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Bergen County, New Jersey

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SECTION I: OVERVIEW

THE ERI PROCESS

This Environmental Resources Inventory (ERI) presents an inventory and discussion (through text, tables and graphics) of the important natural resources and environmental features in the Borough of Glen Rock. This report is intended to provide a baseline snapshot of the Borough's natural assets for measuring, evaluating, and prioritizing resource protection issues. The identification of significant environmental resources is a necessary first step toward ensuring their protection and preservation.

Glen Rock's ERI will be a valuable source of information for the Borough's Council, planning board, environmental commission, zoning board of adjustment and open space committee. As the technical basis for the Conservation Plan Element of the master plan, the ERI provides the foundation for the development of resource protection ordinances and resource-based land planning strategies.

Two New Jersey laws give environmental commissions the authority and responsibility to conduct an ERI: the Environmental Commission Enabling Legislation (N.J.S.A. 40:56A) and the Municipal Land Use Law (N.J.S.A. 40:55D-27b & 28b(2)).

The preparation of this ERI is the result of a collaborative effort of the members of the Glen Rock Environmental Commission (GREC), the Glen Rock Planning Board and the Commission's Planning Consultant, H2M Associates, Inc. The ERI was partially funded by a Smart Growth Planning Grant award from the Association of New Jersey Environmental Commissions (ANJEC).

OVERVIEW OF GLEN ROCK

Glen Rock is a 2.8 square mile, fully developed urban/suburban borough in northwestern Bergen County. Glen Rock is 22 miles west of New York City and 61 miles northeast of Trenton, the state capitol. It is bounded by the Village of Ridgewood to the north and east, the Borough of Fair Lawn to the south, and the Passaic County Borough of Hawthorne to the west. In terms of global location, Glen Rock is positioned 40.95 degrees north of the equator and 74.12 degrees west of the prime meridian.

As of 2000, Glen Rock consisted of 4,024 housing units with an average household size of 2.93 for owner-occupied units. The average family size is 3.22 and the average household size is 2.89. The approximate number of families living in Glen Rock is 3,322.

There were 884,118 people, 330,817 households, and 235,210 families residing in Bergen County as of this Census year. The population density was 3,776 people per square mile (1,458/km²). There were 339,820 housing units at an average density of 1,451 per square mile (560/km²). Bergen County is the fourth most densely populated county in New Jersey as shown in the table below.

Table 1
Top Five Most Densely Populated Counties in New Jersey

Rank	NJ County	Density (persons/sq mile)
1	Hudson	9,799
2	Essex	6,128
3	Union	4,961
4	Bergen	3,581
5	Passaic	2,486

Source: 2000 US Census

New Jersey is the most densely populated state in the nation, with an average population density of 1,171.1 persons per square mile as of 2007, up from 1,138 in 2000.

The Glen Rock public school system www.glenrocknj.org consists of four elementary schools (Richard E. Byrd, Coleman, Central and Hamilton enroll1168 students) and a combined middle/high school (With enrollment of 587 and 778 students, respectively). Total enrollment is 2,533 as of 12/2008. The Glen Rock Board of Education is the second largest landowner in Glen Rock, owning 46.40 acres of property (33.2% of the total open space and recreation lands). Glen Rock is also home to a K-8 parochial school, Academy of Our Lady, housed at St. Catharine's Parish.

Borough Governance

Glen Rock (http://www.glenrocknj.net/) operates under the Mayor/Council form of government with the annual appointment of a full time professional borough administrator who is the Chief Administrative Officer of the Borough, responsible to the Mayor and Council.

The governing body, the Mayor and Council, consists of a mayor and six council members elected at large. Two council members are elected each year for three-year terms and the Mayor is elected for four years. The Mayor is the Chief Executive Officer (CEO) of the Borough. The Mayor appoints the Planning Board, and with the advice and consent of the Council, all other Borough officials committees and boards of the Borough.

Municipal Organizations

The following municipal agencies and local organizations have substantial roles in preserving Glen Rock's environmental resources.

Glen Rock Environmental Commission http://www.glenrocknj.net/Environment/

This commission consists of seven volunteer residents appointed by the Mayor, a planning board representative, and two ad hoc members. The role of the EC is to inform residents about environmental matters, suggest ways to help protect the Borough's natural systems and advise the governing body on a variety of environmental issues.

Sustainable Glen Rock Steering Committee

Formed in March 2009, this Committee is appointed annually by the Mayor. It consists of a minimum of six residents and the Borough Administrator and the Superintendent of Public Works. Under the direction of the Borough Council, it is responsible for developing a Sustainable Glen Rock Plan and pursuing Sustainable Jersey Municipal Certification.

Planning Board

The Planning Board consists of seven members (three Borough officials and four citizen members), two alternates, three non-voting advisors and a secretary. The Board's functions are to adopt and amend a master plan, administer land subdivision and site plan review ordinances, evaluate proposed zoning amendments, recommend capital improvement programs and participate in planning new programs.

Shade Tree Advisory Committee

This committee was created in 1974 to advise the Council on matters concerning pruning, replacing and general maintenance of the 20,000 Borough-owned shade trees. It consists of knowledgeable local citizens serving one-year terms with a professional arborist as an advisor. Pursuant to the Borough's code, all trees on Borough-owned properties are the responsibility of the Borough and may not be removed, trimmed or treated without permission of the Director of Public Works.

G.R.E.E.N. (Glen Rock Ecology and Environment)

This volunteer committee consists of a president, two members and a representative from the Borough Council. Members serve a one-year term. It assists the Department of Public Works with the disposal of plastic recyclables.

Friends of the Arboretum http://glenrocknjarb.org

A 501c (3) organization, the Friends of the Arboretum is committed to preserving, developing and insuring the continued existence of the Carol Thielke Arboretum in Glen Rock. The organization is dedicated to the preservation and conservation of

plants as well as providing a natural haven for birds, small fish, other amphibians and animals.

BERGEN COUNTY

Glen Rock is one of 70 municipalities in Bergen County. The Borough comprises 1.1% of the County's total land area of 247 square miles.

Bergen County Environmental Council
http://www.co.bergen.nj.us/environmental/AboutUs.html
The Council is composed of volunteers, appointed by the Bergen County Board of Chosen Freeholders for a two-year term. The Council reports to the Bergen County Executive. Its mission is to develop a water management strategy on a watershed basis for Bergen County that will:

- Identify water quality problems
- Prioritize those problems
- Research and recommend solutions
- Communicate those findings to the public and appropriate agencies

Bergen County Parks http://www.co.bergen.nj.us/Parks/
The Bergen County Department of Parks is in charge of the recreational and cultural services of the county. Bergen County boasts an excellent park system where residents can ski, skate, jog, cycle, golf, picnic, camp overnight, tour a zoo, visit a Revolutionary War battle site, take a guided nature hike, swim, and play softball and tennis. Some of the county's facilities include a nationally accredited zoo, four golf courses, 19 parks, two stables, an environmental center and nine historic sites. This department includes the Division of Cultural and Historic Affairs.

Bergen County Planning and Economic Development
http://www.co.bergen.nj.us/planning/
This department is charged with shaping the County's environmental and economic future. Its divisions include Community Development, Engineering and Administration, Land Use & Development Review, Open Space, Public/Private Partnerships, Data Resources & Technology, Regional Planning & Transportation and Master Planning. It also includes the Bergen County Planning Board and the Construction Board of Appeals.

The Bergen County Utilities Authority (BCUA) http://www.bcua.org/
The BCUA is a public utility providing sewage disposal for 46 Bergen County municipalities and solid waste services for all 70 Bergen municipalities. The BCUA board is comprised of commissioners who are appointed by the County Executive with

the consent of the Board of Chosen Freeholders. The BCUA's statutory authority is N.J.S.A. 40:14B-1.

Bergen County Open Space, Recreation, Farmland and Historic Preservation Trust Fund
Through State law, New Jersey counties are permitted to establish a dedicated trust fund to acquire land for conservation/open space purposes, recreation facilities enhancement, and farmland and historic preservation. Counties are given great latitude in crafting their own trust funds to meet their particular priorities and objectives.

Bergen County Master Plan http://www.co.bergen.nj.us/openspace/osrefold.htm
Bergen County's last Master Plan was written and formally adopted on December 10, 1962 and amended March 14, 1966 (the oldest in the State of New Jersey). The Department has catalogued and maintained all existing Master Plans and associated amendments for the 70 municipalities and regional agencies (New Jersey Meadowlands Commission and Palisades Interstate Park Commission) within the County, in accordance with its role as repository under the auspices of the New Jersey Municipal Land Use Law.

