approximately 11 acres of grassland, meadows, and shrubs in addition to the high-tension wire towers and a natural gas pipeline. The 1976 NRI recognized the potential of the PSE&G right-of-way as "... a green-link through the Borough" and suggested that "more active recreational facilities should be developed in the right-of-way." There has been a proposal (first suggested in the late 1990s) to develop a bike path in the right-of-way. This proposal has also generated interest in Scotch Plains and Edison Township (in Middlesex County) as the same right-of-way extends through both these municipalities as well. Such a bike path could potentially be 14 miles long and extend to the Raritan River. (The Green Brook Conservancy in Plainfield suggested that a supplemental bike/walking path from the right-of-way extend to a proposed greenway along the waterway.) Initial talks with representatives from the utility company have not been positive as the company has numerous concerns about liability. However, it is well-known that the company has granted hundreds of leases to adjacent property owners for using the right-of-way for gardens, storage sheds, and other uses. As the right-of-way passes by the Nature Center, the Environmental Commission has leased several thousand square feet for an annual wildflower garden as well as the butterfly garden. In Essex County parts of the Lenape Trail (a hiking trail that is part of the Liberty-to-Gap Trail extending from the Statue of Liberty State Park to the Delaware Water Gap) traverses back and forth across the PSE&G right-of-way. With this in mind the bike path proposal and other potential passive uses are worth pursuing.

11.4.2 CONSERVATION-UTILITY ZONE

Also with regard to the right-of-way is the nature of its use—that as a utility corridor. It is possible as technology changes, with regard to energy sources and its transmission, that a 50-ft. right-of-way will no longer be needed by the utility companies. There are some scenarios that suggest that high tension wires and towers could become obsolete. Although such a possibility could be decades away, planning in the present day can at least establish the basis by which this corridor could be used by area residents for unique recreational activities. One possible approach is to zone the right-of-way as a "Conservation-Utility Zone" that would allow the existing uses to continue, but would provide the basis for its use for recreation. Such a designation would not preclude the right-of-way from any other use, but it would give the Borough time to study options for its ultimate use.

11.4.3 POTENTIAL CONSERVATION LAND

At one time it was envisioned that the Beverly Street right-of-way, then a "paper" street (i.e., it is shown on the tax maps as a municipal right-of-way for a road, although there is no physical road in place) off Midway Avenue could be a potential open space area. The right-of-way led to a privately owned parcel of 1.36 acres of land adjacent to the Cedar Creek, one of the few remaining parcels of land over an acre in size. Several development applications were turned down because of a host of developmental and environmental problems at the site. The area was heavily wooded with numerous 6-12 inches+ trees and various shrubs and groundcover. Its proximity to Cedar Creek made this parcel unique in that it is one of the very few places in Fanwood that is near an open stream corridor. Significantly too, the Township of Scotch Plains owns the property on the both sides of the creek, which they have zoned as "Conservation Lands" affording it protection from development. Acquisition and protection of the Fanwood side would have enhanced the overall local environment as well as having benefits for both

communities as an area to detain/absorb storm water and to reduce the impact on downstream county drainage facilities.

Unfortunately, the purchase of this property, attractive as it was, was beyond the financial resources of the Borough. Reportedly, Union County was approached to acquire the parcel as part of its "Open Space Master Plan Program," but deemed the lot "too small" despite the fact it would border conservation lands of Scotch Plains, and that Cedar Creek flows through County drainage facilities. Unfortunately for the environment, the last development proposal was approved, the Beverly road extension was built, and several single-family homes were built.

11.4.4 "ENTRANCE TO FANWOOD" SITE

On the corner of South Avenue and Hetfield Avenue, there is a heavily wooded privately-owned parcel that is currently the site of an advertising display. The lot's location and configuration would seem to make it difficult to develop it commercially or residentially. However, as the parcel is directly on the municipal border, this would also be a potential site of an additional "Welcome to Fanwood" sign with landscaping.

11.4.5 DOWNTOWN REDEVELOPMENT DISTRICT

In the Downtown Redevelopment Area, the demands of development that make it economically viable come with the attendant need for parking. In turn, that makes green space all the more of a precious commodity, competing to be part of the mix. Fanwood has opted for a redevelopment scheme that encourages individual property owners to redevelop their properties within an established zoning umbrella based on carefully laid out regulations on what can built in the area and guidelines on how the finished product should look. This is different from the "traditional" means by which a single developer is chosen to coordinate and build the entire project. The advantage of the latter approach is that the entire redevelopment area can be redone from the ground up and it is not

hampered by the constraints of building around existing features and keeping development patterns essentially the same. The advantage of the Fanwood approach is that it avoids the onerous and time-consuming task of acquiring properties and the sometimes heavy-handed need to use eminent domain. The individual property owners though, are required to contribute to a "redevelopment fund" for elements of the redevelopment area that are common to the entire district (e.g., parking, drainage, et al.).

The 2007 Environmental Resource Inventory made the following comment:

> *It is strongly recommended that of the 283,000 sq ft. within the Redevelopment District that at least several thousand square feet be officially dedicated to an open space area (using the funds as necessary). It would be a place where people could interact, where they could enjoy a snack or lunch from one of the local eateries. A landscaped "green" with a fountain or formal garden as a focal point would produce an aesthetic appeal for the downtown area attractive to residents, shoppers, visitors, and business owners. This area could perhaps capitalize on the existing detention area in the municipal parking lot by converting the pavement on either side into landscaped areas and including a rain garden. Certainly there is a lot of potential for green space within the Redevelopment District.*

Since 2007, however, significant development has taken place in the downtown area. Unfortunately the recommendations of the Commission and others were not implemented. Despite furnishing landscaping schemes, design layouts, and plant lists, as requested of the Commission, none of the proposals were considered or implemented. Also contrary to good planning practice, pedestrian walkways and an access alleyway were eliminated as well. It is hoped that future redevelopment plans will be more cognizant of the environment and pedestrian safety.

Finally, there are several privately owned parcels of land scattered throughout the Borough that are sufficiently large that they could be subdivided into two lots. Some of the lots have significant vegetation on them and are within or close to the Historic District. It could be possible to save these unique "wooded islands" with the Transfer of Development Rights program or some similar means.

CHAPTER 12

HISTORIC FEATURES

NOTES:

12.1 LOCAL HISTORY

The Fanwood area has a rich history boasting of homes constructed prior to 1800. The first residents of this area were the Lenni-Lanape Native American Indian tribe and North Martine Avenue is the route of a former trail used by Native Americans. The area was annexed to the Free Borough of Elizabeth; also known as Elizabethtown in 1664. In 1794 the area that encompasses Fanwood, Scotch Plains and Westfield separated from Elizabethtown, incorporating as the Town of Westfield.

About 40 years later, in 1838, an early railroad bed was cut along Midway Avenue. In 1867, a railroad station was completed at what is now the intersection of Midway, Martine and Woodland Avenues. Scotch Plains and Fanwood separated from Westfield to become the Township of Fanwood on March 6, 1878.

By 1895, the railroad tracks had been moved from Midway Avenue to their current location between North and South Avenues. In that same year (October 2, 1895) 330 residents along the new railroad tracks, which was now the most "developed" area of the Township with numerous homes and shops, formed the Borough of Fanwood. The surrounding area remained the Township of Fanwood until March 29, 1917 when it was renamed the Township of Scotch Plains.

12.2 FANWOOD PARK HISTORIC DISTRICT

In 2004, a portion of Fanwood was designated the "Fanwood Historic Park District" and added to the National Register of Historic Places. The district is comprised of 57 homes on or near North Avenue and North Martine Avenue which surrounds the Fanwood train station, the oldest train station in Union County. The Victorian Gothic building was constructed in 1874 after the tracks were moved to their current location from Midway Avenue. The land surrounding the station was subdivided by the Central New Jersey Land Improvement Company shortly after the

completion of the train station. Fanwood Park was conceived as a railroad suburb, offering upper middle class an escape from the city. The curvilinear layout of the community reinforced the feeling of a return to nature for the new homeowners.

Of the 79 structures in the district, 58 are considered contributing to the historic nature of Fanwood Park. Contributing homes in the district range in date from the late nineteenth century through 1935, and run the gamut of architectural styles from ornate Queen Anne to utilitarian Prairie Craftsman. Among the many prominent early residents of the district was J.P. Stevens, founder of the textile company that bears his name.

Additionally, in 2005, the Borough began participating in a pilot program involving the Transfer of Development Rights (TDR), which would redirect development away from areas with important natural or community resources (such as the Historic Preservation District) to places where growth and development are more appropriate. At the time of publication of the 2007 ERI, the TDR program had been put on hold and remains on the "back burner." Traditionally, TDR programs have been used to save farm land. The pilot program, part of a grant administered by ANJEC included five towns through out New Jersey. The other four towns investigated the more traditional TDR approach of saving open space. Fanwood was the only town to be investigating its use for maintaining the integrity of a historic area. Specifically, deed restrictions or easements would be used to permanently maintain the historic characteristics of the property. It is hoped that this program will reduce the number of historic homes being demolished. Please refer to *Chapter 14: Transfer of Development Rights* for details of this program.

Appendix D lists the historic homes built before 1900, including those which no longer exist or have been modified. It is hopeful that a more comprehensive list will compiled in the near future to include unique homes built in the early twentieth century.

CHAPTER 13

RECYCLING

NOTES:

Fanwood is known as a "volunteer" community and this is certainly evident in the operation of the Recycling Center which began operating in 1986.

The Fanwood Recycling Center was located on North Avenue in Fanwood and was in existence for over 25 years. In 2012, the Center took in 2,575 tons of recyclables. The revenue from these materials was $84,523. In addition to simply recycling materials, the Center also held classes for schools, youth groups and senior citizens to educate them on the benefits and importance of recycling, as well as providing a supervised site for those assigned community service by the County and local courts. A user survey showed that 30% of the users of the Center were residents of other communities, including 16 other towns in Union County.

Recycling is an excellent idea in that reusing various products or converting materials into other products (e.g. soda bottles can become the raw material for polyester clothing) can conserve natural resources, preserve open space, and reduce energy consumption. Unfortunately as many communities have discovered, the large number of recycling programs as well as the competition from new products has kept the price paid for recycled materials sufficiently low, so that it often costs more to collect and transport the item than are paid for them.

Fanwood was the only municipality in Union County that did not have a curbside collection program. As noted above, it operated a voluntary system where residents dropped off recyclable items directly at the Center. It was estimated that this process did save the Borough approximately $200,000 in costs annually. The Center benefitted by being operated by an all-volunteer Recycling Association, comprised of member groups such as Boy Scouts, Girl Scouts, sports organizations, church groups, and other youth and charitable organizations. The Center had six paid part-time employees. The Center operated two days a week: Saturdays from 9:00am – 1:00pm with member groups separating materials; and Wednesdays 9:00 am -1:00 pm where residents separate their own recyclables into the appropriate storage bins.

One of the unique aspects of the voluntary program was that Fanwood's approach to recycling also strengthened the community. Groups staffing the Center earned $300 which they used to

support their own activities in the community. In addition, the excess income from the Center (after expenses) was donated to local Fanwood organizations including the Fanwood Fire Department, Rescue Squad, and the TV station. In recent years, almost $12,000 was given to these and other organizations in town to purchase much needed equipment (and saving taxpayer dollars).

It was estimated that Fanwood residents recycled almost 65% of their potential recyclable materials through the voluntary program. In contrast, the statewide recycling rate is just over 30%.

Because Fanwood handled its own materials, a much larger number of materials were accepted than in a typical curb-side operation. Items collected were: Aluminum, metal cans, glass containers, plastics (Types 1, 2, & 3), clothes, button and car batteries, appliances, used motor oil, paper, newspaper, books, cardboard; old American flags, plastic grocery bags, printer cartridges, appliances, electronics, steel/iron, fluorescent light bulbs; and large plastic items such as toys, buckets, and patio furniture.

Unfortunately, as recycling has gotten more efficient and more programs expanded around the country, in addition to increased supplies of virgin materials, the price received for recycled materials dropped drastically. When the recession of 2007-2008 slowed the economy significantly, the demand for recycled materials also dropped substantially and the prices dropped even further. Instead of producing income above operating costs, the Recycling Association had to begin asking the Borough for subsidies. As the subsidy request increased over several years, the Borough began looking into various alternatives, including curbside collection and a combination curbside/voluntary program.

After several studies and spirited public meetings the Borough opted to contract a curbside collection system with the Plainfield Municipal Utilities Authority (PMUA). The PMUA provided blue, rolling recycling containers (albeit, of large capacity), each one coded to every address in Fanwood. Residents can mix paper (office, packaging, mail, etc.), plastics (bottles

and packaging), glass, and metal (tin, steel, aluminum, etc.). The PMUA collects material from the containers every two weeks and takes it all back to its facility for separation and processing. As a partial compromise, the old recycling center is open the first Saturday morning of the month for residents to drop off various items not collected by the PMUA. (The facility is staffed by Public Works employees.) In addition, Union County has been approached to provide more and varied (electronics, paper shredding, bulk items, etc.) in locations closer to Fanwood. Further, the Borough provides a bulk pick-up program once a year (there is a fee for this). [The Borough also picks up vegetative waste (branches, grass clippings, etc.) several times a year as well as leaves in the autumn with a vacuum truck for mulching.

Although Fanwood has lost the many benefits of voluntary recycling and now must pay a significant fee for the curbside pick-up, early studies have indicated that recycling rates have gone up. Also, a number of residents appreciate the convenience of the curbside program rather than having to schedule time to visit the recycling center (especially within the limited time frame available on Saturdays and Wednesdays).

Another town-wide activity that benefits from volunteer support is Clean Communities Day. This event is usually held in April on the Saturday closest to Earth Day (April 22). Working under the direction of a citizen volunteer committee in conjunction with the Fanwood Public Works Department, dozens of individuals and service groups fan out through the Borough to pick up trash and debris in public areas. These include the parks, Nature Center, public land by the train station and along the railroad tracks, Borough Hall, and so forth. Participants are "rewarded" with T-shirts, coffee, donuts, bagels, pizza, and the satisfaction that comes from a job "well done." The Environmental Commission has used the occasion to hand out tree seedlings and wildflower seed packets in conjunction with informational brochures on good environmental stewardship, storm water management, and related topics.

The Fanwood recycling program has and is a successful blend of municipal and community initiative and "can do" spirit. It serves as a model for small communities throughout New Jersey.

CHAPTER 14

TRANSFER OF DEVELOPMENT RIGHTS

NOTES:

14.1 WHAT IS TDR?

A "Transfer of Development Rights" program (TDR) is a technique for land protection that has come about in the last several decades. Traditionally, it has been used for farmland protection, although its use as a preservation technique has expanded in recent years. It is considered by some to be a "smart growth" technique.

The basic concept behind a TDR is to "redirect" development away from areas of a community that cannot support development (e.g., areas lacking roads, sewers, and other infrastructure) or those that should be preserved (e.g., farmland, environmentally sensitive lands) to areas better suitable for more intense development (e.g., an existing town center, redevelopment areas, industrial zones).

The program does not depend on purchasing a parcel of land outright, but only on acquiring the "right to develop." Accordingly, a municipality establishes the "sending" zones (areas from which "rights" are acquired) and "receiving" zones (areas that can sustain more intense development). For example, a one-acre lot in an area zoned for quarter-acre lots could theoretically be subdivided into four lots or a net increase of three lots. Under the TDR program, each of the theoretical new lots would be assigned a monetary development value, in this example say $10,000 per lot. Thus the "development rights" on this one-acre parcel would be worth $30,000. The one-acre property owner could decide a) not give up any rights and reserve the right to subdivide the land his- or herself into four lots (future zoning permitting); or b) transfer the *right* to subdivide into two, three or four lots into a "TDR" bank."

To continue the example, a developer in the "receiving" zone may have a parcel of property that under the existing zoning permits so many square feet of commercial development and say eight apartment/condominium units on a second floor. However, the TDR study in this example has determined that the parcel in the receiving area can actually support 10 dwelling units. The developer would then have the option to go to the "TDR bank" and purchase sufficient development rights to construct the two additional dwelling units.

14.2 TDR IN FANWOOD

As the 2007 ERI was being prepared for publication, several problems arose with the TDR plan such as control over the approval elements, number of additional dwelling units allowed in the receiving zone, and so forth. The Borough Council has decided that for the present that the program should be "put on hold". However, it was decided to retain this chapter in the ERI for informational and educational purposes in the event the program is ever revived in some form or fashion.

The Fanwood program was different from the typical TDR in that it was not oriented toward preserving large tracts of open space. It was conceived as a pilot program designed to "transfer the unused development potential **from** properties in the recently created Historic District **to** properties in the South Avenue industrial–commercial corridor."

In many communities protecting historical properties is done by passing restrictive development and building code ordinances. These ordinances generally limit the type of changes that can be made to a historical building and may actually spell out in detail the types of paint, trim, ornaments, siding, roofing types and materials, windows, doors, and other architectural treatments that are allowed (or prohibited).

The TDR program is a means of getting people to **voluntarily** preserve the integrity of their historic building by providing monetary incentives. Once a property has transferred a credit, the deed to that property is rewritten and recorded at the county clerk's office with the specific restriction(s) (e.g., the property cannot be subdivided or the building footprint could not be expanded, etc.) In some cases, an easement may be placed on the property as well.

A second and very valuable part of Fanwood's TDR program would have established a "Historic Maintenance and Preservation Trust." This trust fund would provide grants to homeowners for the express purpose of maintaining or restoring the historic features of a home or building site within the historic district. Participation in the trust fund would be open to all properties in the

Historic District; it would not be necessary for a property owner to have sold any credits to the TDR bank. The trust fund would have been a part of the TDR program, but operating separately from the selling and purchasing of actual credits. A person selling a development credit could use the money for any purpose while a person getting a grant from the trust could only use the money for enhancing historic preservation.