In January 2009, Bergen County began the process of creating a new County Master Plan. The Department of Planning and Economic Development has pursued intergovernmental coordination with all 70 constituent municipalities to ensure consistency and encourage sound regional planning principles. Upon its completion and adoption, the County Master Plan will provide a guidance tool for future development, redevelopment, and preservation throughout Bergen County, as well as provide municipalities with a regional framework for their local planning processes. This plan will be fully in accordance with the New Jersey Municipal Land Use Law as well as consistent with the goals and objectives of the New Jersey State Development and Redevelopment Plan.

The Master Plan will contain of eight elements or sub-plans as indicated below:

1. Land Use Plan
2. Transportation Plan
3. Environmental Plan
4. Open Space, Recreation, Farmland and Historic Preservation Plan
5. Housing Plan
6. Utilities Plan
7. Economic Redevelopment Plan
8. Community Facilities Plan

Along with preparing and developing a new Master Plan, the County will develop a new Official County Map, which will show and delineate all Municipal and County Boundaries, County Streets and Roads, Rights-of-Way, Viaducts, Culverts, Bridges, Waterways and Water bodies, Forest Areas, Parks and Open Space Areas, and other public ways or facilities within the County. The development of the County Master Plan and official map will include an extensive public outreach component, including public meetings and hearings, to ensure sufficient public discussion and feedback.

REGIONAL CONTEXT AND PLANS

Watershed

The Borough of Glen Rock is part of Water Management Area 4 (WMA 4), an area encompassing 188.5 square miles in Bergen, Essex, Hudson, Morris, and Passaic Counties. The NJDEP has divided the state into five Water Regions containing 20 Watershed Management Areas, including watersheds of 37 major rivers or groups of smaller rivers. WMA 4 includes the Lower Passaic and Saddle River watersheds. WMA4 is a highly urbanized area and continues to lose forested lands and wetlands.

Table 2
WMA 4: Land Use in Lower Passaic and Saddle River Watersheds (in Acres)

Land Use Type	1995	2002	Net Change
Agriculture	332	287	-45
Barren Land	1,004	1,072	68
Forest	14,467	13,344	-1,123
Urban Land	97,876	99,242	1,366
Water	2,838	2,823	-15
Wetlands	4,130	3,879	-250

Source: http://www.nj.gov/dep/gis/lulc02statisticstables.htm#wma4

Additional information on Glen Rock's watershed can be found in ERI Sections V and VI.

New Jersey State Development and Redevelopment Plan (SDRP)

The New Jersey State Planning Commission released a State Development and Redevelopment Plan (SDRP) in 2004. The State Plan provides a vision for the future that seeks to preserve and enhance the quality of life for all residents of New Jersey. The State Plan is the result of a cross-acceptance process that included thousands of New Jersey citizens in hundreds of public forums, discussing all of the major aspects of the plan, including its goals, strategies, policies and application. This process ensures that the Plan belongs to the citizens of New Jersey, whose hopes and visions have shaped it.

The SDRP establishes five planning areas (plus two sub areas) and outlines a number of goals and objectives related to the future development and redevelopment of the state. The State Development and Redevelopment Plan provides a balance between growth and conservation by designating "planning areas" that share common conditions with regard to development and environmental features.

Glen Rock is entirely located within the **PA-1, Metropolitan Planning Area**, which is characterized by "mature settlement patterns, infrastructure systems that are approaching their reasonable life expectancy, the need to rehabilitate housing, the recognition that redevelopment will be the dominant form of growth, and a growing revitalization of the need to regionalize services and systems."

According to the SDRP, Glen Rock and other communities located in the PA-1 Metropolitan Planning Area are expected to:

- Provide for much of the State's future development;
- Revitalize declining cities and towns;
- Promote growth in compact forms;
- Stabilize older suburbs;
- Redesign areas of sprawl; and
- Protect the character of existing stable communities.

Municipal "Plan Endorsement" is a voluntary review process where the State Planning Commission certifies a municipality's planning documents and mechanisms as being consistent with the goals, policies, and strategies of the SDRP. The benefits of achieving Plan Endorsement include technical assistance, state capital investments, priority for state grants and loans and regulatory changes to implement the endorsed plan. COAH rules require that municipalities obtain Initial Plan Endorsement within three years of receiving substantive certification for their Housing Plans. Therefore, the Borough should consider pursuing Plan Endorsement as it is currently petitioning COAH for third round substantive certification, under the revised 2009 rules.

The New Jersey State Plan Policy Map

The State Plan Policy Map reflects these planning polices graphically across the State on a map. Therefore, the State Plan Policy Map serves as the underlying land use planning and management framework that directs funding, infrastructure improvements, and preservation for programs throughout New Jersey. Simply stated, the State Development and Redevelopment Plan with the State Plan Policy Map is a dynamic vision of New Jersey's development and conservation patterns. The State Planning Commission incorporates new data from state agencies, counties and municipalities on an ongoing basis to support the integrity of the Map.

TRANSPORTATION & INFRASTRUCTURE

As a fully development community, a significant portion of Glen Rock's environment consists not of farmland or forests, but of transportation infrastructure. In fact, transportation is the third largest land use in Glen Rock, comprising 222.4 acres, or 12.8 percent of the total land area. This includes all of the roads, including Route 208 and the two railroad lines that run through the Borough**.** Road and parking areas are a major source of traffic congestion, air pollution, greenhouse gases, road salt, and other contaminants that enter the water supply through stormwater runoff. The impervious surface of roads and parking lots create stormwater runoff during rain storms, which flow into our local streams negatively impacts the quality and quantity of our waterways. Since non point source pollution is the leading cause of water pollution in New Jersey and vehicle exhaust is the leading source of greenhouse gases, an examination of our community's transportation infrastructure is an essential part of a comprehensive environmental inventory.

Highways

State Highway Route 4/208 traverses Glen Rock in an east-west orientation. This four-lane divided highway handled 78,500 vehicles on an average week day, as of 2004. (NJDOT data from 10/6/04). By mid-2007, two-way daily volume had increased to 81,791 vehicles, an increase of 4 %. (NJDOT data as of 6/5/2007)

Railroads

Two NJ Transit commuter train lines, the Bergen Line and the Main Line, run roughly north-south through Glen Rock, each with one commuter rail station. Spots are available to residents who purchase an annual parking permit for $145 for the first pass and $80 for each subsequent vehicle. The remaining spots are available on a first-come, first-served basis for a fee of $6 in quarters daily, as of 2009.

Bus Lines

Glen Rock is served by NJ Transit bus routes, which offer service to destinations including New York Port Authority in midtown Manhattan, Paterson, and Ridgewood.

Commuter Shuttle

Glen Rock operates a commuter shuttle for local residents. For a $75 fee, residents receive one year of rides to the main bus stop and the railroad station for residents who walk to the route used by the bus. The service has 80 paying commuters. During off hours, the bus is used to take senior citizens and handicapped residents to medical appointments and senior centers. The bus came with a financial package that subsidized the first three year of operation and now is funded by annual fees.

Local Roads/Traffic

Glen Rock contains over 1,000 miles of roads. Two county highways, Maple Avenue (Route 507) and Lincoln Avenue (Bergen County 69), carry cars and trucks between Paterson and Hawthorne to the south and Ridgewood and Wyckoff to the north.

Traffic congestion

Traffic congestion is a growing problem in New Jersey and in Bergen County in particular. According to a January 2008 report, "NJ Traffic Congestion: A Growing Crisis," Bergen County is one of the seven most congested counties in New Jersey, with a Roadway Congestion Index of >1.10 The Roadway Congestion Index (RCI) is a measure of vehicle travel density on major roadways in an urban area. An RCI exceeding 1.0 indicates an undesirable congestion level, on an average, on the freeways and principal arterial street systems during the peak period.

The total annual cost of traffic congestion in New Jersey in lost time, operating cost and fuel consumption is $4.9 billion. Of the total cost of congestion, Bergen County -- the most populous – is the highest with $1.063 billion. (Source: Mobility and the Costs of Congestion in New Jersey, a 2000 Report by NJIT for the Foundation of the New Jersey Alliance for Action.)

By 2008, that figure had grown to $8.6 billion, according to Governor Jon Corzine's State of New Jersey report. New Jersey residents waste more than 52 hours a year, a full work week, stuck in traffic. New Jerseyans consume between $345 and $400 in fuel due to traffic congestion.

Traffic noise

Traffic noise is the most pervasive and most acutely perceived negative impact of transportation on the quality of life for residents living next to our highways, according to the NJ Department of Transportation. New Jersey roads are the most intensively used in the nation. In Glen Rock, the greatest source of traffic noise comes from Route 208.

As our state continues to develop and as we strive to maximize the efficiency of our existing highways, road noise impact is expected to remain a quality of life for affected residents. The NJ DOT is working to adopt a realistic, comprehensive policy which recognizes that noise impacts of traffic growth cannot be eliminated, but can be reduced. However, traffic noise must be better managed to reduce its pervasive impacts on Glen Rock's residents.

NJDOT will follow a comprehensive approach to manage traffic noise encompassing the following three areas:

- Reducing noise at the source,
- Education regarding traffic noise and appropriate land use planning, and
- Measures to block traffic noise.

School Transportation

Glen Rock public schools do not provide busing for students. Students are expected to walk or ride their bikes to school. In reality, many students travel by car and are dropped off, or, in the case of high school students, drive themselves. The Glen Rock Middle School and High School parking lot accommodates 178 vehicles, and dozens more parked on adjacent streets every school day.

In New Jersey, as in other parts of this country, travel to school by walking and bicycling has declined dramatically over the past several decades. The adverse impacts of this trend on air quality, traffic congestion and childhood health are alarming.

- Vehicle exhaust is the leading source of hazardous air pollution in New Jersey (Source: NJDEP)
- Research has shown that 25 percent of morning traffic is parents driving their students to school. (source: http://www.walktoschool-usa.org/why/physical-activity.cfm)
- Obesity rates among children have more than doubled in the past twenty years, according to the National Longitudinal Study of Youth. http://www.state.nj.us/transportation/community/srts/
- Only one-quarter of Americans are able to get the Surgeon General's recommended daily dose of exercise (just 30 minutes), Roughly 10% of children nationwide walk to school regularly. Even among those kids living within a mile of their school, only 25% are regular walkers.
- Children's asthma symptoms increase as the result of car exhaust. Asthma is the most common chronic illness in children and the most common cause of school absence. http://www.portlandonline.com/shared/cfm/image.cfm?id=131195

Safe Routes to School (SRTS) is a federal, state and local effort to enable and encourage children, including those with disabilities, to walk and bicycle to school and to make walking and bicycling to school safe and appealing. New Jersey's Safe Routes to School Program assists New Jersey communities in developing and implementing projects and programs that encourage walking and bicycling to school while enhancing the safety of these trips.

The New Jersey Bicycle and Pedestrian Master Plan

Drafted in 2004, Phase 2 of the *New Jersey Bicycle and Pedestrian Master Plan* outlines a vision and action plan for improving the walking and biking environment

through the State. Its key recommendations include a number of steps that can be implemented at the municipal level.

- Develop local bicycle and pedestrian plans;
- Develop bicycle and pedestrian improvements as independent projects and as integral parts of other transportation projects;
- Reassess and revise municipal site plan standards to address bike/ped needs;
- Include bicycle and pedestrian considerations in development codes, including parking requirements for bicycles;
- Establish policies, procedures and incentives to incorporate bike/ped improvements into municipal resurfacing programs;
- Implement internal project review processes to ensure that bike/ped needs are addressed in all projects; and
- Establish policies and procedures to ensure that bike/ped needs are incorporated in all bridge construction and rehabilitation projects.

Increasing the number miles traveled by foot and bicycle will have many potential benefits:

- Reduce air pollution, which causes human health issues and ecological damage,
- Reduce carbon footprint,
- Reduce noise pollution,
- Ease traffic congestion, and
- Fight rising obesity rates.

Bicycle Safety

Bicycle fatalities nearly doubled statewide from 2007 to 2008, rising from 12 to 22, the highest number in at least six years, according to statistics recently released by the state Division of Highway Traffic Safety. The rise in bicycle deaths illustrates the dangerous environment for cyclists on New Jersey roads. In 2007, there were 2,687 crashes involving bicycles in New Jersey, with 148 in Passaic County and 263 in Bergen County. Source: North Jersey.com Jan. 25, 2009

Glen Rock's Bicycle-Friendly Features

Glen Rock does not have any ordinances or policies providing for the needs of bicyclists. In terms of infrastructure, Glen Rock does not have any designated bicycle lanes. Currently, bicycle racks are located at: each public school, the Borough Hall Train station, the Glen Rock Pool, and the Public Library.

CONCLUSIONS

The Borough should consider pursuing Plan Endorsement as it is currently petitioning COAH for third round substantive certification, under the revised 2009 rules.

Glen Rock could improve air quality, reduce congestion, reduce its carbon footprint and improve residents' health by encouraging walking and bicycling in lieu of vehicle use. This could be accomplished by education and enhancing the pedestrian and bicycle friendly infrastructure.

Sources:

- Glen Rock Web site. www.glenrocknj.net
- 2000 US Census. http://www.census.gov/prod/cen2000/dp1/2kh34.pdf
- 2000 US Census http://ready.nj.gov/pdf/mitigation/appendixI_popden1.pdf
- Wikipedia/2000 Census
- The New Jersey Bicycle and Pedestrian Master Plan http://www.bikemap.com/RBA/NJBikePed.pdf
- NJDOT "Traffic Noise Management Policy and Noise Wall Design Guidelines," 7/10/03.
- http://www.nj.gov/transportation/eng/documents/env/pdf/attachment03t05.pdf
- http://www.nj.gov/transportation/about/press/2008/documents/CongestionReport.pdf
- Bergen County Planning and Development web site. http://www.co.bergen.nj.us/planning/
- NJ Department of Community Affairs, Office of Smart Growth http://www.state.nj.us/dca/osg/plan/

SECTION II: OPEN SPACE

INTRODUCTION

"Open space" is generally considered undeveloped land areas that have valuable ecological functions, natural resources, or cultural resources that should be protected for conservation and preservation. Such areas may contain, but are not limited to forests, old fields, floodplains and wetlands. Open space can also encompass scenic vistas, recreational areas, and historic sites. The definition of open space is broad, and can include areas that are "active" in nature, such as parks and ball fields (recreation areas), as well as areas that are "passive" in nature such as wetlands preserves and flood control properties (natural areas). Glen Rock has both active and passive open space areas within its borders. Some areas, such as those that have received Green Acres funding, are protected. Other areas, such as forest and wetlands, are subject to development and should be protected for the benefit of future generations.

Benefits of Open Space

Sometimes incorrectly viewed as wasted space or land that is underutilized, open space provides many environmental, economic, physical and health benefits. Open space provides environmental "services" such as maintaining air quality, operation of the hydrological cycle including flood control and drinking water supply, waste assimilation, recycling of nutrients, generation of soils, pollination of crops, and maintenance of the vast genetic library (Berkes, 1994). As such, open space directly benefits human health. Open space also provides valuable habitat for wildlife, especially in large parcels. (See Section X: Habitat and Wildlife). Open space preserved in its natural state in Glen Rock tends to be wooded, and forests are known to provide numerous benefits such as air quality, carbon sequestration and air cooling. (See Section IX: Vegetation)

Groundwater Recharge and Pollution Protection

Because Glen Rock has 33 percent impervious coverage (Source: Maps for Mayors), the natural processes of rainfall infiltration and groundwater recharge are severely diminished. This design creates flooding, impairs surface water quality and prevents recharge of the local potable water supply. Rectifying these results may involve engineering, whether for new construction or for retrofitting existing neighborhoods, which is costly to taxpayers and rate payers (sewage and water).

Natural habitats such as the Arboretum, Saddle River County Park and Diamond Brook Park act as giant sponges, allowing rainwater to percolate into the ground without being polluted, and to recharge aquifers with clean water. Thus, preserving and

expanding these open space resources are important environmental protection goals for Glen Rock.

Economic Benefits of Open Space

The "value" of undeveloped land differs depending on who is calculating its value. To environmentalists and conservationists, economic value may not come to mind. To a real estate developer or a builder, land is a commodity that may represent an investment, a salary, profits, tax benefits and liabilities, and future earnings. To a town planner, open land may represent a park, a school, a parking lot, houses, a farm, or tax ratables. Therefore, many factors must be considered to determine the true, long-term value of a piece of land.

Indeed, one of the most easily understood benefits of open space protection is the protection of property values. Frequently, property values near parks, refuges and preserves are higher than those of properties surrounded by houses. Properties near open space are desirable because they offer beauty, seclusion, nearby amenities and high resale value.

Finally, the services of ecological systems (e.g. water filtration, crop pollination, and flood control) and the natural capital stocks that produce them are critical to the functioning of the Earth's life-support system. They contribute to human welfare, both directly and indirectly, and therefore represent part of the total economic value of a community and even the planet.

GLEN ROCK'S OPEN SPACE

Approximately 139.85 acres or 8.03% of the total land area in the Borough of Glen Rock is used for recreation and open space purposes. All of the land included within this land use classification can be broken down into two categories:

- Open space and recreation lands that are owned by the Borough
- Lands that are owned by the Board of Education

The Borough owns 93.45 acres (66.8%) and the Board of Education owns 46.40 acres (33.2%) of the total open space and recreation lands in Glen Rock (See Table 3 below). These lands are used for many different passive and active open space purposes. A detailed analysis and inventory can be found in the Open Space and Recreation Element of the Master Plan.