As noted above, the properties within the historic preservation district constituted the "sending" zone. The designated receiving zone was identified predominantly as the South Avenue corridor- between First Avenue and Terrill Road, but not including the redevelopment district or the train station. It also included the properties along the easterly side of Martine Avenue between South Avenue and LaGrande Avenue. A large portion of South Avenue is zoned as light industrial with the remainder having several different commercial/office and residential designations. This receiving area currently is more or less developed along the lines of the zoning. During the past several years, while some business entities have gone out of business or moved, others have started up or have relocated to Fanwood from other towns. By designating this area as the "receiving" zone it would have continued to promote future development with a compatible mix of commercial and residential uses, but would encourage a "net positive" growth to the zone and business stability. The South Avenue area was found to be the only significant non-residential area other than the Downtown Redevelopment Area that was available and suitable for the intended program. South Avenue, also being a state highway [Route 28] with its proximity to Martine Avenue, Terrill Road, Route 22, and Interstate 78 adds to its developmental potential.

There were numerous factors to consider with such an ambitious program. First and foremost was to determine interest among those in the sending and receiving zones. A series of public meetings were held that were fairly well attended and the program was well publicized in local and statewide newspapers explaining all facets of the program. Two other important steps were undertaken:

1. To conduct a market study to establish the tentative potential value of sending credits, such as, a subdivision's worth, or the value of a building expansion.

2. To establish a value for density bonuses in the receiving area, such as, the number of sending credits that would be required to increase the floor area of a store or apartment or to add another dwelling unit.

Further study would be required to determine the appropriate mix of uses in the receiving zone, the intensity of development, and the range of allowable credits available for certain uses. Supporting infrastructure also needs to be examined, such as, whether it would be considered on a case-by-case basis or would there be a shared municipal system, or whether and how much "green" space is needed, and so on. Finally, municipal land development ordinances may also need to be revised and new zoning regulations may be required to complete the program.

There have been some criticisms of the program because of the perceived notion that the density in the receiving area may be increased to too high a level and may lead to a dramatic increase in school-age children. Statistically, apartments and condominiums usually generate a much lower number of school-age children than do single-family housing, although admittedly statistics are certainly subject to the "exception to the rule" factor. However, an increase in the residential density in the receiving area would mean that another area in Fanwood would not see a house expansion, or a lot would not be subdivided for a new home. One of the big misconceptions of this program is that a number of people think that the owners of historic properties would be "forced" into this program. This is simple not the case as one of the most important features of the program is that it calls for voluntary participation.

There were numerous potential advantages from this program for Fanwood. Obviously the most direct benefit is that it would have helped preserve Fanwood's historic heritage, the uniqueness and charm of architecture from another age, and the town's character as a whole. From an environmental viewpoint, if a large existing lot sold the right to subdivide or expand an existing house, then in effect a small piece of "open space" would likewise be preserved. This in turn

would have reduced potential impervious cover, reduced potential storm water runoff and erosion, and could save vegetation. By directing development into an area that is more suited for intense use with regard to location and infrastructure, there would have been actually less demand on municipal services. With development credits, this area would have increased its development potential and even in times of economic slowdowns would have kept developers interested in pursuing projects. This is all within keeping with modern environmental planning practices (providing a mix of residential units with neighborhood services) as well as some of the goals of the New Jersey State Plan.

It has the potential to benefit the Borough both culturally and environmentally. However, it is obvious that critical elements of the TDR program must be reexamined in light of the questions raised and the possible overall impact on the Borough. If this program is resurrected, Fanwood must have a bigger role in directing the process. As this is a pilot program, all of the involved entities should err on the side of caution for the benefit of the town's residents and future development.

AFFORDABLE HOUSING

In the 2010s a number of municipalities throughout New Jersey slowed or did not implement programs, zoning, and ordinances to promote affordable housing units. It was thought at the time that the state Executive and Legislative branches were going to change the rules to make the inclusion of housing units for low- and moderate-income residents into development projects less demanding and to perhaps to remove some of the requirements completely. However, in 2015 the courts ruled otherwise, stating more or less that not only did municipalities have the obligation to provide a system to promote affordable housing, they were also required to "make up" the number of units they would have had built had this "slow-down" not occurred. Thus, a number of towns are now scrambling to belatedly meet their affordable housing obligation. The obvious concern is that good planning practice and environmental concerns not be pushed to the sides in this development frenzy.

CHAPTER 15

OBSERVATIONS & RECOMMENDATIONS

NOTES:

During the process of review and research for this report, we found the opportunity to examine the changes in Fanwood in present times in comparison to the information from the 1976 & 1991 NRI's and the 2007 ERI. It is our hope that these observations and recommendations based on the information contained in this document will be considered and perhaps become part of Fanwood's policies and future legacies.

15.1 GREEN FANWOOD

Despite being nearly completely developed, Fanwood can still boast of a number of open spaces, most notably the Nature Center and two excellent multi-purpose parks along with several other smaller parcels of open space. Most streets in the Borough are tree-lined with stately trees and the Shade Tree Commission continues to provide trees and advice to help keep the town "green."

Since Fanwood is an older town and a desirable place to live, it has been intensely developed and opportunities to acquire **new open space** are limited. However, the Borough should keep an "open mind" to any such possibilities (via land donations, easements, and County or State grants). While it can be argued that such open spaces do not bring in tax revenue, the better argument is that it does not place any demand on municipal services. It has been demonstrated time and time again that green areas enhance the appearance and aesthetics of a community, promote a higher quality of life, and help increase property values.

The existing **PSE&G right-of-way** is the largest significant parcel of "open space" land in the Borough. It is recommended that the right-of-way be designated as a **"Utility-Conservation Zone."** The idea would be to maintain its existing use for the utilities that already are in place and to provide the opportunity to use the corridor for future active or passive recreation. (Interestingly it has been theorized that at some point in the future that power transmission may all be underground or use some other means that does not involve towers and high voltage wires, that is, wireless transmission of electricity) This does not mean that the right-of-way land could never be used for some other purpose. However by re-designating the right-of-way, it would present the Borough with the opportunity to consider the use of all or part of the right-of-way

segments for trails, gardens, bike paths, landscaped sitting areas, tree planting, and as greenways to other parks and recreation areas. Union County in its *Cross-Acceptance Report for the New Jersey State Plan* and other documents has expressed its support in maintaining these right-of-ways throughout the county as linear greenways and green "connectors."

One recommendation from the 2007 ERI has become a reality. The Borough owns a small triangular parcel of property at the corner of LaGrande and South Avenue (near Hetfield). Because of its prominence on a major roadway near the municipal border, the Commission stated that this is be an excellent location for a **"Welcome to Fanwood"** sign and a flower garden. A Boy Scout undertook this project and produced an esthetically pleasing sign with a small garden around its base. (Interestingly, the adjacent property owner has "adopted" this site and waters and trims the plantings as necessary.) In the 1976 NRI, it was reported that Fanwood had six state **record trees** which is the largest known trees in the state of a particular species. Although a number of these trees have succumbed to disease, age, or development, the Borough should do whatever it can to protect its other unique and large trees. (Several years ago the Shade Tree Commission and Environmental Commission had a contest for property owners to try and identify the largest trees around town—whether it was street tree or a tree on their property.) Also, there seems to be trend to replace some of the older shade trees as they decay and die with ornamental species. While the latter have their place and are extremely beautifying when they bloom, **shade trees** should still be the mainstay plantings.

15.2 DOWNTOWN AREA

The Downtown area is slowly being revitalized. We do recommend that the entire downtown area be continually looked at as a "complete package" and that as development proposals are reviewed, they be examined as to how they fit their part of the "puzzle" and not as individual projects. As we have noted elsewhere in this document, it is extremely important to consider the inclusion of some "green space" in the Downtown area where residents and shoppers can pause, relax, and enjoy the moment. Also as noted above, the original downtown plans included

pedestrian walkways and alleys that were eliminated in the final design. It is recommended that any future redevelopment work, whether it is in the established Downtown area or elsewhere in town include both green spaces and pedestrian-friendly features. Landscaped islands and shade trees should grace the interior lots as well. Quite simply, anywhere a person can get by car, they should be able to **get there safely by walking or biking**. Another consideration for the buildings ringing the interior parking would be to include a covered walkway so as to make the downtown area more pedestrian friendly during inclement weather or hot, sunny days.

15.3 DRAINAGE

The Planning Board and the professional staff have done a great job in requiring storm water management techniques for development projects of all sizes. We encourage and support this goal. To this end, we would also like to encourage the continued and expanded use of rain gardens and other non-structural management techniques to reduce runoff. The Borough and the Environmental Commission, in conjunction with other agencies and County and State entities, has provided literature and outreach programs to help educate residents about stormwater management and the benefits and construction procedure for rain gardens. Significantly the Commission in conjunction with other agencies has produced two demonstration rain gardens—one at the library and the other in front of town hall. Members of the Environmental Commission working with the Public Works Department have coordinated the state-manadated work of placing "Do Not Dump Waste" markers on all the storm sewer inlets in town. With the help of Eagle Scout candidates, this Borough's nearly 800 storm sewer inlets have been marked. (This project was completed in 2008.) Rain garden and similar drainage techniques used on private must be protected by conservation easements or other techniques.

15.4 LANDSCAPING

Related to the above, the Environmental Commission encourages landscaping schemes that favor shrubs and trees over simple lawns. Larger plants are beneficial for storm water control by breaking up the force of raindrops and enhancing infiltration into the ground and thereby

reducing runoff. Such landscaping plans are generally less demanding on the environment in that they do not require frequent mowing, pesticides, fertilizers, or area-wide irrigation. Trees also absorb greater quantities of carbon dioxide from the atmosphere and release oxygen.

15.5 MULCHING

The Borough should encourage leaf and grass clipping recycling via mulching and/or composting. Informational brochures, video instruction (e.g., Channel 35), and other means could spread the word about "mulching mowers" and simple composting bins. Again, Fanwood could lead the way by mulching and composting grass clippings and leaves from Borough property.

15.6 ENERGY AUDITS and ENERGY SAVINGS

Several months ago the Borough adopted the Mayors' and Governors' Initiative to promote energy conservation and to reduce greenhouse gases. As part of this initiative several Borough buildings were examined for the extent and condition of insulation in the walls and ceilings and to then upgrade and improve the same. If not completed already, an energy audit should be conducted on all municipal facilities. Another worthwhile task would be to inventory municipal buildings and facilities to determine the suitability of placing solar panels to provide some of the Borough's energy needs. Two means of doing this would be through a consultant or a community volunteer with a background in architecture, engineering, and/or solar energy systems. A third and perhaps preferred way, would be to use the services of a "solar leasing" company. This relatively new approach has already been utilized by a number of commercial companies and educational institutions. Such a company would perform a suitability audit and if feasible, install the solar energy system at no initial cost to the user. Further, the company would arrange a lease that results in lower energy costs to the user and the lessor benefits by selling excess energy back into the power grid. Although the leasing company does receive valuable energy credits, the overall use of solar energy is a positive benefit to the environment. It is

possible that the Borough does not possess enough "roof area" to make this a viable option, but it is certainly worth pursuing.

Geothermal heating systems and heat pumps are other alternatives that can provide significant energy savings as well as reduce reliance on fossil fuels. Sealing window and door frames and adding wall and roof insulation are among the simplest, but most cost-effective ways of reducing energy use. If not done as a separate project, as municipal facilities are repaired, rehabilitated, or expanded, "super-insulating" the walls and roofs should be a mandatory operation.

The Borough should continue to take advantage of any State of New Jersey projects and programs to encourage and promote energy conservation. Programs in the past have included reimbursing municipalities for conducting energy audits (up to 100% if the audit recommendations are implemented).

A final part of the overall energy saving approach would be to examine the Borough's building codes to promote super-insulated building structures, the incorporation of energy saving architectural elements and appliances, and perhaps incentives for developers to seek LEEDS certification. Studies have shown that the initial increased costs for implementing energy savings measures are relatively quickly returned on the "investment" and can pay back the costs many times over the life of a facility.

15.7 ENVIRONMENTAL COMMISSION PROJECTS

Over the past 30 years the Fanwood Environmental Commission has been involved in numerous projects and programs on behalf of the Borough. Some of its work has included:

- ✓ Providing environmental advice to the Borough as a whole and to individual citizens
- ✓ Reviewing site plans and subdivisions
- ✓ Keeping a record of open space and the promotion of the same
- ✓ Recommending environmentally friendly ordinances and policies
- ✓ Attending meetings, seminars, and workshops
- ✓ Promoting the "green" approach to health and quality of life issues.

In addition to continuing the above, the Commission in recent years, has

- ✓ Worked with the Nature Center caretaker to promote the wildflower garden
- ✓ Coordinated the storm sewer inlet marking project
- ✓ Disseminated information on good stormwater management techniques
- ✓ Issued "what-can-you-do-for-the-environment" press releases
- ✓ Has displays and gives out information at Fanny Wood Day
- ✓ Attended the Annual Congress and workshops of the Association of New Jersey Environmental Commissions (ANJEC)
- ✓ Conducted community outreach programs, such as bird workshops to promote the Great Backyard Bird Count program (a national program sponsored by the Audubon Society & Cornell Laboratory of Ornithology)
- ✓ Participated with the Rahway River Association and Union County in the educational "BioBlitz" program
- ✓ Helped Fanwood obtain one of only six state demonstration rain gardens
- ✓ Created a second demonstration rain garden at Borough Hall and worked with a Girl Scout to create a pollinator garden
- ✓ Persuaded the Borough to place a protective conservation easement over the Nature Center
- ✓ Initiated and helped set up the "Goat Project"—arranging for a herd of goats to be penned at the Nature Center for the purpose of devouring non-native, invasive vegetation completed in the summer of 2017
- ✓ Worked with a Boy Scout and a Girl Scout to establish certified side-by-side Monarch Butterfly Way Stations
- ✓ Worked with two other Boy Scouts—one of whom built a new sign for the Nature Center and the other who built a series of bat boxes
- ✓ Produced other brochures, press releases, and a map of the Nature Center
- ✓ Worked with the Shade Tree Commission to create a "Who Has the Biggest Trees in Fanwood" contest
- ✓ With the aid of a park naturalist, conducted walking tours to find wild edible plants.

Possible future projects include:

- Continuing to promote and advocate for recreational amenities such as a bike path and open space
- Producing additional brochures and press releases
- Reformatting, producing, and publishing a color guide to the plants and animals of the Nature Center
- Develop an area-wide guide of local natural areas with directions and maps that would include parks and nature centers in nearby towns and county facilities (e.g., Watchung Reservation, Ashbrook Swamp, etc.)
- Arrange to have a new tree inventory conducted
- Develop projects with local schools to promote environmental awareness and "green" thinking to solve environmental problems
- Working with the municipality to reduce its use of pesticides and herbicides

- Working with the town to continue to seek ways to save energy and implement alternative energy systems
- Have a water quality control structure installed at the end of the stormwater outfall pipe that forms the beginning of the Robinson Branch tributary
- Provide an "environmental educational center" at Borough Hall.
- Create additional municipal gardens (e.g., rain, pollinator, shade, wildflower, etc.)

Two potential special projects include:

The Gardens of Fanwood—One of the goals of the Commission is to explore ways for the Borough to eliminate some of the extensive lawn area surrounding the town hall complex. Over the past year a rain garden and a pollinator garden have been established in front of Borough Hall. Another Boy Scout project created another butterfly garden in the front lawn around the existing flag poles. The thought is, why stop there? The tentative concept is to develop a series of gardens—a wildflower garden, a fern grotto, a shade-tolerant garden, a deer-resistant garden, and so forth on the one acre+ front lawn. Walking paths and informational signs would complement the educational aspects of the gardens. There are a number of obstacles that would have to be overcome for what would probably be a multi-year project (not the least of which the soils around the town hall are compacted and nutrient poor). A survey and plant inventory would need to be conducted, the types of gardens established and planned, and then installed. Maintenance of the gardens would be significant but could be a combination of volunteers, public works staff, certified horticulturist, and "adoption" by local businesses and landscapers.

Environmental Education Center—In conjunction with the above, the idea came up to make the Borough Hall an "environmental destination." As residents come to town hall for permits, pay taxes, and seek other services, it is assumed that the various gardens would grab the attention of a number of people. The front of the current town hall building has a convenient large protective overhang. It has been proposed to provide a display board with information on the

rain and butterfly gardens (and how residents can install their own) and other numerous aspects environment awareness and protection. Items to be included would feature brochures on how home and business owners could create their own rain and butterfly gardens, mulching, stormwater management, anti-idling facts, energy audits and energy saving techniques, low impact garden techniques, and much more. The actual display itself has not been decided on—with ideas ranging from a simple brochure rack to an interactive computer monitor. Current thinking is to have a covered bulletin board with brochure racks on either side (also in protective enclosures).

COMMENTS

We welcome any comments that members of the governing body, professional staff, boards and commissions, consultants, and the public at large may have about this document. Please use the form in Appendix F for feedback. All comments (both praise, critical, and suggestive) will be considered for a supplemental edition of the *Environmental Resource Inventory* or for another complete revision at some point in the future. We trust that this document will not only be helpful as a planning aid and as an information resource, but as a look at the "state of Fanwood" in the early 21st Century.

APPENDIXES

SECTION

APPENDIX A

Specimen Trees in the Borough of Fanwood

Because of time and budgetary constraints, it was not possible at this time to re-inventory the Borough's trees. The following pages have been reproduced from the 1991 Natural (Environmental) Resources Inventory.

List was compiled from field investigations by Najarain Associates L.P. and the 1976 NRI.