Table 3
Open Space Ownership in Glen Rock

Land owner	Acres	Percentage	Type of Space and Amenities
Borough	93.45	66.8%	Public parks, pools, tennis courts
Board of Education	46.40	33.2%	Athletic playing fields, lawns
Bergen County			Public parks, tennis courts, playground
PSEG Right-of-way			Open fields
Total Open Space	*139.85*		

The Value of a Recreation and Open Space Inventory

Under New Jersey's *Green Acres* Program, each Local Unit (municipality or county) is required to prepare a Recreation and Open Space Inventory (ROSI) as a condition of applying for and receiving Green Acres funding. The ROSI lists all Green Acres-funded properties ("funded parkland") as well as all other lands held for conservation and/or recreation purposes ("unfunded parkland") at the time the Local Unit last received funding from Green Acres. Lands listed on a ROSI include those owned, leased, or otherwise controlled by the Local Unit and may include land owned in fee, land leased by the Local Unit for recreation purposes, land owned by a private entity upon which the Local Unit holds a conservation easement, or any land in which the Local Unit holds a specific recreation and/or conservation interest. Because Green Acres restrictions are contractual and statutory in nature, a property may be subject to Green Acres restrictions even if it is omitted from a ROSI.

To date, two (2) of the Borough's parks have received Green Acres funding. Both Wilde Memorial Park and Dean Street Park were recipients of this type of funding award. Land that is purchased by Green Acres funding becomes permanently preserved, and a way to protect environmentally sensitive areas or other significant areas from development. The Borough's parks listed on the ROSI and those receiving Green Acres funding are shown in the table below.

Table 4
Glen Rock's Recreation and Open Space Inventory (ROSI)

Block	Lot	Facility Name	Interest	Type	Funded?	Last Updated
101	1	MAIN STREET PARK	ET/FE	M	N	
11	12	SYCAMORE PARK	ET/FE	M	N	
115	12	DEMAREST PARK	ET/FE	M	N	
127	13	SADDLE RIVER COUNTY PARK	ET/FE	C	N	
127	15	SADDLE RIVER COUNTY PARK	ET/FE	C	N	
165	19	WILDE MEMORIAL PARK	ET/FE	M	Y	
187.02	2	MAIN STREET FIELD	ET/FE	M	N	
20	21	DEAN STREET PARK	ET/FE	M	Y	
243	1	SADDLE RIVER COUNTY PARK	ET/FE	C	N	
243	2	SADDLE RIVER COUNTY PARK	ET/FE	C	N	
243	3	SADDLE RIVER COUNTY PARK	ET/FE	C	N	
247	2	SADDLE RIVER COUNTY PARK	ET/FE	C	N	
247	3	SADDLE RIVER COUNTY PARK	ET/FE	C	N	
247	4	SADDLE RIVER COUNTY PARK	ET/FE	C	N	
46	3	ARBORETUM	ET/FE	M	N	
46	4	FABER FIELD	ET/FE	M	N	
46	4.01	UPPER FABER FIELD	ET/FE	M	N	
85	30	LOWER DOREMUS	ET/FE	M	N	
8	8	SYCAMORE PARK	ET/FE	M	N	

Legend: Facility Name: If followed by - DIV = parcel was entirely diverted; if followed by - P/DIV = parcel was partially diverted; and if followed by - COMP = parcel was a compensation piece for previous diversion.
Interest: ET/FE - Entire Taking/Fee Simple; PT/FE - Partial Taking/Fee Simple; LEASE - Leased Land; ET/CE - Entire Taking/Conservation Easement; PT/CE - Partial Taking/Conservation Easement
Type: M - Municipal; C - County; N - Non Profit
Funded?: Y - Park received Green Acres funding; N - Park did not receive Green Acres funding; L: funded under the Federal Land and Water Conservation Fund only
Last Updated: October 7, 2004

Source: NJDEP Green Acres Open Space Database
http://www.state.nj.us/dep/greenacres/openspace.htm

Glen Rock's Open Space Plan

Glen Rock has an Open Space and Recreation Plan Element as part of its 2002 Master Plan. An open space plan is a comprehensive document that serves as a guide for open space protection and preservation in a municipality, a county or some other defined region like a watershed. The plan tells why and how open space will be protected. Because open space preservation is generally pursued over a long period of time, through many successive administrations, it is imperative that a comprehensive plan be in place to assure continuity and policy consistency.

Preparation of an OSRP is one of the steps necessary for the Borough to eligible for the Green Trust Planning Incentive funding. The Borough must also establish an open space tax or adopt an alternative means of funding. Glen Rock's Open Space and Recreation Plan encourages the acquisition of open space that is:

1. Publicly owned parkland, and
2. Privately owned property where a government or a non-profit organization has purchased the development rights.

Development rights (or easements) are one of a "bundle of rights" people have when they own property. Individual rights (for example: road or utility rights-of-way, mineral rights, etc.) can be sold separately. When property is preserved through the purchase of development rights, only those rights are purchased. The original owner continues to own the property and can lease or sell it if he wishes, but the property can no longer be developed.

Bergen County's Open Space Plan

In August 2004, the Bergen County Planning Board adopted the Bergen County Open Space and Recreation Plan (OSRP) to provide county-wide direction on open space and recreation issues. The preparation of an OSRP maintains Bergen County's eligibility to receive New Jersey Green Acres Planning Incentive grant funding. The OSRP serves as a strategic plan and guide describing Bergen County's open space and recreation needs and a proposed action plan.

OSRP Recommendations Relevant to Glen Rock

Among other opportunities, the Bergen County OSRP identifies several open space acquisition and preservation opportunities in certain areas, including the Saddle River and Passaic River Corridors. Specifically, the plan recommends "the addition of appropriate lands adjacent to or abutting existing state, County, or municipal parklands that further expand or enhance riverside conservation, preservation and recreation objectives. This includes, but is not limited to, wetlands, woodlands and watershed properties associated with the Passaic River and Saddle River, their tributaries, lakes, ponds, and reservoirs, and all other bodies of water." In the related map, the OSRP identifies the Saddle River County Park – Glen Rock area as an Open Space Acquisition and Preservation Opportunity.

Bergen County Open Space Funding

In 1998, the Bergen County Board of Chosen Freeholders established the Bergen County Open Space, Recreation, Farmland & Historic Preservation Trust Fund. The Trust Fund is divided into two separate programs, each having its own distinct goals and objectives.

The County Program uses Trust Fund dollars on a countywide basis to preserve land, maximize recreational opportunities, and preserve farmland and historic areas. Those that are eligible to apply to the County Program include: County agencies, municipalities, and charitable conservancies. The second program of the Trust Fund is the Municipal Park Improvement and Land Acquisition Program. Each of Bergen County's 70 municipalities is eligible to apply to this program in order to improve their municipal open space and recreational facilities.

This program is designed to supplement municipal efforts and does not serve as a full funding resource. The Trust Fund is funded through a property tax assessment to be determined annually by the governing body of the County, at a rate not to exceed one cent per $100.00 of total county equalized real property valuation.

The Trust fund has five separate funds, each with a specific focus.

- *Open Space Land Acquisition Trust Fund.* Bergen County utilizes Trust Fund dollars to facilitate the acquisition of land for conservation and/or recreation purposes by the County, its municipalities, and qualified non-profit organizations.

- *Open Space Farmland Preservation Trust Fund*. Bergen County utilizes Trust Fund dollars in conjunction with the State Agriculture Development Committee's Farmland Preservation Program to purchase the development rights of qualified farmland for its permanent preservation for agricultural production.

- *Open Space Historic Preservation Trust Fund*. Bergen County offers matching grants for the acquisition, stabilization, rehabilitation, restoration, preservation, and preparation of plans and reports for capital historic preservation projects. Eligible applicants for the competitive grants are the County, municipalities, and qualified non-profit organizations. All properties for grant-funded activities must be located in Bergen County and listed on or eligible for listing on the New Jersey Register of Historic Places, either individually or as a contributing part of a historic district.

- *Open Space Municipal Program Trust Fund.* Bergen County considers matching grants for the development or redevelopment of outdoor, active, and passive municipal recreation facilities.

- *Open Space Parks & Recreation Trust Fund*. The Bergen County Department of Parks utilizes Trust Fund dollars for the development and rehabilitation of new and/or existing County Park facilities.

Between 1999 and 2007, Glen Rock received the following project awards from the Recreation Trust Fund.