SCIENTIFIC NAME	COMMON NAME	LOCATION	DIMENSIONS		COMMENTS
			Dia.	Cir.	
Acer rubrum	Red Maple	109 Russel Road	50.00"	13.0'	Estimated at 140 years old
Catalpa speciosa	Northern Catalpa	185 Westfield Road	40.80"	10.7'	Largest tree of its species in New Jersey
Fagus grandifolia	American Beech	40 St. John Place	33.30"	8.72'	225 years old
Fagus sylvatica	Copper Beech	99 North Martine Ave.	34.70"	9.1'	
Fraxinus americana	White Ash	Slocum Property	37.55"	9.78'	
Gleditsia tricanthos	Honey Locust	519 Terrill Rd	39.80"	10.45'	
		Slocum Property	33.00"	8.65'	
		519 Terrill Rd	30.00"	7.75'	
Juglans nigra	Black Walnut	Slocum Property	33.80"	8.85'	Tree no longer present. Tree was 185 years old in 1976
Liriodendron tulipifera	Tulip Poplar	167 Pleasant Ave.	33.30"	8.72'	215 years old
		197 North Martine Ave.	27.50"	7.20'	125 years old

Magnolia acuminata	Cucumbertree	519 Terrill Road	30.90"	8.1'	
Platanus occidentalis	Sycamore	194 North Martine Ave.	46.20"	12.1'	215 years old
Pinus resinosa	Red Pine	Slocum Property	23.90"	6.2'	
Pinus strobus	Eastern White Pine	314 South Ave.	28.90"	7.57'	
Pyrus communis	Domestic Pear	Slocum Property	29.60"	7.4'	Largest tree of its species in New Jersey
Quercus alba	White Oak	90 North Martine Ave.	61.90"	16.2'	415+ years old. The "Fanwood Oak".
		95 Hunter Ave.	46.60"	12.2'	255 years old.
		374 South Ave.	43.70"	11.45'	245 years old
		77 Tillotson Road	38.50"	10.1'	
		100 Forest Road	37.90"	9.95'	
		95 North Ave.	36.80"	9.64'	
		120 Forest Rd.	36.35"	9.53'	
		28 Hunter Ave.	36.20"	9.46'	
		21 Hunter Ave.	36.20"	9.46'	
		221 Burns Way	35.20"	9.22'	
		59 Russell Rd	34.70"	9.10'	235 years old
		116 North Ave.	32.00"	8.38'	
		120 Forest Rd	31.68"	8.30'	200 years old
		76 Tillotson Rd.	31.50"	8.25'	
		374 South Ave.	31.30"	8.20'	
		Midway Detention Basin	31.20"	8.17'	205 years old
		77 Tillotson Rd	29.70"	7.80'	
		240 Herbert Ave.	28.60"	7.49'	Double trunked.
			30.00"	7.86'	
		126 Farley Ave.	29.10"	7.62'	235 years old
Quercus bicolor	Swamp White Oak	95 Hunter Ave.	39.00"	10.2'	265 years old
Quercus cerris	European Oak	40 Forest Rd	44.50"	11.6'	195 years old. Largest tree of its species in New Jersey.
Quercus palustris	Pin Oak	172 North Martine Ave.	42.25"	11.05'	235 years old
		183 North Martine Ave.	4.070"	10.70'	215 years old
		33 Elm Ave.	39.90"	10.45'	

		227 Midway Ave.	38.10"	10.00'	
		170 NorthMartine Ave.	36.20"	9.45'	
		15 North Ave.	36.70"	9.60'	
		243 Midway Ave.	35.50"	9.30'	
		172 North Martine Ave.	35.00"	9.15'	
		Fanwood Nature Center	34.20"	8.97'	148 years old
		183 North Martine Ave.	33.50"	8.80'	
		157 Hunter Ave.	33.30"	8.72'	
		157 Hunter Ave.	33.20"	8.69'	
		95 Forest Road	33.20"	8.69'	
		Midway Detention Basin	32.30"	8.46'	
		183 North Martine Ave.	31.10"	8.20'	
		183 North Martine Ave.	30.00"	7.75'	195 years old.
Quercus rubra	Red Oak	191 Paterson Rd.	51.60"	13.5'	200 years old.
		95 Hunter Ave.	49.50"	13.0'	185 years old.
		101 North Ave.	44.20"	11.58'	
		95 North Ave.	40.20"	10.52'	
		25 Hunter Ave.	37.90"	9.82'	175 years old.
		95 North Ave.	35.90"	9.40'	
		101 Paterson Rd.	34.40"	9.10'	
		131 Hunter Ave.	34.40"	9.10'	
		100 Paterson Rd.	33.00"	8.64'	
		131 Hunter Ave.	31.40"	8.22'	
		131 Hunter Ave.	30.80"	8.06'	
Quercus velutina	Black Oak	101 Cray Terrace	42.20"	11.05'	235 years old.
		30 Farley Ave.	40.70"	10.65'	
		95 Hunter Ave.	38.30"	10.10'	
		153 Hunter Ave.	38.20"	10.00'	
		70 Willoughby Rd.	35.50"	9.30'	215 years old.
		42 Fourth Street	35.40"	9.27'	218 years old.
		265 Paterson Rd.	35.00"	9.15'	218 years old.
		68 Willoughby Rd.	34.50"	9.10'	

		100 Paterson Rd.	34.40"	9.00'	
		116 North Ave.	33.90"	8.89'	
		63 Russell Rd.	32.70"	8.56'	
		41 Hunter Ave.	32.60"	8.53'	200 years old.
		70 Willoughby Rd.	31.80"	8.10'	
		68 Willoughby Rd.	31.00"	8.10'	
		76 Kempshall Terrace	30.40"	7.96'	
Salix nigra	Black Willow	79 North Ave.	63.50"	16.63'	Tree no longer present. Largest tree of its species in NJ
		79 North Ave.	46.30"	12.13'	Tree declining in health
		115 Westfield Road	42.00"	11.00'	
		185 Westfield Road	35.20"	9.20'	Tree no longer present.
Sassafras albidum	Sassafrass	Slocum Property	34.50"	9.00'	Tree no longer present. Was 125 yrs old in 1976.
Tilia heterophylla	White Linden	Slocum Property	53.00"	13.90'	Tree declining in health. Largest tree of its species in NJ
Tilia petiolaris	Weeping Linden	Slocum Property	32.9"	8.60'	Largest tree of its species in NJ
Ulmus sp.	Elm	265 Westfield Rd.	29.80"	7.80'	

APPENDIX B

SITE PHOTOGRAPHS WITH DESCRIPTIONS (Photographs prepared by Amy S. Greene Environmental Consultants)

Photo A: Looking southwest along secondary successional areas in Area 1

Photo B: Looking northwest at larger oaks in Area 1

Photo C: View of open successional forest with downed trees in Area 1. Note the Japanese stiltgrass patches in the understory.

Photo D: View looking northwest at Japanese knotweed monocultures near the northwest boundary of the Fanwood Nature Center Forest and the power line ROW.

Photo E: View looking southwest at the eastern end of Area 2. This forest contains a mix of mature and semi mature red maple and sweetgum.

Photo F: View looking west in Area 2 A. This part of Area 2 contains a significant break in the monoculture of Japanese stiltgrass in the floor and appears to periodically hold standing water.

Photo G: View looking west at a large forest break in Area 2 caused by downed trees. The monoculture of Japanese stiltgrass in extremely dense in this area.

Photo H: View looking southeast from area 3. Some native herbaceous wetland species mixed with Japanese stiltgrass were identified in the understory in the left of the photo.

Photo I: View looking west across area 3 at a mix of Red maple and sweet gum.

Photo J: View looking at northwest at the riparian habitat and adjacent shrub successional area in Area 4.

Photo K: View looking south near the border of Areas 2 and 4. A patch of hay scented fern is the dominant understory cover in this area.

Photo L: View looking south at riparian and shrub successional habitats along the stream in Area 5.

Photo M: View looking southwest at herbaceous and shrub wetlands near the border of Areas 5 and 6.

Photo N: View looking north at the edge of the herbaceous wetlands in Area 6. There was evidence of groundwater hydrology in this area.

APPENDIX C

Vegetation Species Found in Fanwood

LIST OF VASCULAR PLANT SPECIES WITHIN THE BOROUGH

T- Tree **P-Plant** **S-Shrub**

GENUS	SPECIES (scientific/common name)
Osumndaceae	*Osmunda cinnamomea* - Cinnamon fern *Osmunda claytonia* - Interrupted fern
Woodsiaceae	*Onoclea Sensibilis* - Sensitive fern
Dennstaedtiaceae	*Dennstaedtia punctilobula*- Hay scented fern
Aspleniaceae	*Polystichum acrositchoides*- Christmas fern *Matteuccia struthiopteris*- Ostrich fern
Taxaceae	*Taxus brevifolia*- Western yew
Pinaceae	*Pinus resinosa*- Red pine *Pinus strobes*- Eastern white pine *Pinus sylvestris*- Scotch pine
Cupressaceae	*Juniperus virginiana*- Red cedar
Salicaceae	*Populus deltoids*- Cottonwood *Salix nigra*- Black willow *Salix bablonica*- Weeping willow
Magnoliaceae – All Trees	*Liriodendron tulipifera*- Tulip poplar *Magnolia acuminate*- Cucumbertree *Magnolia macrophylla*- - Big leaf magnolia
Ranunculaceae- All Plants	*Acatea pachypoda*- White baneberry *Aquilegia canadensis*- Columbine

	Ranunculus sp.- Buttercup
	Thalictrum polygamum- Meadow-rue
Lauraceae	*Lindera benzoin*- Spicebush-S
Lauraceae	*Sassafras albidum*-Sassafras-T
Papaveraceae	*Dicentra eximia*- Bleeding hearts- P
Berberidaceae	*Berberis Canadensis*- American Barberry-S
	Berberis thunbergii- Japanese Barberry-S
	Podophllum peltatum- Mayapple-P
Hamamelidaceae	*Hamamelis virginiana*- Witch hazel-S
	Liquidambar styraciflua- Sweetgum-T
Ulmaceae	*Ulmus Americana*- American elm-T
Moraceae-All Trees	*Morus rubra*- Red mulberry
Juglandaceae- All Trees	*Carya ovata*- Shagbark hickory
	Carya tomentosa- Mockernut hickory
	Juglans nigra- Black walnut
Fagaceae- All Trees	*Castanea dentata*- American chestnut
	Fagus grandilolia- American beech
	Fagus sylvatica- Copper beech
	Quercus alba- White oak
	Quercus bicolor- Swamp white oak
	Quercus cerris- European oak
	Quercus palustris- Pin oak
	Quercus velutina- Black oak
	Quercus rubra- Red oak
Betulaceae- All Trees	*Betula lenta*- Black birch
	Bertula populifolia- Gray birch
	Carpinus caroliniana- Ironwood
Aristolochiaceae	*Asarum sp.*- Wild ginger-P
Polygonaceae-All Plants	*Polygonum sagittatum*- Tear thumb
	Polygonum sp.- Smartweed

	Rumex crispus- Curly dock
Phytolaccaceae	*Phytolacca americana*- Pokeweed-P
Portulaccaacaeae	*Claytonia virginica*- Spring beauty-P
Caryophyllaceae-All Plants	*Dianthus armeria* –Deptford pink *Silene cucubalus*- Bladder campion *Stellaria media*- Common chickweed
Brassicaceae-All Plants	*Brassica sp.* – Mustard *Dentaria diphylla*- Toothwort *Hesperis matronalis*- Dame's rocket
Rosaceae	*Crataegus sp.*- Hawthorn- T *Geum virginianum* – Rough avens- unknown *Malus pumila*- Apple- T *Prunus serotina*- Black cherry-T *Prunus virginiana*-Choke cherry-T *Pyrus communis*- Pear-T *Potentilla sp.*- Cinquefoil-S *Rosa multiflora*- Multiflora rose-S *Rubus alleghinsis*- Blackberry-S *Rubus phoenicolasius*- Wine berry-S
Caesalpiniaceae	*Cassia nictans*- Wild sensitive plant-P *Gleditsia tricanthos*- Honey locust-T
Fabaceae	*Amorpha fruiticosa*- Indigobush-S *Robinia pseudo-acacia*- Black locust-T *Trifolium pretense*- Red clover-P
Euphorbiaceae	*Euphorbia cyparissias*- Cypress spurge-P
Anacardiaceae	*Rhus copallina* – Winged sumac-S *Rhus typhina*- Stagnorn sumac-S *Toxicodendron radicans*- Poison Ivy-P
Aceraceae-All Trees	*Acer platanoides*- Norway maple *Acer saccharum*- Sugar maple *Acer saccharinum*- Silver maple

	Acer rubrum- Red maple
Hippocastanaceae	*Aesculus hipocastanum*- Horse chestnut-T
Vitaceae-All Plants	*Parthenocissus quinquefolia*- Virginia creeper *Vitis aestiivalis*- Silverleaf grape
Balsaminaceae	*Impateins capensis*- Jewel weed-P
Tiliaceae- All Trees	*Tilia heterophylla*- White linden *Tilia petiolaris* – Weeping linden
Hypericaceae	*Hypericum perforatum*- St. Johnswort-P
Violaceae-All Plants	*Viola sp.*- Large leaf violet *Viola tricolor*- wild pansy
Nyssaceae	*Nyssa sylvatica*- Black gum-T
Onagraceae	*Oenothera biennis*- Evening primrose-P
Apiaceae	*Daucus carota*- Queen Anne's lace-P
Cornaceae	*Cornus florida*- Flowering dogwood-T
Primulaceae	*Lysimachia quadrifolia*- Whorled loosestrife-P
Oleaceae	*Fraxinus Americana*- White ash-T *Forsythis sp.*- Forsythia- S
Polemoniaceae-All Plants	*Phlox divaricata*- Wild sweet william *Phlox paniculata*- Summer phlox *Phlox stolonifera*- Creeping phlox *Polemonium sp.* – Jacob's ladder
Apocynacceae	*Vinca minor*- Periwinkle-P
Asclepiadaceae	*Asclepias syriaca*- Common milkweed-S
Boraginaceae	*Mysotis scorpiodes*- Forget-me-not-P
Lamiaceae-All Plants	*Glechoma sp.*- Ground ivy *Lamium purpureum*- Purple dead nettle *Monarda didyma*- Oswego tea

	Monarda fistulosa- Wild bergamont
Solanaceae-All Plants	*Physalis sp.*- Ground cherry
	Solanum ptycanthum- Black nightshade
Bignoniaceae-All Trees	*Catalpa speciosa*- Northern catalpa
	Catalpa bignonoides- Catalpa
Scrophulariaceae-All Plants	*Digitalis purpurea*- Foxglove
	Verbascum thapsus- Common mullein
	Linaria vulgaris – Butter and eggs
Plantaginaceae	*Plantago lanceolata*- Buckhorn plantain-unknown
	Plantago rugelii- Rugles plantain-unknown
Rubiaceae	*Galium sp.*- Bedstraw-P
Caprifoliaceae	*Lonicera japonica*- Japanese honeysuckle-P
Caprifoliaceae	*Sambucus canadensis*- Elderberry-S
	Viburnum dentatum- Arrowwood-S
	Viburnum prunifolium- Black haw-S
	Viburnum reconitum- Arrowwood-S
	Viburnum trifolium- Carnberry viburnum-S
Campanulaceae	*Lobelia siphilitica*- Blue lobelia-unknown
Asteraceae-All Plants	*Achillea millefolim*- Yarrow
	Articum sp.- Burdock
	Aster novae-anglae- New England aster
	Aster pilosus- Hairy aster
	Aster sp.- Aster
	Cichorium intybus- Chickory
	Cirsium sp.- Thistle
	Chrysanthemum sp.- Daisy
	Conyza canadensis- Horseweed
	Erigeron annuus- Annual fleabane
	Eupatorium sp.- Bone-set
	Helianthus tuberosus- Jerusalem artichoke
	Hieracium venosum- Rattlesanke week

	Prenanthes altissima- White lettuce
	Rudbeckia hirta- Black-eyed susan
	Solidage sp. – Goldenrod
	Taraxacum officionale- Dandelion
Typhaceae	*Typha latifolia*- Cattail-P
Commelineaeae-All Plants	*Commelina sp.*- Dayflower
	Tradescantia virginiana- Spiderwort
Araceae – All Plants	*Arisaema triphyllum*- Jack-in-the-pulpit
	Symplocarpus foetidus- Skunk cabbage
Cyperaceae	*Carex sp.*- Sedge-unknown
	Cyperus sp.- Galingale-unknown
Poaceae- All unknown	*Agrostis perennans*
	Dactylis glomerata
	Phleum pratense
	Poa annua
	Setaria faberi
Poaceae- All unknown	*Tridens flava*
Liliaceae-All Plants	*Allium stellatum*- Wild onion
	Hemerocallis fulva- Day lily
	Ornithogalum umbellatum- Star of Bethlehem
	Polygonatum biflorum- Lesser solomon's seal
	Polygonatum canaliculatum- Greater solomon's seal
	Smilancina sp.- False solomon's seal
	Uvularia sessilifolia – Bellwort
	Yucca filamentosa- Yucca
Smilaceceae-All Plants	*Smilax rotunddifolia*- Cat-brier
	Smilax glauca-Catbrier
Iridaceae	*Sisyrichium sp.*- Bule-eyed grass-P

APPENDIX D

Wildlife Species Found or Expected in Fanwood

GENUS	COMMON NAME / SCIENTIFIC NAME
Mammalian species	Woodchuck- Marmota monax
	Meadow vole- Microtus pennsylvanicus
	Muskrat- Ondatra zibethicus
	Eastern cottontail- Syvilagus floridanus
	Raccoon- Procyon lotor
	Eastern gray squirrel- Sciurus carolinensis
	Oppossum- Didelphis marsupialis
	Skunk- Mephitis mephitis
	Masked shrew- Sorex cinereus
	Shorttail shrew- Blarina brevicauda
	Eastern mole- Scalopus aquaticus
	Little brown myotis - Myotis lucifugus
	Southern flying squirrel- Glaucomys volans
	White-footed mouse- Peromyscus leucopus
	Norway rat- Rattus norvegicus
	House mouse- Mus musculus
	Meadow jumping mouse- Zapus hudsonius
	White tailed deer- Odocileus virginianus
	Red fox- Vulpes
Avian species	Red-winged blackbird- Agelaius phoeniceus
	Yellow-headed blackbird- Xanthocephalus xanthocephalus
	Bluejay- Cyanocitta cristata
	Cardinal- Richmondena cardinalis
	Catbird- Dumetella carolinensis
	Yellow breasted chat- Icteria virens
	Black-capped chickadee- Parus atricapillus
	Cowbird- Molothrus ater
	Brown creeper - Certhia familiaris
	Eastern red crossbill- Loxia curvirostra

White-winged crossbill- Loxia leucoptera
Common crow- Corvus brachyrhynchos
Fish crow- Corvus ossifragus
Yellow-billed cuckoo- Coccyzus americanus
Black-billed cuckoo- Coccyzus erythropthalmus
Morning dove- Zenaidura macroura
Rock dove (pigeon)- Columbia livia
Mallard – Anas platyrhynchos
Eastern purple finch- Carpodacus purpureus
House finch- Carpodacus mexicanus
Yellow-shafted flicker- Colaptes auratus
Crested flycatcher- Myiarchus crinitus
Least flycatcher- Empidonax minimus
Olive sided flycatcher- Nuttallornis borealis
Yellow-bellied flycatcher- Empidonax flaviventris
Blue-grey gnatcatcher- Polioptila caerulea
Canada goose- Branta Canadensis
Goldfinch- Spinus tristis
Grackle- Quiscalus quiscula
Evening grosbeak- Hesperiphona vespertina
Rose-breasted grosbeck- Pheucticus ludovicianus
Herring gull- Larus argentatus*
Broadwing hawk- Buteo platypterus*
Red-shouldered hawk- Buteo lineatus*
Red-tailed hawk- Buteo jamaicensis*
Sharp-shinned hawk- Accipiter striatus*

Osprey- Pandion haliaetus*
Golden-crowned kinglet- Regulus calendula
Eastern meadowlark- Sturnella magna
Mockingbird- Mimus polyglottos
Nighthawk- Chordeiles minor
Red-breasted nuthatch- Sitta carolinrsis
Baltimore oriole- Icterus spurious
Kestral- Falco sparverius
Green heron- Butorides virescens
Ruby-throated hummingbird- Archilochus colubris

Junco- Junco hyemalis
Killdeer- Charadrius vociferous
Eastern kingbird- Tyannus tyrannus
Ovenbird- Seiurus aurocapillus
Screech owl- Otus asio
Eastern wood pewee- Contopus virens
Phobe- Sayornis phoebe
Redpoll- Acanthis hornemanni
American redstart- Setophaga ruticilla
Robin- Turdus migratorius
Yellow-bellied sapsucker- Sphyrapicus varius
Chipping sparrow- Spizella pallida
Field sparrow- Spizella pusilla
Fox sparrow- Passerella iliaca
House sparrow- Passer domesticus
Song sparrow- Melospiza geogriana
Tree sparrow- Spizella passerine
White-crowned sparrow- Zonotrichia leucophryus
White-throated sparrow- Zonotrichia albicollis
Starling- Sturnus vulgaris
Barn swallow- Hirundo rustica
Tree swallow- Iridoprocne bicolor
Chimmney swift- Chaetura pelagica
Scarlet tanager- Piranga olivacea
Thrasher- Toxostoma rufum
Hermit thrush- Hyloccichla guttata
Wood thrush- Hylocichla mustelina

Bay-breasted warbler- Dendroica castanea
Black and white warbler- Mniotila varia
Blackburnian warbler- Dendorica fusca
Blackpoll warbler- Dendroica striata
Solitary vireo- Vireo solitarius
Warbling vireo-Vireo gilvus
White-eyed vireo- Vireo griseus
Yellow-throated vireo-Vireo flavifrons
Turkey vulture- Catartes aura*
Tufted titmouse- Parus bicolor

	Rofous sided towhee- Pipilo erythrophthalmus
	Turkey- Meleagris gallopavo
	Veery- Hyocichla fuscens
	Red-eyed vireo- Vireo olivaceus
	Black-throated blue warbler- Dendroica caerulescens
	Black-throated green warbler- Dendroica virens
	Canada warbler- Wilsonia Canadensis
	Cape May warbler- Dendroica tigrina
	Chestnut-sided warbler- Dendroica pensylvanica
	Magnolia warbler- Dendroica magnolia
	Myrtle warbler- Dendroica coronata
	Nashville warbler- Vermivora ruficapilla
	Palm warbler- Dendronica palmarum
	Parula warbler- Parula Americana
	Pine warbler- Dendronica pinus
	Swaisnon's warbler- Limnothlypis swainsonii
	Wilson's warbler- Wilsonia pusilla
	Yellow warbler- Dendronica petecia
	Yellow- throated warbler- Dendronica dominica
	Downy woodpecker- Dendrocopos pubescens
	Hairy woodpecker- Dendrocopos villosus
	Pileated woodpecker- Dryocopus pileatus*
	Red-bellied woodpecker- Centrurs carolinus
	Louisiana waterthrush- Seiorus noveboracensis
	Carolina wren- Thryothorus ludovicianus
	House wren- Troglodytes aedon
	Winter wren- Troglodytes troglodytes
Amphibian and reptilian species	Eastern box turtle- Terrapene carolina
	Eastern garter snake- Thamnophis sirtalis
	Red-backed salamander- Plethodon cinereus
	American toad- Bufo americanus
	Northern spring peeper- Hyla crucifer
	Wood frog- Rana sylvatica

*These birds might be seen passing through the Borough at various times of the year, but lack of habitat prevents these species from being permanent residents.

List of avian species was compiled from records of the Fanwood Environmental Commission, Audobon Winter Bird Counts, and local residents with feeders.

APPENDIX E

Historic Buildings in the Borough of Fanwood

DATE	ADDRESS	HISTORY
	Homes Built Before 1800	
c. 1790	281 Terrill	The first owner was Enoch Terrill whose sons fought in the war of 1812. Also owned by Andrew Farley House. Has been demolished
c.1790	100 N. Martine Avenue	Owned by W. Randall in 1862; later by John and Charles Kyte; Kyte sisters ran a boarding house in 1890's
c.1790	185 Westfield Road 189 Westfield Road	Colonial farmhouse with 2 rooms; part of the barn is the peak of the garage on adjacent property; owned by C.R. Anderson in 1862; site of the State's largest northern catalpa.
	Homes Built Between 1800 and 1862	
c.1830	61 Woodland Avenue	Property part of estate and deed of Hannah Darby in 1830; later owned by Sarah Hetfield on 1902 County map.
c.1830	75 N. Martine Avenue	Original farmhouse built on pre-revolutionary foundation; owned in 1830 by Russell; called the Homestead in 1895. Demolished by Borough; site of current Borough Hall
c. 1850	99 S. Martine Avenue – house 11 MacLennan Road - barn	1862 map and 1882 maps show owner to be A. Hoggett; a windmill 11 MacLennan Road-barn once stood to the right of the drive and supplied water to house, barn, and Fanwood's first fire hydrant; original rooms may date to revolution. Later owned by George Kyte, an early Fanwoood Mayor
c.1860	295 Midway Avenue	Original RR depot when tracks ran Midway Avenue. Was depot until 1875 when property was sold to M. Young.
c. 1860	147 King Street	Property purchased by Manning family in 1857; located on Wheelbarrow Lane, now King Street.

DATE	ADDRESS	HISTORY
	Homes Built Between 1862 and 1882	
c.1874	North Avenue	Second train depot for the CNJ; now the Fanwood Community Center.
c.1875	199 N. Martine Ave	House located on estate of Harry Ackerman in 1882.
c. 1875	203 N. Martine Avenue	House located on estate of Warren Ackerman in 1882. Later sold to Peter Frazer.
c. 1875	211 N. Martine Avenue	House located on estate of Warren Ackerman. Orchard once stood behind house.
c. 1875	221 N. Martine Avenue	House located on estate of Warren Ackerman in 1882.
c. 1880	75 N. Martine Avenue	Carriage house on property of W. Cooper in 1882. Current site of municipal offices. The carriage house serves as a theater for community functions.
c.1880	270 North Ave.	J.H. Martine carriage house; moved to this location in late 1930's; Martine – Urner home destroyed.
c. 1880	95 Hunter Avenue	Farmhouse with fieldstone built by Andrew Farley
c. 1880	455 Terrill Road	In 1882 owned by Briggs; later maps show owner, J.Brick, employee of the railroad
	Homes Built Between 1882 and 1890	
c. 1885	66 Woodland Avenue	Home built by Thomas Young, Fanwood's first Mayor, for his daughter. Home has been demolished.
c. 1885	69 Woodland Avenue	Property part of original subdivision of 1830; home owned by Dr. Westcott.
c. 1885	60 N. Martine Avenue	Earliest recorded owner, R.B. Reilly; house vacant for many years and considered haunted until purchased by the Hope family in 1902.
c. 1885	67 N. Martine Avenue	Home of Mary E. Goodwin in 1902
c. 1885	157 North Avenue	Farmhouse owned by the CNJLI Co.

DATE	ADDRESS	HISTORY
c. 1885	215 North Avenue	Home of Burton Hall in 1895. Hall was a member of the first Board of Health.
c. 1885	320 North Avenue	Home of A.D Beeken in 1895. Member of first Borough Council
c. 1885	324 North Avenue	No ownership listed on early maps.
c.1885	350 North Avenue	No ownership listed on early maps.
c. 1887	21 Hunter Avenue	Carriage House of the Kleb family. Later owned by Beardsley. House Destroyed.
c. 1887	145 North Avenue	First owned by West family. Later sold to CNJLI Co. and then to Van Hoosens. Original foundation much earlier date.
c. 1890	67 Tillotson Road	Now ownership listed on early maps. Demolished.
c.1890	76 Tillotson Avenue	Owned by N.K. Walker in 1902.
c. 1890	101 North Avenue	Home of George Carter in 1902
c. 1890	104 North Avenue	No owner on early maps
c. 1890	141 North Avenue	Home of Charles Beardsley, owner of land now Arlene Court, Pleasant Avenue and Birchwood Terrace
c. 1890	146 North Avenue	Home of G. Robinson in 1902.
c. 1890	241 North Avenue	Home of Dr. Frank Westcott; appointed Borough physician in 1895 for a yearly sum of $1.00.
c. 1890	266 North Avenue	1895 post office and library. In 1896 Miss Elizabeth Kyte held school in one room of the library
c. 1890	311 North Avenue	Home of Mrs. E. Man in 1902.
c. 1890	99 N. Martine Avenue	Home of W.E. Collins in 1902
c. 1890	105 N. Martine Avenue	Home of A.M. Hoar, one of Fanwood's early mayors.
c. 1890	115. N. Martine Avenue	House owned by A.D. Beeken.
c. 1890	127 N. Martine Avenue	Owned by CNJLI Co. in 1902.

DATE	ADDRESS	HISTORY
c. 1890	133 N. Martine Avenue	Home of the Hayes sisters.
c. 1890	177 N. Martine Avenue	Owned by A.H. McConn in 1902.
c. 1890	193 N. Martine Avenue	Home of A. Strong in 1902.
c. 1890	230 South Avenue	C.A. Smith Coal Co.; a spur of the railroad crossed South Avenue to this building. To be demolished
c. 1890	477 Terrill Road	Home of A. Tromantano, who worked in Public Works Department with Hans Lambertsen. House was totally refurbished.
c. 1890	306 South Avenue	Home of first Borough Clerk, Mr. Hall. His yearly salary is 1885 was $35.00. House demolished
c. 1890	313 South Avenue	No ownership on early maps. Demolished
c. 1890	314 South Avenue	Home of G. Neider. Demolished.
c. 1890	85 S. Martine Avenue	Owned by CNJLI Co. in 1902.
c. 1890	125 Hunter Avenue	Farmhouse with fieldstone foundation. Owned by James Farley
c. 1892.	225 North Avenue	Home of Walter S. Force, first Borough Tax Collector. Later owned by Dr. Munger, assistant to Dr.Wescott. Munger later became Chief surgeon of Muehlenburg.
c. 1892	95 North Avenue	Home of A.L. Pentz (Frentz).
c. 1893	86 Forest Road	Home of L.J. Ellis on 1902 map.
c. 1893	193 South Avenue	First grocers and butcher shop in Fanwood - Baker and Meade. Augustus Sheelan was first clerk and later owner. Central Crossing Bridge known as Sheelan's Bridge to long time Fanwood residents.
c. 1894	25 Tillotson Road	Property owned by Benjamin Urner who built house for his daughter as a gift when she married Dr. Wm. Gibbs. Dr. Gibbs worked with Thomas Edison on sound recording devices and was a member of Fanwood's first Board of Health.

DATE	ADDRESS	HISTORY
c. 1895	208 Terrill Road	Two-room residence with chestnut siding owned by S. Venezia
c. 1895	45 N. Martine Avenue	Home of R. Stanbery, Tax Assessor for Fanwood in 1895.
c. 1895	35 N. Martine Avenue	Home owned by Dr. Westcott. Same as 241 North Avenue.
c. 1896	40 Forest Road	Home of J.P. Stevens, mill company owner. Site of largest European Turkish oak in the State.
c. 1898	83. S. Martine Avenue	Log cabin with fireplace built for an exposition in New York City; logs from Maine, building moved to Fanwood in early 1900's. No longer in Fanwood.
c. 1900	15 North Avenue	Home of Hans Lamberstsen, first marshall of Fanwood, pound-keeper, and road supervisor. Worked for the sum of $1.00 per year plus $0.02 an hour.
c. 1900	74 LaGrande Avenue	Home of J. Rusi, employee of Public Works Department.
c. 1900	180 S. Martine Avenue	Home may date to 1850's. Owned by J. Squire in 1862; then by Dr. Chase who sold to W.W. Coriell, no structure shown on 1902 map; but this home may be a reconstruction of the Squire Home.

APPENDIX F

Useful Websites

ASSOCIATION OF NEW JERSEY ENVIRONMENTAL COMMISSIONS (ANJEC)	www.anjec.org
NEW JERSEY STATE – General Information	www.nj.gov
NEW JERSEY DEPARTMENT OF ENVIRONMENTAL PROTECTION (NJDEP)	www.nj.gov/dep
NEW JERSEY GEOGRAPHICAL INFORMATION SYSTEMS (GIS) [Geoweb]	http://www.nj.gov/dep/gis/geowebsplash.htm
NEW JERSEY GEOLOGICAL SURVEY	www.njgovda/org
NEW JERSEY STATE PLAN	www.nj.gov/emp/index.shtml
NEW JERSEY ENERGY MASTER PLAN	www.nj.gov/emp/index.shtml
NATIVE PLANT SOCIETY OF NEW JERSEY (NPSNJ)	www.npsnj.org/index.htm
NPSNJ MANUAL OF CONSTRUCTION RAIN GARDENS	www.npsnj.org/rain_gardens_home.htm
RUTGER SCHOOL OF ENVIRONMENTAL & BIOLOGICAL SCIENCES (formerly Cook College) [New Jersey Agriculture Experiment Station]	http://njaes.rutgers.edu http://cookce.rutgers.edu/index.html

NATURAL RESOURCES CONSERVATION SERVICE – NEW JERSEY (INFORMATION ON SOILS)	**WWW.NJ.NRCS.USDA.GOV/TECHNICAL/SOILS/INDEX.HTML#SOILSURVEYPRODUCTS**
UNION COUNTY	http://unioncountynj.org
WEATHER INFORMATION	www.weather.com
BOROUGH OF FANWOOD	www.Fanwoodnj.org
RARITAN RIVER BASIN – WATERSHED MANAGEMENT	http://raritanbasin.org/index.htm
NJDEP BUREAU OF AIR MONITORING WEBSITE	HTTP://WWW.STATE.NJ.US/DEP/AIRMON
USEPA Air Now	http://www.airnow.gov
USEPA National Ambient Air Quality Standards (NAAQS)	http://www.epa.gov/air/criteria.html