Table 5
Recreation Trust Fund Awards (1999-2007)

Year	Amount	Project	Trust Fund Program	Trust Fund Project Type
2000	$17,500	Wilde Park Playground Equipment	Municipal	Recreation
2001	$15,000	Batting Cages – various ballfields	Municipal	Recreation
2006	$90,000	Wilde Park Tennis courts rehabilitation	Municipal	Recreation

Source: Bergen County Open Space Trust Fund Summary Report 1999-2007

PRESERVING OPEN SPACE

The process of obtaining and preserving open space usually follows the model: Inventory, Assess, Plan and Implement. The preparation of this ERI is part of the "inventory" phase, the first step in determining the Borough's greatest land assets that should be preserved. Specifically, the maps in this ERI delineate the Borough's open space, environmentally sensitive land features, water features, historic sites, habitat, vegetation and other natural and manmade assets. Other land to inventory includes Borough-owned and vacant land that could potentially be converted to open space (See section on "COAH" below).

The "assessment" of these mapped features can help the Borough select and prioritize land that should be preserved for open space and recreational purposes. Environmental resources in danger or susceptible to development or degradation, for example, should be identified as a high priority. Other factors to consider when prioritizing include obvious gaps in areas where there is no open space, or where connections to parks or to other Borough assets are needed. Specific "criteria" should be established for prioritizing land to protect. Public feedback can help to narrow down options and reveal specific community values. The prioritization of open space parcels may require several rounds of open discussion.

The "plan" phase of open space preservation involves creating the documents that lay out the Borough's policy recommendations. This is usually done in the preparation of

a Master Plan, which includes a Land Use Plan and an Open Space Plan. The Land Use Plan outlines areas where the Borough wants to see growth, and an Open Space Plan should show areas recommended for protection. The Master Plan creates a Land Use Plan or "road map for the Borough, based on a comprehensive analysis of land use goals and objectives and issues and opportunities. Other potential sections of the Master Plan, such as the Stormwater Protection Plan, Circulation Plan, Historic Plan and Capital Improvement Plan can also recommend and inform policy for land protection.

The "implementation" phase determines the proactive measures and enforcement mechanisms that can be implemented for land protection. Land development and zoning ordinances, for example, can require a certain percentage of open space, or that buffers of a specified depth surround waterways, or that impervious coverage be limited, or they may require that trees be planted along streets and native landscaping be used. Ordinances that require compact, high density development (as opposed to sprawl,) enable more land to be preserved so that development goes "up," not "out." Redevelopment of brownfield sites is one option for securing open space. Direct purchase and acquisition of open space is another method. Funds for purchase can be obtained via grant awards, municipal bonds, donations, an open space tax, local land trust, or other sources. Conservation easements can also be purchased and tax incentives provided. The previous phases of inventory, assessment and plan have prioritized land that can be preserved by special ordinance, purchase or other method.

COUNCIL ON AFFORDABLE HOUSING (COAH) & OPEN SPACE

The Council on Affordable Housing (COAH) requires that municipalities provide their "fair share" of low- and moderate-income housing, based on how fast they are "growing," or developing. This "growth share" is measured by counting the number of new residences constructed, combined with the number of new jobs (square footage of new, non-residential development) in the community each year. Per the latest round of COAH regulations (at the time of this ERI publication), affordable housing must be provided for a percentage of most new residential construction at a ratio of: one (1) affordable dwelling unit for every five (5) market rate housing units constructed. Affordable housing must be provided for non-residential construction, as well, based on the number of new "jobs" (using a square footage calculation depending on the "use" of the building), where essentially one affordable housing unit must be provided for every 25 jobs created.

The Borough of Glen Rock is seeking certification of its Third Round Housing and Fair Share Plan, which calculates the Borough's affordable housing obligation, based on such new development. Once the number of required affordable units is determined,

the Housing and Fair Share Plan establishes an inventory of all vacant land in the Borough. This vacant land must be evaluated as potential land for construction of affordable housing to meet the Borough's obligation. All public and private vacant land parcels, typically greater than one half acre in size, are mapped in a Vacant Land Analysis Map. This analysis/mapping can help the Borough to visualize available undeveloped land that may also be desirable for open space preservation.

LAND USE/LAND COVER IN GLEN ROCK

As a nearly fully built-out community, land use and land cover in the Borough of Glen Rock is largely (91%) urbanized. The latest land coverage data available is from the New Jersey Department of Environmental Protection (NJDEP) land use/land cover update for Watershed Management Area 4, which categorized land area as agricultural, barren, forest, urban, water or wetlands in 1995/97 and 2002.

The table below shows how land use has changed in Glen Rock between 1995/97 and 2002. According to the data, the Borough lost 6.1 acres of forest and 1.5 acres of wetlands, representing a 10% loss in Borough forested areas and a 1.7% percent loss in wetlands, over this 7 year period. These losses can be attributed to increased development or other urbanization, or in the case of wetlands, perhaps a "drier" year. The Borough should recognize this changing landscape as a potentially detrimental trend and prevent further deforestation and wetlands disturbance by implementing regulatory and other protection measures. Appendix 1 shows a map of how land use changed in the Borough between 1986 and 1995/97.

Figure 1
Land Use/Land Cover in Glen Rock, 2002

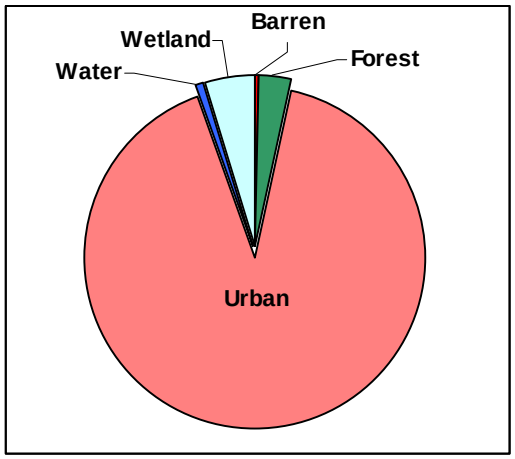

Table 6
Land Use & Land Cover Change in Glen Rock between 1995 and 2002

	1995		2002		1995-2002 Change	
Land Use	**Acres**	**Percent**	**Acres**	**Percent**	**Acres**	**Percent**
Barren Land	3.3	0.2%	2.9	0.2%	-0.4	-12.8%
Forest	60.2	3.5%	54.2	3.1%	-6.1	-10.1%
Urban Land	1,567.3	90.8%	1,575.3	91.3%	8.0	0.5%
Water	9.9	0.6%	9.9	0.6%	0.0	0.0%
Wetland	85.1	4.9%	83.6	4.8%	-1.5	-1.7%
Total	1,725.8	100.0%	1,725.8	100.0%		

CONCLUSIONS

Now that Glen Rock has completed the first step in open space acquisition, preparing an Environmental Resources Inventory, the borough is ready to embark on the second step, Assessment. While Glen Rock has an open space plan, it needs to adopt an open space tax or an alternative means of funding in order to acquire open space.

Sources:

- *2008 Master Plan Reexamination Report*
- Bergen County Planning and Development web site
- OSR plan: http://www.co.bergen.nj.us/planning/os/OS_Plan.pdf
- http://www.co.bergen.nj.us/planning/os/Program_Statement.pdf
- http://www.state.nj.us/dca/coah/

SECTION III: GEOLOGY

INTRODUCTION: WHAT IS GEOLOGY?

Geology is the study of the earth and the various processes that have formed and modified it. The purpose of this chapter in the Glen Rock Environmental Resource Inventory is to describe the geologic processes that have formed and changed Glen Rock. Glen Rock is a small place on a much larger planet. In order to adequately describe the geology of Glen Rock, we have attempted to summarize the available information specific to Glen Rock in the context of the larger geologic events and processes.

Geology is a dynamic science. As science and technology advances, our ability to interpret and evaluate conditions on the planet expands on both on the micro and macro scales. What is currently accepted today will be revised by the new developments and viewpoints of tomorrow. Because the current interpretations of existing geologic information can and will change, the reader is cautioned not to take everything presented here for granite.

GLEN ROCK'S LOCATION

The Borough of Glen Rock is a municipality located on the western border of Bergen County in northeastern New Jersey, approximately 15 miles west of New York City. With an area of approximately 2.7 square miles, Glen Rock is bordered on the west by Hawthorne and to the south by Fair Lawn. The Village of Ridgewood and Paramus border Glen Rock on the north and east, respectively.

Glen Rock is an irregularly shaped municipality and, under just the right conditions, the outline of the Borough resembles the shape of its namesake, the large glacial erratic, known as the "Glen Rock," and located corner of Doremus Avenue and Rock Road. The geographic coordinates of the "Glen Rock" are North 40º 57' 45.3" and West 74º 08' 05" North American Datum 1983 (NAD 83). In terms of the New Jersey grid coordinate system, the location of the Glen Rock is Easting 592964 feet and Northing 775838 feet (NAD 83).