ENVIRONMENTAL RESOURCES INVENTORY FEEDBACK FORM

Date: _____

Name: _____

Address: _____

Phone #: _____ **Email:** _____

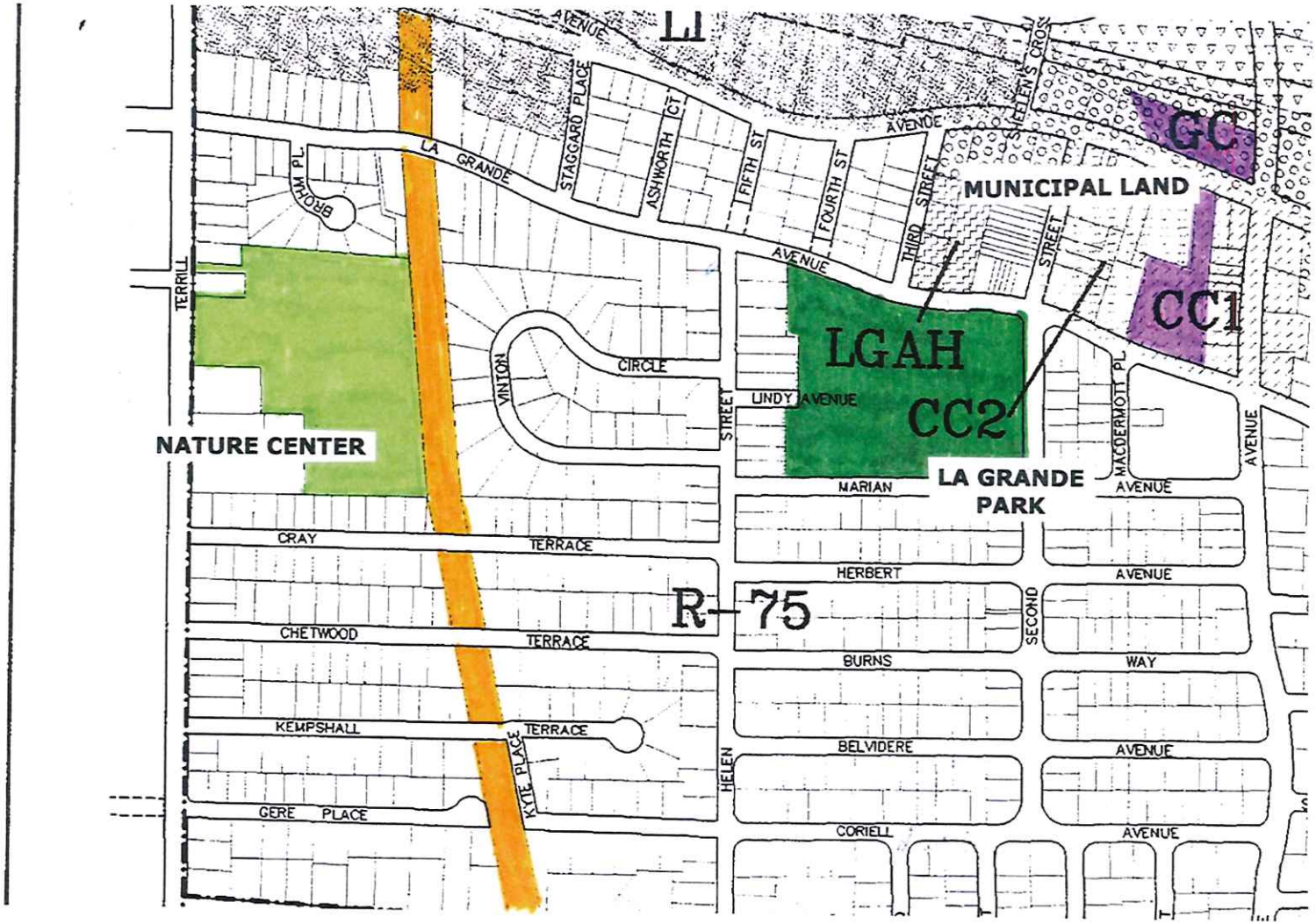
Chapter & Section #: _____

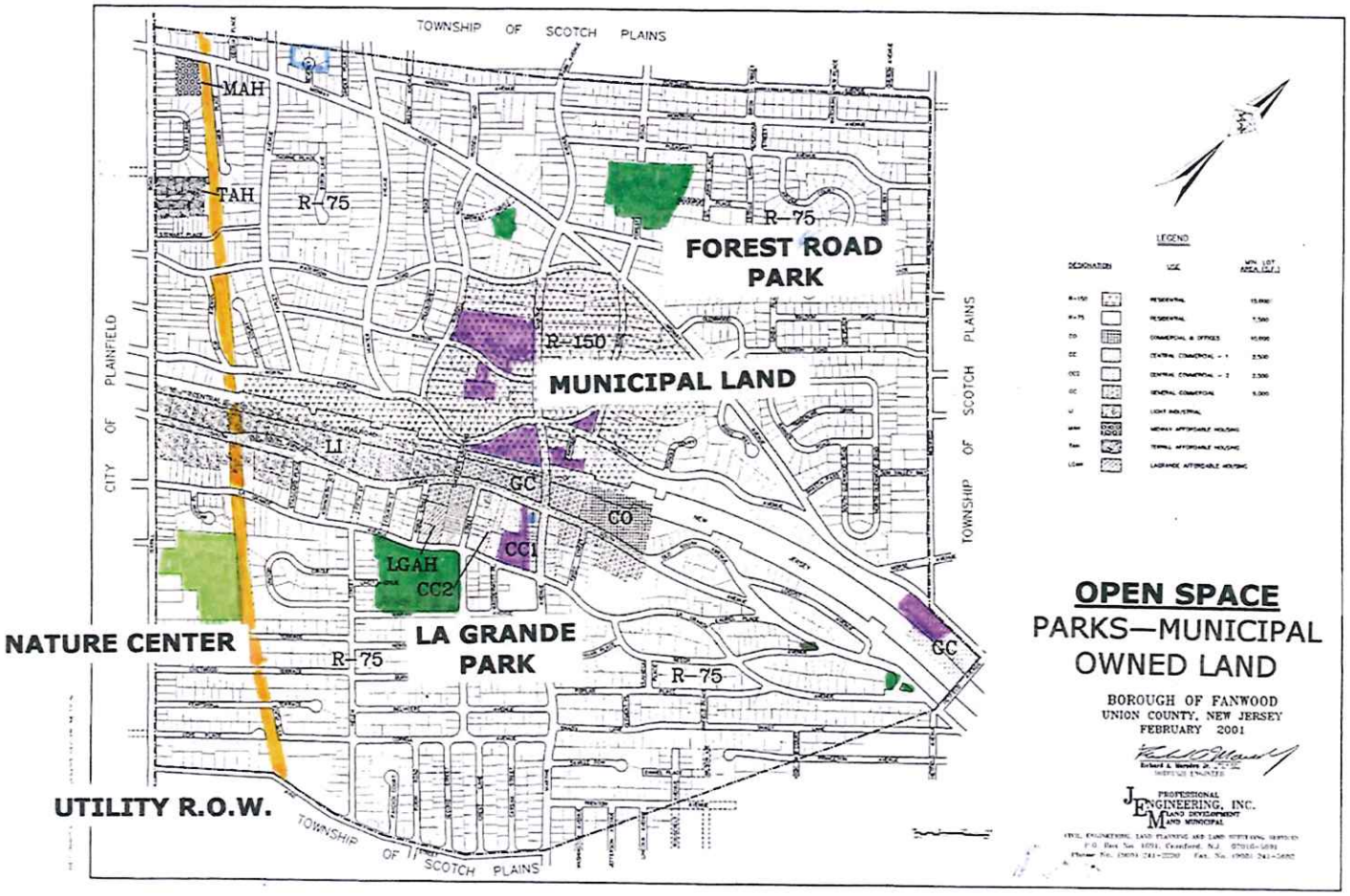
Comment/ Suggestion: *Please use additional sheets, if required*

Thank you for your feedback! Please return form to Mailbox - Fanwood Environmental Commission in the Borough Hall.

MAP

SECTION


LI
GC
MUNICIPAL LAND
CC1
LGAH
CC2
NATURE CENTER
LA GRANDE PARK
R-75
LA GRANDE AVENUE
STAGGARD PLACE
ASHWORTH CT
FIFTH ST
FOURTH ST
THIRD STREET
STREET
BROHM PL
TERRILL
VINTON CIRCLE
LINDY AVENUE
MACDERMOTT PL
AVENUE
MARIAN AVENUE
CRAY TERRACE
HERBERT AVENUE
SECOND
CHETWOOD TERRACE
BURNS WAY
KEMPSHALL TERRACE
KYTE PLACE
BELVIDERE AVENUE
HELEN
GERE PLACE
CORIELL AVENUE
UTILITY R.O.W.


TOWNSHIP OF SCOTCH PLAINS
CITY OF PLAINFIELD
TOWNSHIP OF SCOTCH PLAINS
TOWNSHIP OF SCOTCH PLAINS
MAH
TAH
R-75
R-75
FOREST ROAD PARK
R-150
MUNICIPAL LAND
LI
GC
CO
CC1
LGAH
CC2
NATURE CENTER
LA GRANDE PARK
R-75
R-75
GC
UTILITY R.O.W.
LEGEND
OPEN SPACE
PARKS—MUNICIPAL OWNED LAND
BOROUGH OF FANWOOD
UNION COUNTY, NEW JERSEY
FEBRUARY 2001
PROFESSIONAL ENGINEERING, INC.
LAND DEVELOPMENT
LAND MUNICIPAL

Soil Map—Somerset County, New Jersey, and Union County, New Jersey
(SOILS--FANWOOD & LOCAL AREA)

Map Scale: 1:22,700 if printed on A landscape (11" x 8.5") sheet.

N

0 300 600 1200 1800 Meters

0 1000 2000 4000 6000 Feet

Map projection: Web Mercator Corner coordinates: WGS84 Edge tics: UTM Zone 18N WGS84

MAP LEGEND

Area of Interest (AOI)
- Area of Interest (AOI)

Soils
- Soil Map Unit Polygons
- Soil Map Unit Lines
- Soil Map Unit Points

Special Point Features
- Blowout
- Borrow Pit
- Clay Spot
- Closed Depression
- Gravel Pit
- Gravelly Spot
- Landfill
- Lava Flow
- Marsh or swamp
- Mine or Quarry
- Miscellaneous Water
- Perennial Water
- Rock Outcrop
- Saline Spot
- Sandy Spot
- Severely Eroded Spot
- Sinkhole
- Slide or Slip
- Sodic Spot
- Spoil Area
- Stony Spot
- Very Stony Spot
- Wet Spot
- Other
- Special Line Features

Water Features
- Streams and Canals

Transportation
- Rails
- Interstate Highways
- US Routes
- Major Roads
- Local Roads

Background
- Aerial Photography

MAP INFORMATION

The soil surveys that comprise your AOI were mapped at 1:24,000.

Please rely on the bar scale on each map sheet for map measurements.

Source of Map: Natural Resources Conservation Service
Web Soil Survey URL:
Coordinate System: Web Mercator (EPSG:3857)

Maps from the Web Soil Survey are based on the Web Mercator projection, which preserves direction and shape but distorts distance and area. A projection that preserves area, such as the Albers equal-area conic projection, should be used if more accurate calculations of distance or area are required.

This product is generated from the USDA-NRCS certified data as of the version date(s) listed below.

Soil Survey Area: Somerset County, New Jersey
Survey Area Data: Version 15, Oct 6, 2017

Soil Survey Area: Union County, New Jersey
Survey Area Data: Version 11, Oct 6, 2017

Your area of interest (AOI) includes more than one soil survey area. These survey areas may have been mapped at different scales, with a different land use in mind, at different times, or at different levels of detail. This may result in map unit symbols, soil properties, and interpretations that do not completely agree across soil survey area boundaries.

Soil map units are labeled (as space allows) for map scales 1:50,000 or larger.

Date(s) aerial images were photographed: Dec 31, 2009—Feb 26, 2017

The orthophoto or other base map on which the soil lines were compiled and digitized probably differs from the background imagery displayed on these maps. As a result, some minor shifting of map unit boundaries may be evident.

Map Unit Legend

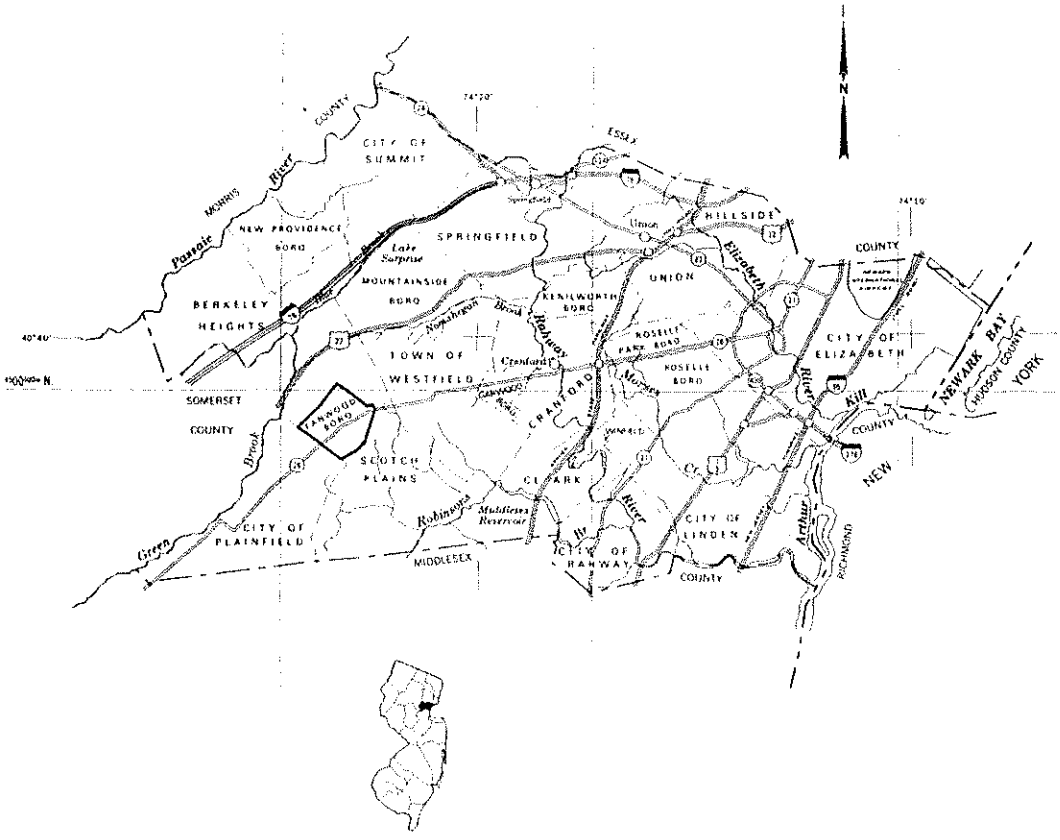
Map Unit Symbol	Map Unit Name	Acres in AOI	Percent of AOI
BhnBr	Birdsboro silt loam, 2 to 6 percent slopes, rarely flooded	0.3	0.0%
BoyAt	Bowmansville silt loam, 0 to 2 percent slopes, frequently flooded	0.1	0.0%
RorAt	Rowland silt loam, 0 to 2 percent slopes, frequently flooded	0.0	0.0%
Subtotals for Soil Survey Area		**0.4**	**0.0%**
Totals for Area of Interest		**2,030.3**	**100.0%**

Map Unit Symbol	Map Unit Name	Acres in AOI	Percent of AOI
BhpBr	Birdsboro-Urban land complex, 0 to 6 percent slopes, rarely flooded	269.6	13.3%
BogB	Boonton loam, 3 to 8 percent slopes	8.3	0.4%
BohC	Boonton moderately well drained gravelly loam, 8 to 15 percent slopes	0.9	0.0%
BohD	Boonton moderately well drained gravelly loam, 15 to 25 percent slopes	2.8	0.1%
BouD	Boonton-Urban land complex, 15 to 25 percent slopes	3.4	0.2%
BovB	Boonton-Urban land-Haledon complex, 0 to 8 percent slopes	1,019.8	50.2%
CarbAt	Catden-Timakwa mucks, 0 to 2 percent slopes, frequently flooded	0.6	0.0%
DunB	Dunellen sandy loam, 3 to 8 percent slopes	1.6	0.1%
FmhAt	Fluvaquents, loamy, 0 to 3 percent slopes, frequently flooded	0.1	0.0%
HakA	Haledon loam, 0 to 3 percent slopes	18.2	0.9%
HakB	Haledon loam, 3 to 8 percent slopes	11.7	0.6%
HatB	Haledon-Urban land-Hasbrouck complex, 0 to 8 percent slopes	418.9	20.6%

Map Unit Symbol	Map Unit Name	Acres In AOI	Percent of AOI
HctAr	Hasbrouck silt loam, 0 to 3 percent slopes, rarely flooded	33.8	1.7%
RarAr	Raritan silt loam, 0 to 3 percent slopes, rarely flooded	6.2	0.3%
RasAr	Raritan-Urban land-Passaic complex, 0 to 3 percent slopes, rarely flooded	34.1	1.7%
TunE	Tunkhannock gravelly loam, 25 to 45 percent slopes	2.4	0.1%
UdkttB	Udorthents, loamy substratum, 0 to 8 percent slopes	36.0	1.8%
UdrB	Udorthents, refuse substratum, 0 to 8 percent slopes	6.5	0.3%
UR	Urban land	155.0	7.6%
Subtotals for Soil Survey Area		**2,029.9**	**100.0%**
Totals for Area of Interest		**2,030.3**	**100.0%**

NATURAL RESOURCES INVENTORY

Borough of Fanwood
Union County
New Jersey



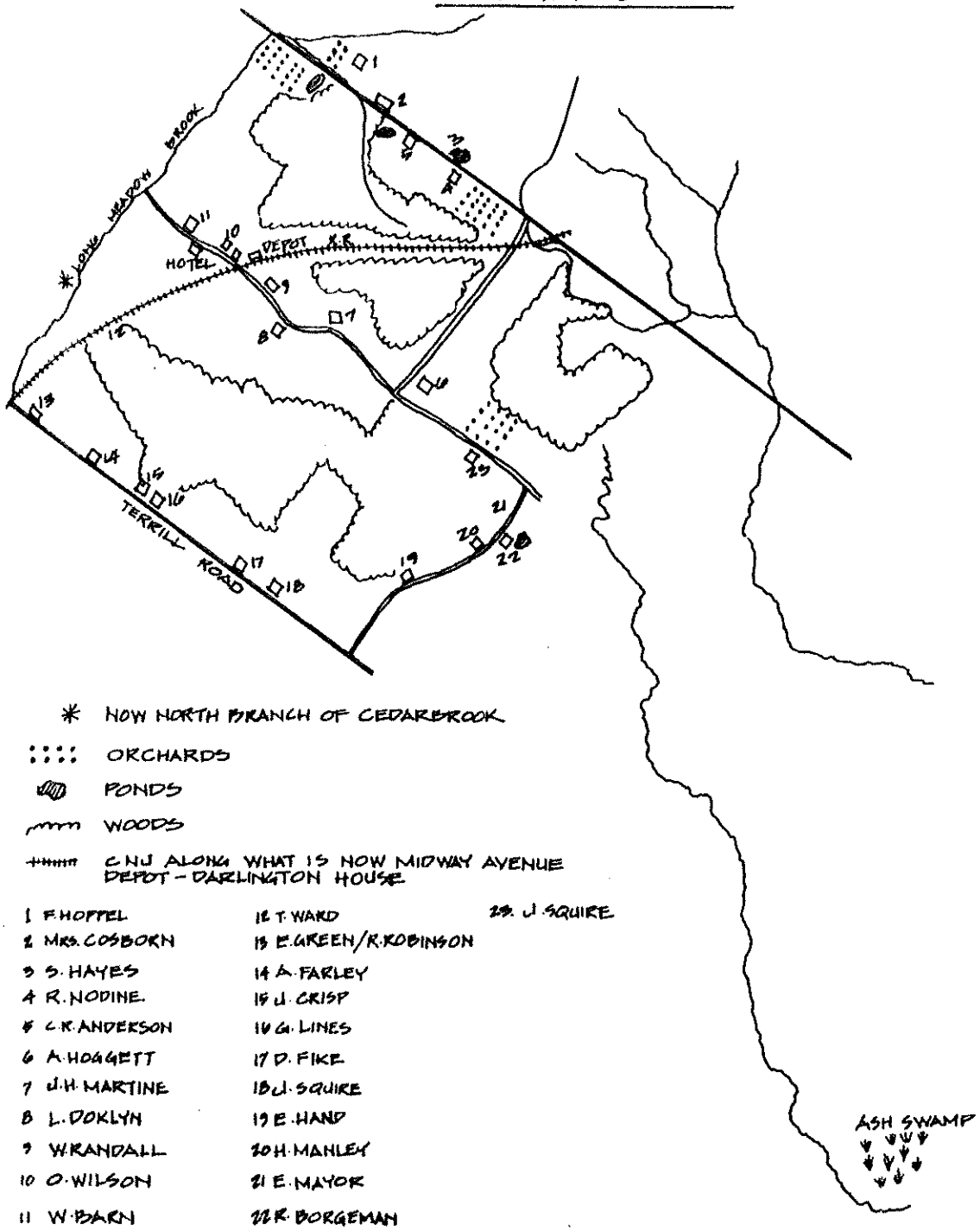
SOURCE:
U.S. DEPARTMENT OF AGRICULTURE, SOIL CONSERVATION SERVICE, 1991
UNION COUNTY, NEW JERSEY -
DRAFT SOIL SURVEY.