Geologic Setting

The Borough of Glen Rock is located in the Piedmont Physiographic Province of New Jersey. "Piedmont" is a topographic term used to describe the land located between the "Coastal Plain" and areas with higher elevations or "Highlands." In geologic terms, Glen Rock is located in the "Newark Basin", which is used to describe a geologic feature in northern New Jersey formed during the Triassic and Jurassic Periods of the Mesozoic Era, roughly 251 to 145 million years ago. The Newark Basin extends over an area of approximately 7,000 square kilometers (2,700 square miles) from southeastern New York, through northeast and central New Jersey and into Pennsylvania. (Olsen et al., 1996)

The distribution of the current continental landmasses and oceans on the earth's surface and the large scale changes observed in the earth's crust over geologic time can be explained by the "Theory of Plate Tectonics." This theory proposes that the earth's lithosphere, or surface crust to a depth of approximately 50 miles, is composed of a series of discrete plates (tectonic plates) which move relative to each other over time as the result of the convection currents within the earth's mantle. (Kious and Tilling, 1996)

During the Permian Period, from approximately 299 to 251 million years ago, the tectonic plates collided to create a super-continent called "Pangaea" meaning "entire earth."(Wegner, 1966) The east coast of North America was located on the interior of Pangaea and adjacent to the northwest coast of Africa. As the North American and the African plates collided, the pre-existing rock formations were thrust together and over one another, deforming many of the rock formations in eastern and central North America to create the Appalachian and Ouachita Mountains. (Stoffer, P., 1998 (Revised, 2003))

During the Triassic Period, approximately 251 to 200 million years ago, the tectonic plates began to drift apart separating the African and North American land masses to eventually form the Atlantic Ocean. As the tectonic plates began to separate, the crust was stretched and thinned forming a series of basins along the east coast of North America. The Newark Basin is one of a series of similar basins formed during the Triassic in North America from the Bay of Fundy in New Brunswick, Canada to North Carolina. Similar basins are also located on the northwestern coast of Africa in Algeria and the Western Sahara. (Van Houten, 1988)

There is some debate regarding the formation of this group of basins on the mid-Atlantic coast of North America as the North American and the African plates began to separate. One idea is that a large northeast-southwest depression formed along the east coast of North America in response to the crust extending in the northeast-southwest direction during the breakup of Pangaea. (Faill, 1988) This group that proposes this explanation calls the resulting series of basins extending from New York to North Carolina, the "Birdsboro Basin." A second group describes the basin formation as the result of crustal rifting in a general east to west direction and this group refers to the various basins as the "Newark Supergroup." (Olsen et al., 1996) A full discussion of this debate is not possible here, but arguments supporting each side can be found in the reference. (Schlische and Withjack, 2005 (Discussion) and Faill, 2005, (Reply)

The Newark Basin is bordered on the west by the rocks of the Highlands physiographic province which are primarily deformed igneous and metamorphic rocks formed the Pre-Cambrian, Middle Proterozoic approximately 1 to 1.5 billion years ago. (Volkert, 1993) The contact, or boundary, between the rocks of the Newark Basin and the rocks of the Highlands in northeastern New Jersey is the Ramapo fault which, in northern Bergen County, roughly follows portions of Routes 206 and 287 from Mahwah to the south.

A fault is a break or fracture in the bedrock where there is movement in the bedrock relative to each side of the fracture. The Ramapo fault is a "normal fault," meaning that there is a vertical displacement between two rock masses where one side, called the "hanging wall," falls relative to the stable side, called the "foot wall." In the case of the northern Newark Basin, the hanging wall is on the east side of the Ramapo fault and the foot wall is on the west, or the Highlands side. A portion of the Ramapo fault foot wall is exposed immediately west of the intersection of Route 17 and Route 287.

Normal faults are typically formed in situations where the earth's crust is stretched and thinned. The structure in the Newark Basin is described as a "half-graben," which is the depression that forms on the hanging wall side of a normal fault. In the case of the Newark Basin, the half-graben periodically filled with water and sediments from surrounding streams as the basin was forming. (Schlische, R. W., 1991) As the sediments were deposited in the basin and as the crust continued to stretch and the hanging wall continued to fall, the sediments were tilted to the northwest in a process called "syndepositional faulting." (Schlische, 1991; Olsen et al., 1996) As a result, the sedimentary rocks within the Newark Basin typically have an orientation, or strike, to the northeast and a dip, or angle of bedding, to the northwest. The bedrock formations also tend to thicken to the west towards the border fault.

An alternate explanation of the orientation of the bedrock in the Newark Basin is that the rock formations were tilted after deposition. (Faill, 2004) There are also a number of examples in the Newark Basin where the bedrock is oriented differently from the typical northeast strike and southwest dip. These atypical bedrock orientations are attributed to intra-basin faulting and folding. (Volkert, 2006; Herman, 2005)

Most of the rocks in the Newark Basin are clastic sedimentary rocks, meaning that they were formed from the compaction and cementation of particles or clasts rather than the result of volcanic or metamorphic activity. A "Formation" is defined as a mapped bedrock unit and the sedimentary rock formations in the Newark Basin in New Jersey include the Stockton, Lockatong, Passaic, Feltville, Towaco and Boonton Formations. The bedrock in Glen Rock is considered to be part of the Passaic Formation. (Olsen, 1980, Volkert, 2006)

The bedrock beneath Glen Rock is covered by glacial sediments deposited during and after the last major continental glaciation which ended in New Jersey approximately 20,000 years ago. The only bedrock outcrop in Glen Rock is reported in the vicinity of Carol Court and Gramercy Place. (Stanford, 1993)

Sedimentary rocks are classified by the size of the particles or "clasts" forming the rock. Other descriptive terms are also used to describe how the sediment particles are cemented

together, the "roundness" of the particles and the types of rock in the clasts. A conglomerate is a sedimentary rock composed of gravel sized clasts. Similarly, "sandstone" and "siltstone" are composed primarily of sand and silt sized clasts.

Two sedimentary bedrock units have been mapped in Glen Rock and include a quartzite clast conglomerate "JTrpcq" within the western part of Glen Rock and conglomeratic sandstone "JTrpsc" to the east. (Drake et al, 1996) The contact between the conglomerate and coarse sandstone units roughly follows Maple Avenue. The clasts of the conglomerate bedrock are quartzite with minor sandstone and dolomite. The structure of the conglomerate in northwest Bergen County has been described as a series of fining upward sequences with evidence of the development of periodic "caliche paleosols," or ancient calcium cemented soils. (Van Houten, 1988) This description suggests that the conglomerate was formed in a series of cycles over an extended period of time.

The conglomerate in northwestern Bergen County is adjacent to the border fault between the Newark Basin and the igneous and metamorphic rock units of the Highlands and extends in a broad area to the east of the fault. (Volkert et al., 1996) In plan view, the outline of the conglomerate and coarse sandstone formations on the geologic map appear to be "draped" over the northwest corner of Bergen County.

The location of the conglomerates adjacent to the border fault, the size of the clasts and the location of the coarse sandstone to the east of the conglomerate suggests that these deposits were the result of fast moving streams entering the Newark Basin from the eroding mountains in the Highlands to the west and forming an "alluvial fan," or deposit of materials transported and deposited by water. This type of deposit is called a "fanglomerate" and is believed to be a major source of sediment in the other portions of the Newark Basin as the basin was forming. (Van Houten, 1988) Similar fanglomerate deposits have also been identified along the western sides of the Triassic basins from New Jersey to Virginia. (Faill, 2004)

The conglomerate and sandstone found in Glen Rock are significantly coarser than the finer grained siltstones, siltstones and shales found in other parts of the Newark Basin. The sedimentary rocks in the Newark Basin to the south and east of Glen Rock typically consist of alternating layers of sandstone, siltstone and shale with alternating colors (red, purple, gray and black). (Olsen et al., 1996) The size of the clasts in each type of sedimentary rock is a reflection of the energy in the depositional environment. Coarser grained clasts are an indication that they were deposited in moving waters and the presence of finer grained clasts indicate slow moving water conditions similar to swamps and lakes. The color of the rocks is also an indication of the environmental conditions in which the rocks were formed. Lighter colored rocks indicate that the sediments were deposited in shallow oxygen rich waters such as streams and rivers. Darker rock colors typically indicate oxygen poor environments which would occur in deeper water conditions such as a lake. This variation in the sedimentary rock

type and color suggests some variability in the environments in which the rocks of the central Newark Basin were deposited.