MAP 1

LOCATION MAP

MAP 2

1862 TOPOGRAPHICAL MAP OF UNION COUNTY



* NOW NORTH BRANCH OF CEDARBROOK

:::: ORCHARDS

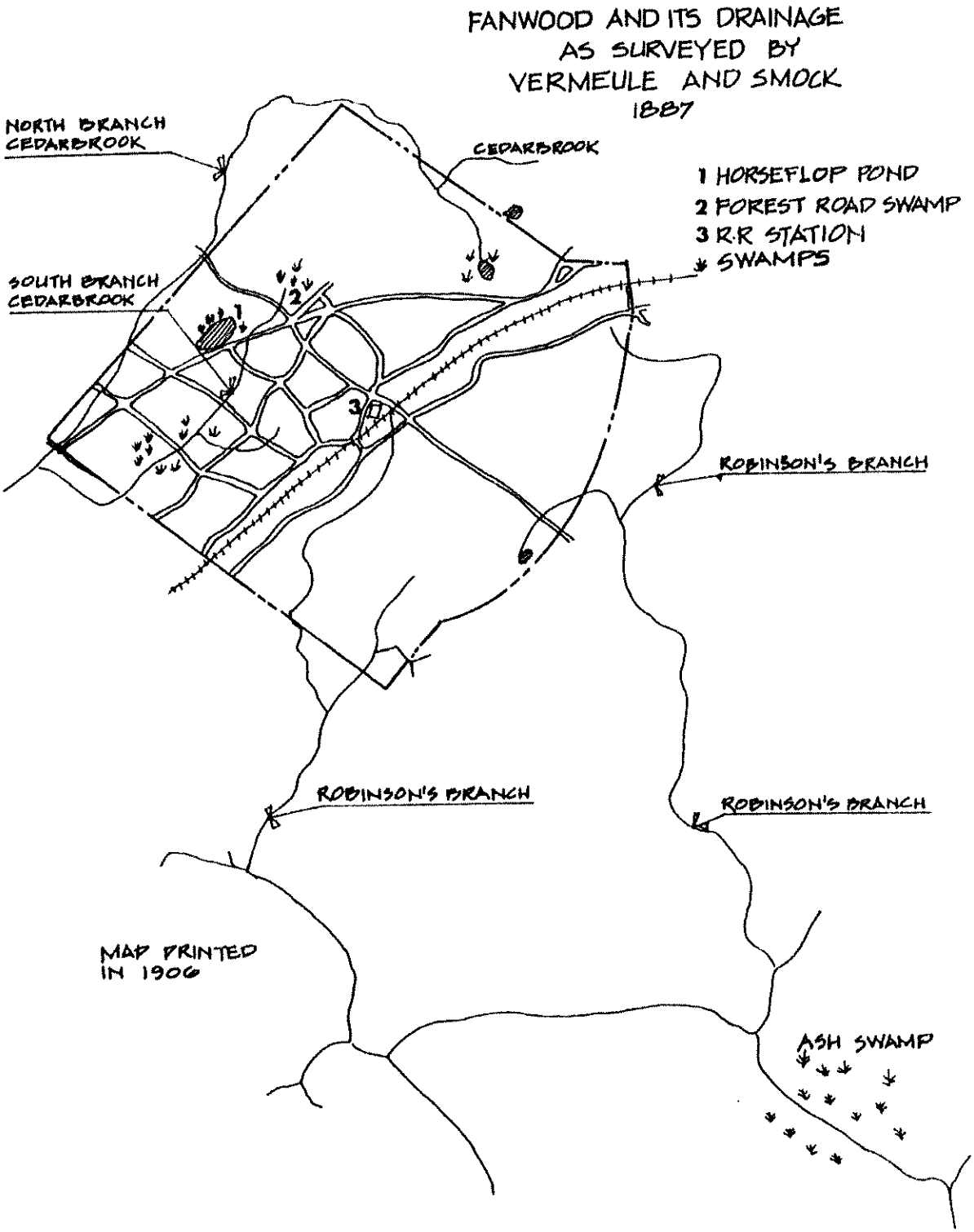
POND

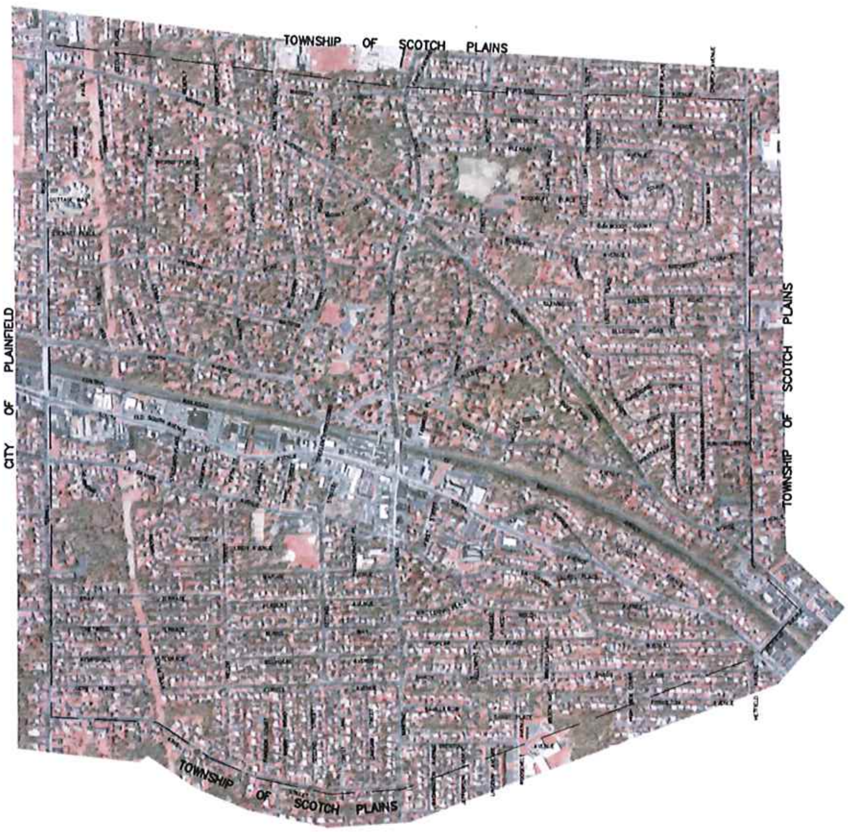
WOODS

CNJ ALONG WHAT IS NOW MIDWAY AVENUE
DEPOT – DARLINGTON HOUSE

1 F. HOPPEL
2 MRS. COSBORN
3 S. HAYES
4 R. NODINE
5 C.K. ANDERSON
6 A. HOAGGETT
7 J.H. MARTINE
8 L. DOKLYN
9 W. RANDALL
10 O. WILSON
11 W. BARN
12 T. WARD
13 E. GREEN/R. ROBINSON
14 A. FARLEY
15 J. CRISP
16 G. LINES
17 D. FIKE
18 J. SQUIRE
19 E. HAND
20 H. MANLEY
21 E. MAYOR
22 R. BORGEMAN
23 J. SQUIRE

MAP 3


FANWOOD AND ITS DRAINAGE
AS SURVEYED BY
VERMEULE AND SMOCK
1887
NORTH BRANCH
CEDARBROOK
CEDARBROOK
1 HORSEFLOP POND
2 FOREST ROAD SWAMP
3 R.R STATION
SWAMPS
SOUTH BRANCH
CEDARBROOK
1
2
3
ROBINSON'S BRANCH
ROBINSON'S BRANCH
ROBINSON'S BRANCH
MAP PRINTED
IN 1906
ASH SWAMP



NO.	DATE	DESCRIPTION	CHKD.	APPRD.

REVISIONS

DESIGNED:
DRAWN: P.J.M.
OFFICE CHECKED:

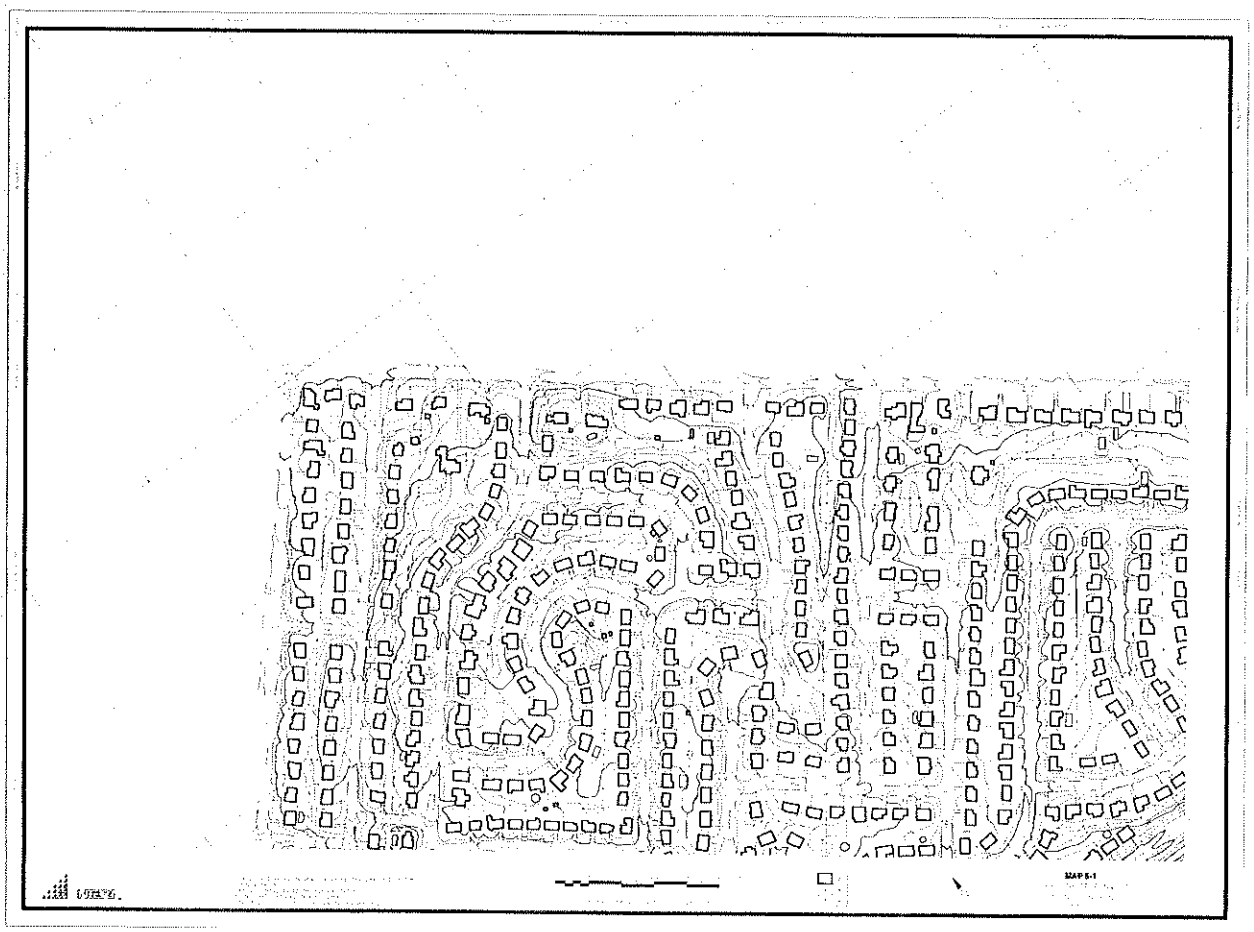
MAP AND DATA REFERENCES:

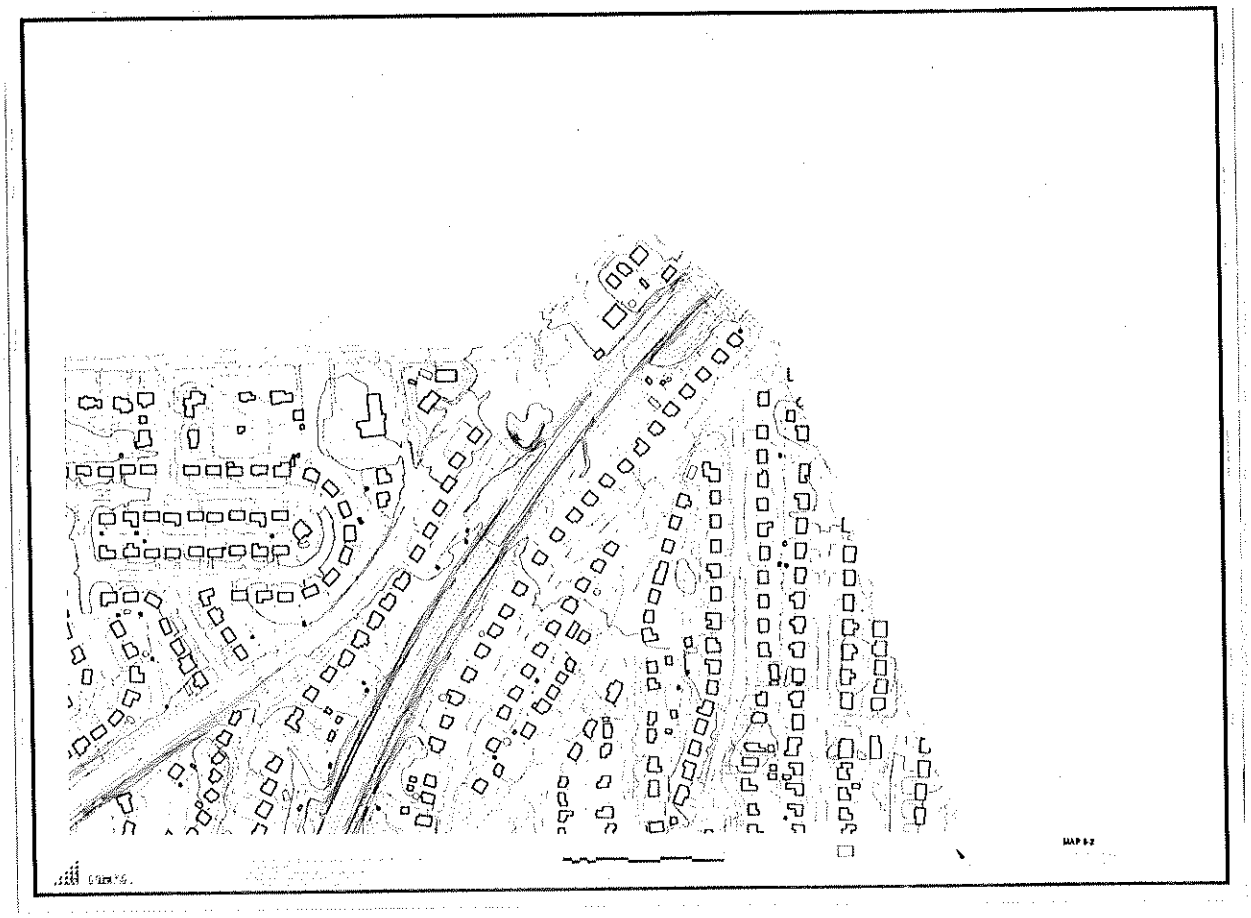
AERIAL PHOTO – 2002 DIGITAL ORTHO PHOTOS IMAGE TILES [illegible] AVAILABLE FROM N.J. OFFICE OF INFORMATION TECHNOLOGY, OFFICE OF GIS.
FLIGHT DATES (FOR STATE) WERE MARCH THROUGH APRIL 2002

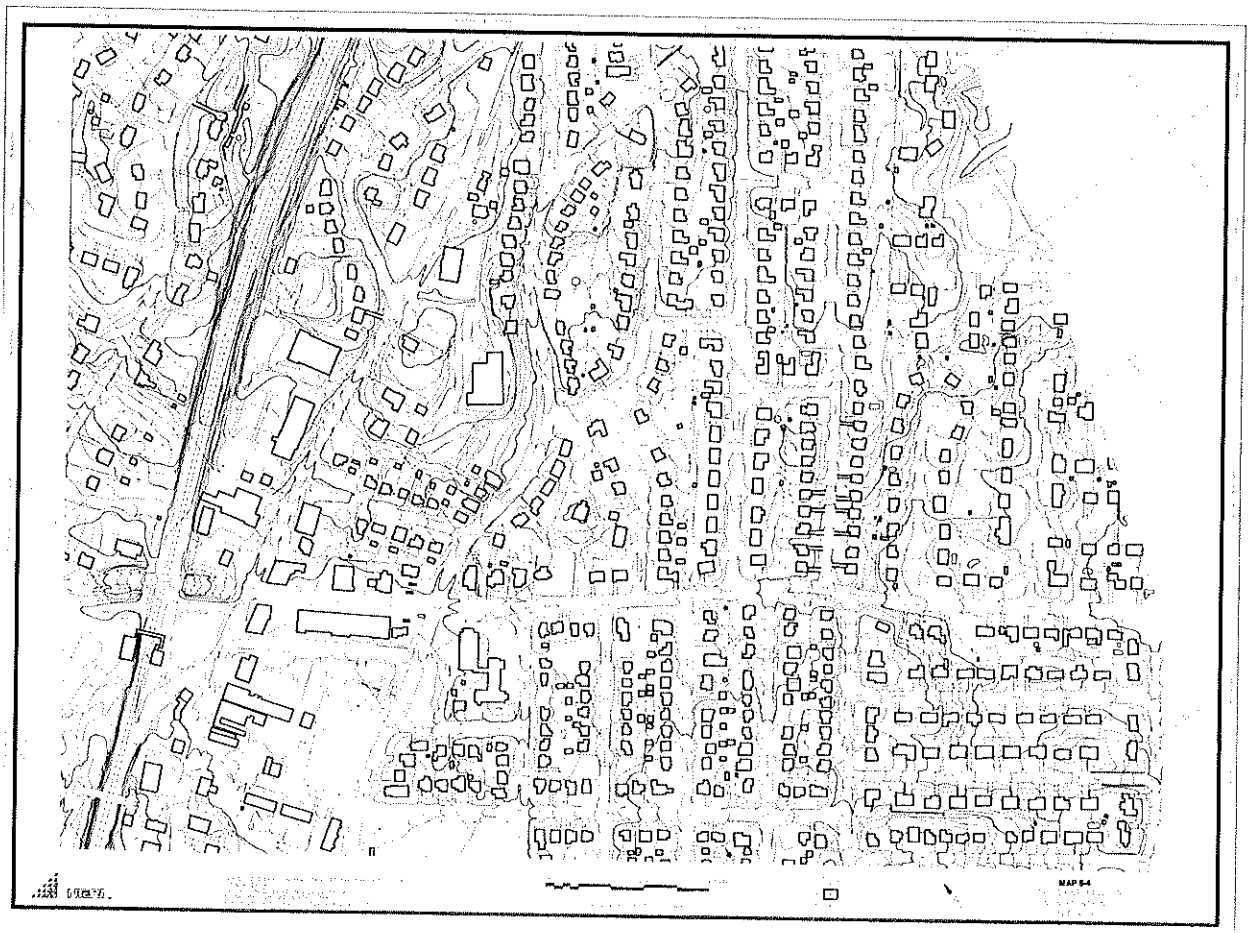
KUPPER ASSOCIATES
N.J. CERTIFICATE OF AUTHORIZATION #24GA2795660
15 STELTON ROAD, PISCATAWAY, N.J. 08855-0036
732-752-5600

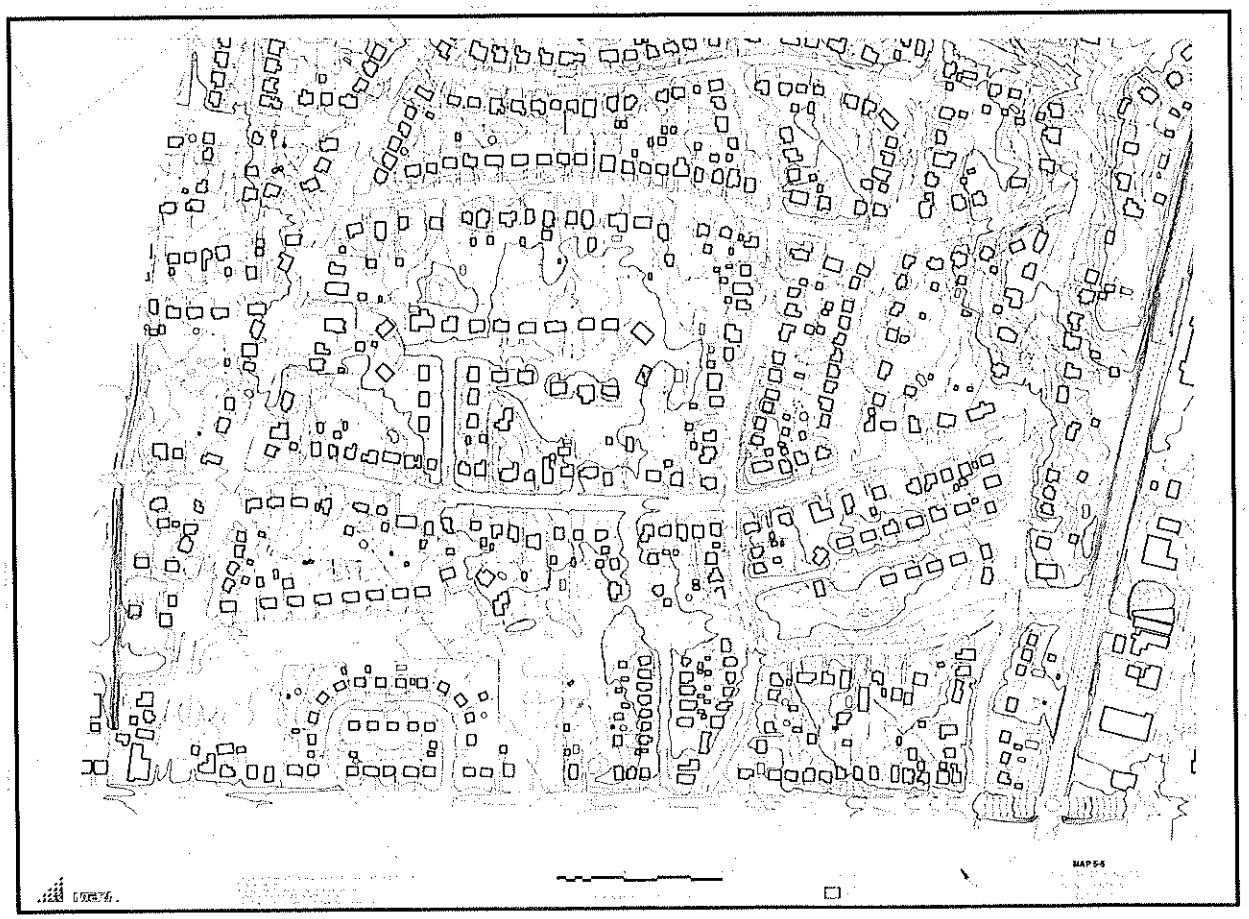
NATURAL RESOURCES INVENTORY
MAP 4
AERIAL PHOTO MAP
BOROUGH OF FANWOOD UNION COUNTY
SCALE: 1" = 400' N.J. DATE: 3/06

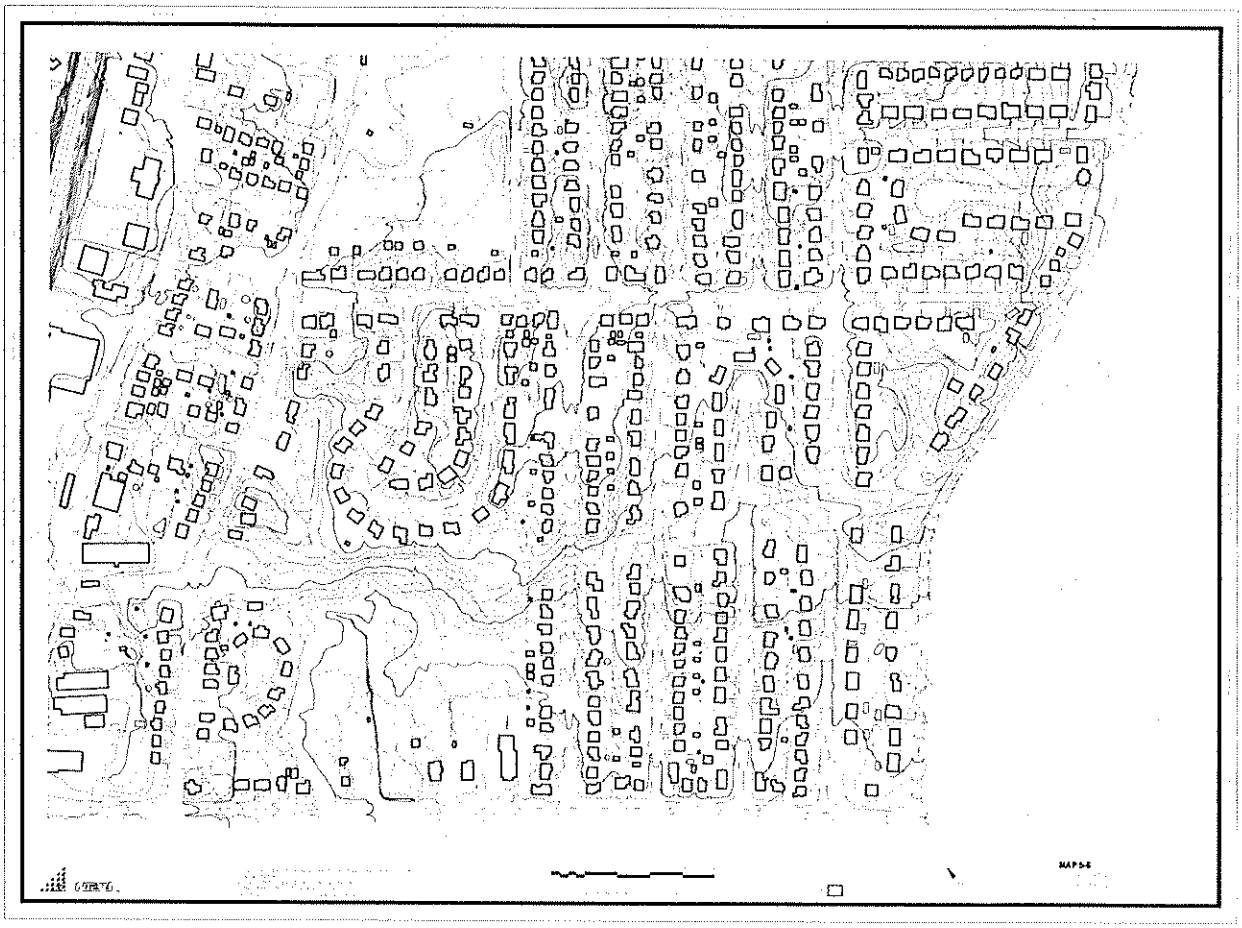
1 OF 1
275210.01
CONTRACT NO.

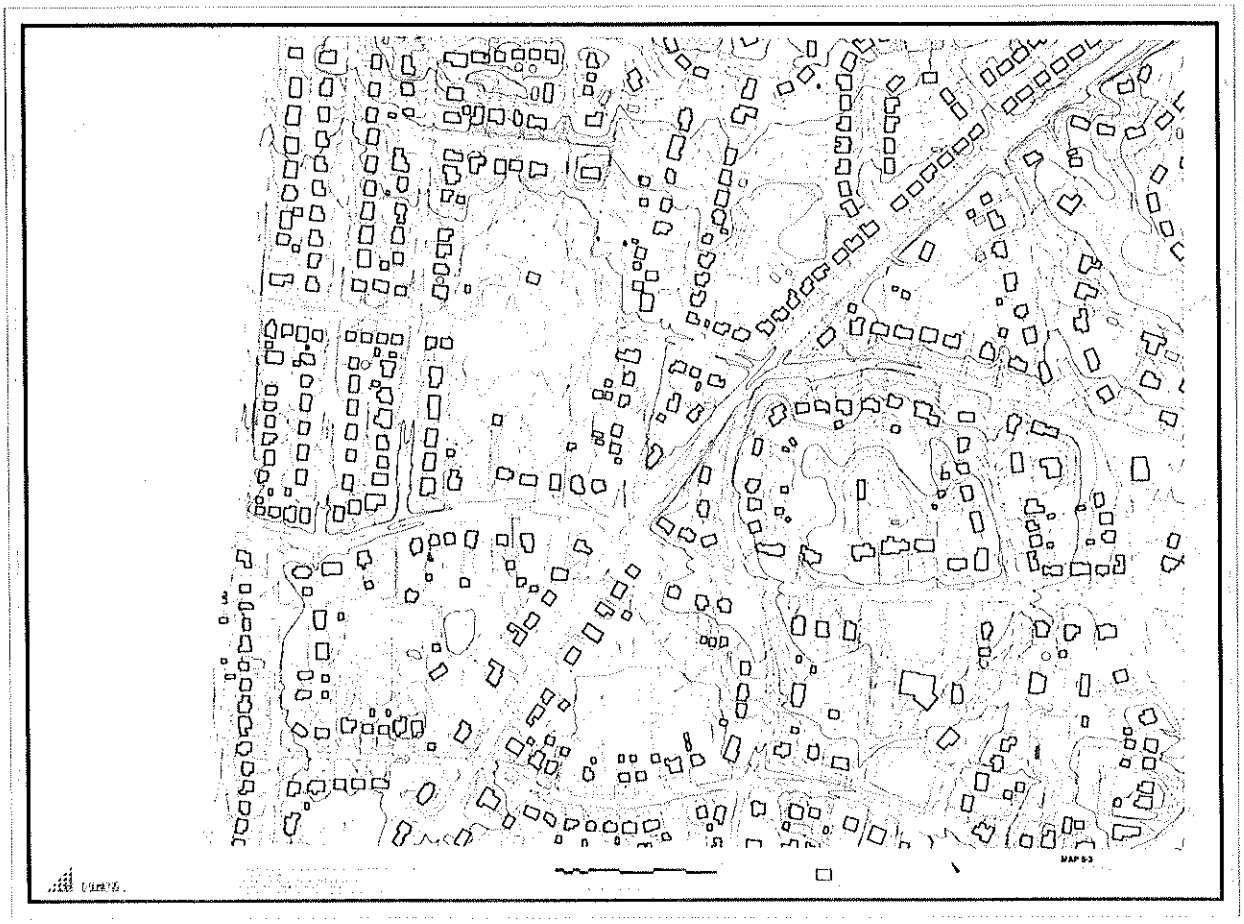


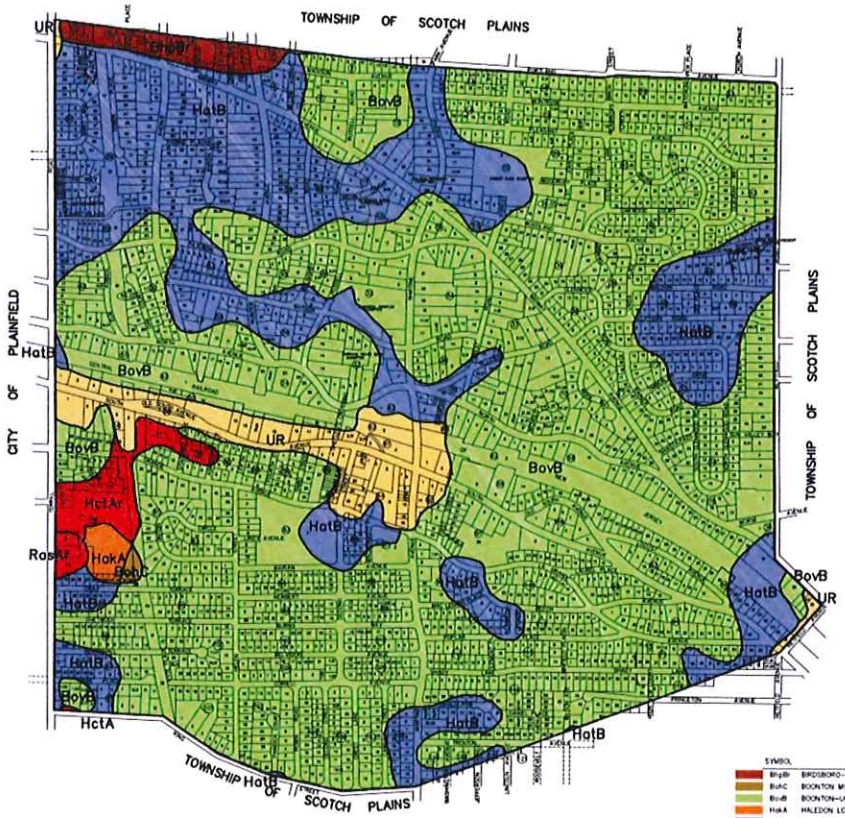












NO.	DATE	DESCRIPTION	CHK'D	APPR'D
		REVISIONS		

DESIGNED:
DRAWN: P.J.M.
OFFICE CHECKED:

MAP AND DATA REFERENCES:
SOILS – NJDEP SHAPE FILE (UN-SSURGO) DATED 2/14/06
CLIPPED TO MUNICIPAL BOUNDARY

KUPPER ASSOCIATES
N.J. CERTIFICATE OF AUTHORIZATION #24GA27995600
15 STELTON ROAD, PISCATAWAY, N.J. 08855–0036
732–752–5600

NATURAL RESOURCES INVENTORY
MAP 6
SOILS MAP
BOROUGH OF FANWOOD UNION COUNTY
SCALE: 1" = 400' N.J. DATE: 3/06

1 1
27 01
CONTRACT NO.