A nearly continuous core of the sedimentary rock in the Newark Basin was collected in the 1990s during the Newark Basin Coring Project (NBCP). One of the findings of the NBCP was that variations in the sedimentary rock appear to repeat in cycles on the order of 20,000 years (Van Houten Cycles), 100,000 years (Short Modulating Cycles) and 400,000 years (McLaughlin Cycles). (Olsen et al., 1996) The cycles observed in the sedimentary rocks of the Newark Basin have periods similar to the Milankovitch cycles, which describe the orientation of the earth relative to the sun and the shape of the earth's orbit over time. (Olsen et al., 1996) On this basis, it is proposed that the bedrock cycles observed in the central portions of the Newark Basin reflect variations in environmental conditions controlled or forced by the earth's relationship to the sun. (Olsen et al., 1996)

Probably, the biggest news story in the early Jurassic would have been the volcanic activity which occurred during the breakup of Pangaea approximately 200 million years ago. (McHone, 1999) This volcanic activity occurred over a huge area in the central portion of Pangaea, which has been called the "Central Atlantic Magmatic Province" or 'CAMP.' (Marzoli, 1999) Volcanic rocks resulting from the massive eruptions have been found not only on the east coast of the North America, but also beneath the sediments in the Gulf of Mexico and Brazil, in exposures along the west coast of Africa and throughout Spain and into France. (McHone, 1999)

The volcanic rocks associated with CAMP in the Newark basin near Glen Rock include the Palisades diabase sill to the east of Glen Rock and the basalts of the Orange Mountain, the Preakness Mountain and the Hook Mountain Formations to the west. The Palisades Formation was the result of magma intruded in between the Stockton and Lockatong Formations well below the ground surface. The Orange Mountain, Preakness Mountain and Hook Mountain Formations resulted from "fissure" eruptions where the lava flowed over the ground surface.

The molten lava flowing over the surface of the wet sediments released huge plumes of steam and gasses similar to the relatively small eruptions occurring in Hawaii today. The sediments in contact with the molten rock were baked by the high temperatures into a "contact" metamorphic rock called "hornfels." The hot molten rock in contact with the sediments was also chilled. These contacts are exposed at the base of the basalt flows in many quarries and bedrock outcrops in the Newark Basin, which are world renowned for their unique mineral deposits.

The volcanic activity in the Newark Basin continued over a period of approximately 550,000 years in the early Jurassic. (Olsen and Fedosh, 1988) The Orange Mountain eruption was followed by the Preakness Mountain and Hook Mountain eruptions and sedimentation

continued in the Newark basin following each of these episodes. The sediments of the Feltville formation were deposited to the west of the Orange Mountain and were partially covered by the Preakness basalt flow. The Towaco Formation sediments were deposited west of the Preakness Mountain and were partially covered by the Hook Mountain basalt. Finally, the sediments of the Boonton formation were deposited west of the Hook Mountain.

Following this 'brief' period of volcanic activity (relative to geologic time), tectonic development and sedimentation continued within the Newark Basin into the middle of the Jurassic. (Herman, 2005) At some time in the mid-Jurassic, the active tectonic spreading margin shifted into the developing Atlantic basin. (Herman, 2005 after Benson, 2002)

The total thickness of the Mesozoic rocks in the Newark Basin is estimated to be approximately 24,000 feet. (Volkert, 2006) From approximately 202 to 127 million years ago, there is a "stratigraphic hiatus" in the New Jersey geologic record, meaning that there are no rock formations from this period of time identified in New Jersey. (Herman, 2005) The view from an overlook on Garret Mountain in Paterson provides a visual clue to what happened in the Newark basin after all of the sedimentation and volcanic activity in the Mesozoic ended. Looking east from the Lambert Castle in Paterson, the ridge in the distance is the crest of the Palisades Formation and the broad valley, from the edge of the cliff to the Palisades are the rocks of the Passaic Formation. Recognizing that the crest of the Palisades was formed at some depth below the ground surface, it is visually evident that the Palisades has been uplifted and a tremendous amount of erosion has occurred in the Newark Basin.

The Fossil Record: Mass Extinctions of Life

There is another interesting aspect to the events that occurred in Glen Rock 200 million years ago at the Triassic-Jurassic boundary. Evidence from the fossil record indicates that many of the life forms that developed and were prolific during the Triassic, both on land and in the marine environment suddenly disappear in the Jurassic. (Olsen et al., 2004) This distinct gap in the fossil record is evidence of a mass extinction.

In the broader view, mass extinction events have occurred with some frequency in the earth's history. The largest extinction events occurred 251, 199 and 65 million years ago at the Permian/Triassic, Triassic/Jurassic and the Cretaceous/Tertiary period boundaries. The cause of each of these mass extinctions is under debate. One possible cause for these events may have been the environmental effects of the tremendous volcanic activity which occurred at each boundary extinction event including the Siberian eruptions at the Permian/Triassic boundary, eruptions related to CAMP at the Triassic/Jurassic boundary and the Deccan eruptions at the Cretaceous/Tertiary boundary. An alternate explanation has also been proposed and is based on evidence of bolide impacts near in time to each of the boundaries. (Olsen et al., 2004)

Glacial Geology: How Ice Sheets Shaped Glen Rock's Geology

Beginning approximately 2 million years ago and between 800,000 to approximately 11,500 years ago, at least nine glaciations occurred in North America which inundated the northern portions of the continent. (Stanford, 2000) Each period of glacial activity is characterized as a period of time when temperatures were cold and the rate of snow and ice melting was less than the rate of snow and ice accumulation, which allowed for the formation of significant glacial ice. (Flint, 1971) As snow and ice accumulate, glaciers begin to form first in the higher latitudes and elevations and then, under continuing cold conditions, the glaciers expand to cover large areas. Under the stress caused by the weight of a massive accumulation of ice, the ice becomes plastic and flows in a direction of least resistance, which in the case of a glacier, would mean a down-hill or, if the glacier is large enough, a down-latitude direction.

The evidence that massive continental ice sheets, Laurentide ice sheets, advanced into the northern portions of New Jersey on three occasions is based on the distinctive deposits left by the glaciers. (Stanford, 2000) The first glaciation identified in New Jersey, advanced into the central portions of the state and is known as the "pre-Illinoian" or formerly "Jerseyian" glaciation. The age of the pre-Illinoian glaciation is not certain and estimates range from a minimum 788,000 years to as old as 2 million years. (Stanford, 2000) The pre-Illinoian terminal moraine, or the deposit left at the glacier's terminus or edge, is limited to western New Jersey in Hunterdon, Morris and Somerset Counties. (Stanford, 2000) The glacial deposits left by the pre-Illinoin glaciation in the northern parts of New Jersey were overridden and reworkd by subsequent glacial activity. Approximately 150,000 years ago, the Illinoian glaciation reached its maximum extent and created a terminal moraine as far south as Warren and Morris Counties, just north of the pre-Illinoin terminal moraine. The most recent glacial advance, known as the Wisconsinian glaciation reached its maximum approximately 18,000 years ago. The terminal moraine left by the Wisconsinian glaciation extends across New Jersey from Belvidere on the Delaware River, through the Morristown area and then south to Perth Amboy and Staten Island.

The amount of glacial ice that covered New Jersey during each glaciation is not known for certain, but it has been estimated that as much as 2000 feet of ice may have covered High Point during the Wisconsinian maximum. (Witte, 1998) As each glacial advance covered northern New Jersey, the existing ground surface was eroded and the surface sediments were redistributed. The deposits left by the glaciers in the Glen Rock area have been mapped and are shown on two surface geology maps prepared by the New Jersey Geological Survey for the Hackensack and Paterson quadrangles. (Stanford, 1993; Stanford, 2003) The glacial deposits identified in Glen Rock include glacial till, ice contact deposits and sediments which were deposited in pro-glacial lakes created as the glaciers melted.

Glacial till is an unstratified (non-layered) mixture of silts, clays sands, gravel, cobbles and boulders which have been worked, or mixed, by the glacier, and deposited. Much of the glacial till found in Glen Rock is red brown in color, indicating that the parent material for these glacial till was the bedrock in the Newark Basin. This type of glacial till has been mapped throughout much of northern New Jersey as the Rahway Till (Qr). Rahway Till is mapped in the higher elevations in Glen Rock within the central portion of town. Other types of glacial till found in the vicinity of Glen Rock are typically brown to yellow brown in color and are mapped as the Netcong Till (Qn). The Netcong Till consists of materials which have been transported from areas outside the Newark Basin and includes materials derived from the granites and metamorphic rocks of the Hudson Highlands to the north.

The surface of the glacial till as deposited was modified by the glacier into a series of rounded and elongated hills called drumlins. There are a number of drumlins and drumlin-like features in the vicinity of Glen Rock, all of which are oriented in a northeast direction indicating the direction of the flow of the ice throughout the area. An interesting and large drumlin is located in Hawthorne immediately west of Glen Rock. Mountain Avenue runs along the crest of this drumlin and the till in this drumlin has been mapped as Netcong Till. Additional mapped drumlins are located in Fairlawn to the southeast and several more are located to the northeast of Glen Rock.