NATURAL RESOURCES INVENTORY

Borough of Fanwood
Union County
New Jersey

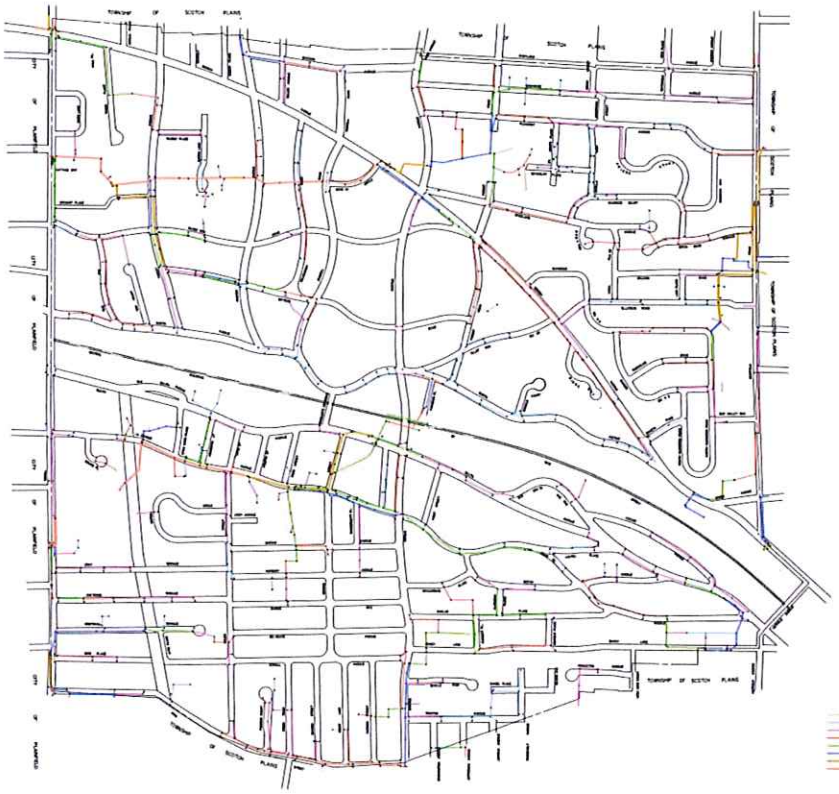
LEGEND:

- WATERSHED RIDGE LINE
- DRAINAGE BASIN
- FLOOD PRONE

Source: BOROUGH OF FANWOOD

MAP 7

FLOOD PRONE & DRAINAGE AREAS



LEGEND

DESCRIPTION	MAP COUNT
6" OR LESS STORM DRAIN	1,100 L.F.
7" TO 12" STORM DRAIN	19,500 L.F.
13" TO 15" STORM DRAIN	32,500 L.F.
16" TO 18" STORM DRAIN	24,700 L.F.
19" TO 24" STORM DRAIN	17,300 L.F.
25" TO 36" STORM DRAIN	10,300 L.F.
37" TO 48" STORM DRAIN	7,600 L.F.
49" OR LARGER STORM DRAIN	5,700 L.F.
INLET	927
MANHOLE	240

NO.	DATE	DESCRIPTION	CHK'D	APPR'D
		REVISIONS		

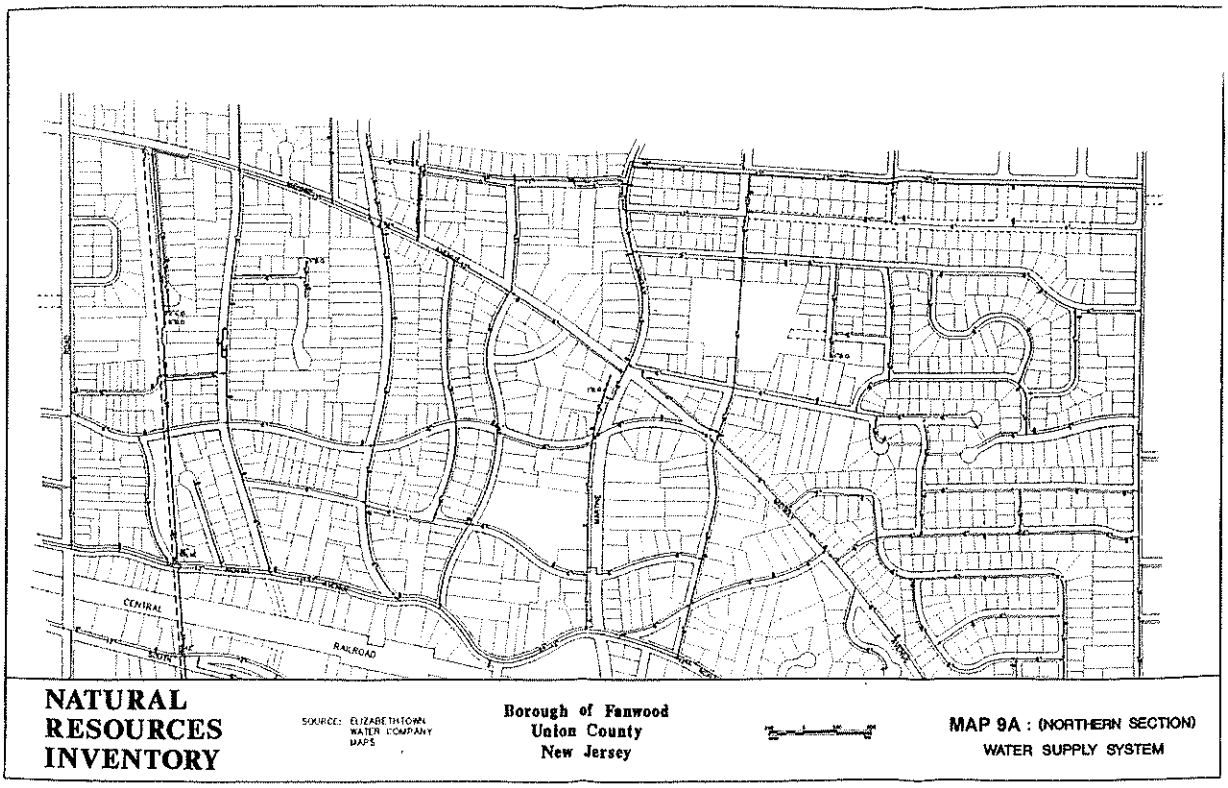
DESIGNED:
DRAWN: P.J.M.
OFFICE CHECKED:

MAP AND DATA REFERENCES:
MAPS ENTITLED "STORM SEWER, BOROUGH OF FANWOOD"
SHEETS 01-1 THROUGH 01-4, DATED 12/12/94
PREPARED BY JOHNSON ENGINEERING INC.

KUPPER ASSOCIATES
N.J. CERTIFICATE OF AUTHORIZATION #24GA27995660
15 STELTON ROAD, PISCATAWAY, N.J. 08855-0036
732-752-5600

NATURAL RESOURCES INVENTORY
MAP 8
STORMWATER MANAGEMENT SYSTEM MAP
BOROUGH OF FANWOOD UNION COUNTY
SCALE: 1" = 400' N.J. DATE: 3/06

1 OF 1
CONTRACT NO. 275210.01

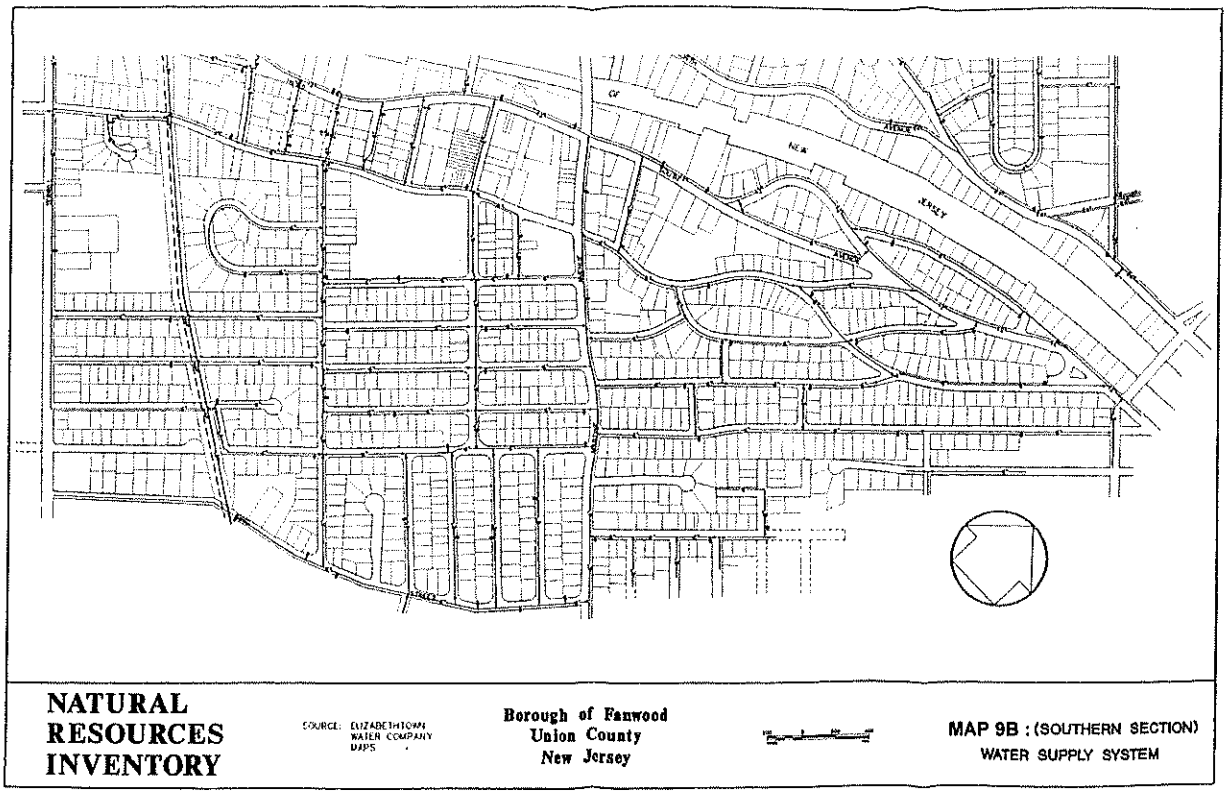


NATURAL RESOURCES INVENTORY

SOURCE: ELIZABETHTOWN WATER COMPANY MAPS

Borough of Fanwood
Union County
New Jersey

MAP 9A : (NORTHERN SECTION)
WATER SUPPLY SYSTEM

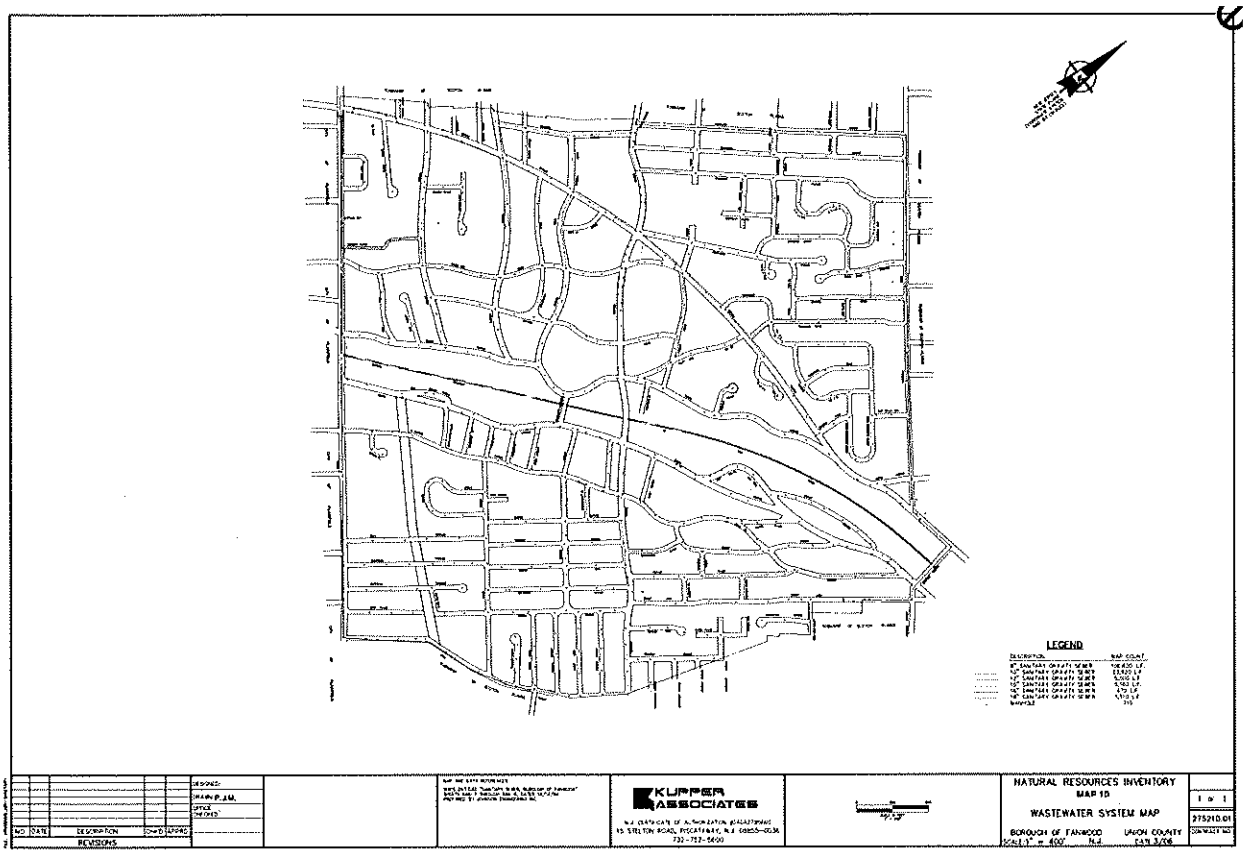


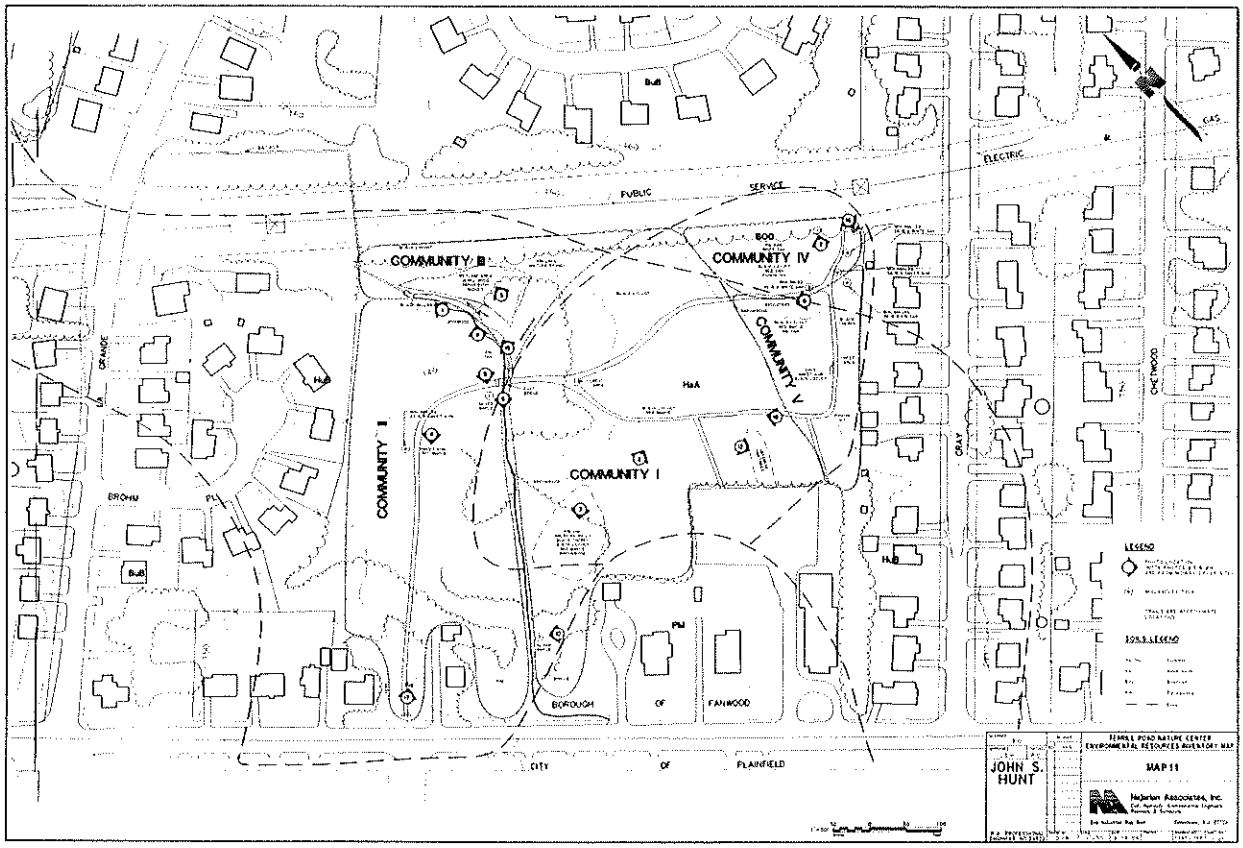
NATURAL RESOURCES INVENTORY

SOURCE: ELIZABETHTOWN WATER COMPANY MAPS

Borough of Fanwood
Union County
New Jersey

MAP 9B : (SOUTHERN SECTION)
WATER SUPPLY SYSTEM


LEGEND
KUPPER ASSOCIATES
NATURAL RESOURCES INVENTORY
MAP 10
WASTEWATER SYSTEM MAP
BOROUGH OF FANWOOD
UNION COUNTY


COMMUNITY II
COMMUNITY III
COMMUNITY IV
COMMUNITY V
COMMUNITY I
PUBLIC SERVICE
ELECTRIC
GAS
GRANDVIEW
ORCHARD
OAK
BOROUGH OF FANWOOD
CITY OF PLAINFIELD
JOHN S. HUNT
MAP 11