Ice-contact deposits are materials sorted by melt water flowing through the glacier and were deposited in the channels formed within or adjacent to the ice. (Flint, 1971) Types of deposits classified as ice-contact deposits include “kames” and “eskers” depending on their shape and the area of deposition within the glacier. Eskers are long sinuous sand deposits which were deposited in melt water channels formed within the glacier. A kame is a steep sloped deposit of material which was washed down and deposited in meltwater channels developed along the side of a glacier. There are two small kames which have been mapped on the west side of Glen Rock in the vicinity of Lincoln Avenue near Rutland Road. (Stanford, 2003)

As the glaciers melted and retreated, a tremendous amount of water was released and ponded to the south of the ice front in large lakes, called “pro-glacial lakes.” The major pro-glacial lakes that formed in northern New Jersey included Glacial Lake Passaic, to the west of Glen Rock and Glacial Lake Hackensack, to the east. A number of smaller pro-glacial lakes also formed in the central portion of the Newark Basin including Glacial Lake Paramus within and surrounding Glen Rock.

The water level in Glacial Lake Paramus, at its maximum, was controlled by a spillway on a delta that previously formed in Rutherford and extended north to the retreating ice front in Westwood. When the ice melted in Westwood, Glacial Lake Paramus drained through the Musquapsink Book valley and into Glacial Lake Hackensack to the east. (Stanford, 2003)

The melt water entering the pro-glacial lakes from the melting glacier contained a significant amount of sand, gravel, silt and clay which was deposited as layered and sorted sediments. The Glacial Lake Paramus deposits in Glen Rock are primarily sand and gravel overlying lacustrine (lake bottom) sediments, and based on well drilling logs, are approximately 20 to 30 feet thick. These sand and gravel deposits are excellent construction materials and were mined during the late 1800s and early 1900s in a quarry located in what is now Diamond Brook Park. Diamond Brook Park also contains the remnants of an abandoned train yard with the foundations a former roundhouse and evidence of several former train sidings. The former quarry in Diamond Brook Park appears to have been a significant operation for its time and the materials mined from the area were probably loaded onto rail cars.

The tremendous weight of the glacier, with its load of soil and boulders, depressed the elevation of the ground surface as it moved over Glen Rock in direct proportion to the thickness of the ice and the load of material carried by the glacier. After the ice retreated from the area, the ground surface rebounded, or increased in elevation, in an elastic response to the removal of the weight of the glacier called "glacial-isostatic rebound. (Flint, 1971) The glacial isostatic rebound between Clifton and Hawthorne has been estimated on the order of 15 feet by comparing the current ground surface elevation of the former Lake Paramus shoreline. (Stanford, 2003)

The 'Glen Rock'

The 'Glen Rock', the large granitic boulder at the corner of Rock Road and Doremus Avenue, is classified as a "glacial erratic," meaning that it was deposited by a glacier and that the composition of the rock is different from the bedrock type commonly found in the area. By this definition, the term glacial erratic could be applied to any size particle ranging from silt and clay to the size of the Glen Rock and beyond, which was transported by a glacier from a different terrain. Most of the time, the term glacial erratic is typically reserved for the "big boys" like the Glen Rock.

The rounded shape of the Glen Rock boulder is an indication that it was transported a considerable distance and the granitic texture and composition is an indication that it is not native to the Newark Basin. Since the orientation of the flow of glacial ice in Glen Rock during the last glaciation was from the northeast, as evidenced by the orientation of the area drumlins, and the closest source of granite bedrock to Glen Rock is the Hudson Highlands in southern New York State, the Glen Rock was probably transported from southern New York State.

The Glen Rock is located in the middle of the former Glacial Lake Paramus and the lake sediments in the vicinity of the rock, based on a drilling log produced during the installation of a nearby water supply well, are approximately 25 feet thick. (Stanford, 2003) This

information indicates that the Glen Rock may be much larger than the exposure on the ground surface would suggest. Alternately, the Glen Rock may have been ice rafted on Glacial Lake Paramus and the dropped onto the lake bottom when the iceberg melted. But then again, the Glen Rock, or 'Pamachapura', may have been dropped from Heaven.

Extended periods of cold global climatic conditions and the resulting glacial activity are not rare phenomena in geologic history and evidence has been found to suggest that many large scale glaciations have occurred on earth from the Pre-Cambrian to the Pleistocene. Extended periods of warmer climate conditions are also not rare. The changing climate from cooler conditions to warmer conditions appears, at least in the Pleistocene, to occur in 100,000 year cycles and the cause of the changing climate over geologic time has not been fully explained. (Stanford, 2000) The current warmer climate, from the last cold snap approximately 11,500 years ago to the present, is considered to be an interglacial period. (Witte, 1998)

There are a number of hypotheses that have been promoted in an attempt to explain the change in climate temperature conditions over time. (Jansen, E. J., et al 2007) In summary, these possible explanations include:

- Variations in the orientation of the earth relative to the sun.
- Variations in the sun's energy output.
- Events occurring on earth which would tend to block the solar radiation received.
- Introduction of greenhouse gasses into the atmosphere.
- Changes in the ocean currents.

Recent studies have identified a small but consistent increase in global temperatures since approximately 1910. (Le Treut, H. R. et al., 2007) The International Panel on Climate Change (IPCC) has exhaustively reviewed the existing data on previous and current climatic conditions and has determined that the primary cause of the increasing global temperatures observed today are the result of human activity since approximately 1750 through the emission of greenhouse gasses from our industrial activity. (IPCC, 2007) If the conclusions of the IPCC are correct, the global warming trends observed today are anticipated to continue for some time into the future, and even if controls of manmade greenhouse gas emissions are implemented. (IPCC, 2007)

GEOLOGIC HAZARDS IN GLEN ROCK

There are a number of potential hazards associated with the geology in Glen Rock. These potential hazards include:

- radon,
- radiological compounds in water,
- earthquakes,
- soil movement or landslides, and

- contamination sources.

Radon**.** Exposure to radon can cause cancer and the USEPA estimates that radon may be responsible for up to 20,000 deaths in the United States per year. (USEPA, 2007) Radon exposure typically occurs when the gas migrates through soil and accumulates in the home. Radon is a colorless, odorless, radioactive gas which naturally occurs in the uranium decay series and uranium is a trace element found in soil and bedrock throughout the United States. Exposure to radon can also occur from water.

The USEPA has conducted an investigation to identify potential radon hazards in each county in the United States as required by the Indoor Radon Abatement Act of 1988. Bergen County has been classified as an area with a predicted average indoor radon screening level between 2 and 4 picoCuries per liter. (USEPA, 2008)

Radiological compounds. In New Jersey, the amount of uranium and other radioactive elements in soil and bedrock varies with the bedrock formation and soil type. Drinking water obtained from the Cohansey formation in several areas in southern New Jersey has been found to have elevated concentrations of radium. (NJDEP, 2004a) Elevated concentrations of uranium have been found in water supply wells in the Highlands. (NJDEP, 2004b) The former Lodi Municipal Well Field was closed in the 1980s due to the discovery of volatile organic and radiological compounds in the drinking water. (USEPA, 1998) The source of the radiological compounds detected in the water supply wells were determined to be naturally occurring in the sediments in the Newark Basin. Use of the municipal well field was discontinued and an alternate water supply was installed in the Borough.

Earthquakes. Although Glen Rock is located on the relatively stable interior of the North American tectonic plate, earthquakes have occurred in the vicinity of Glen Rock in the past. An earthquake is a sudden movement in the earth's crust due to a sudden release of energy from accumulated strain along a fault. (Dombroski, 1998) The strength of an earthquake is defined as the magnitude which is a measurement of the relative amplitude of the seismic wave. On the Richter scale, each unit increase represents a 10-fold increase in the amplitude of a seismic wave which is equivalent to a 32-fold increase in the amount of energy released. The intensity of an earthquake is evaluated by observing the effects of ground movement using the Modified Mercalli scale. (Dombroski, 1998) An intensity of I on the Modified Mercalli scale is equivalent to a 1.9 magnitude on the Richter scale and is barely felt. XII on the Mercalli intensity scale is equivalent to 8.5 on the Richter scale and the effects are judged to be total destruction.

The New Jersey Geological Survey has mapped the epicenters of 152 earthquakes which have occurred in New Jersey in recent time. (NJDEP and NJGS, 2008a) Most of the monitored events were low magnitude earthquakes up to 5.3 on the Richter scale. Earthquake

epicenters appear to be clustered in the Highlands to the west of Glen Rock. The closest earthquake epicenters to Glen Rock were reported in Hackensack. Four larger earthquakes were recorded in New Jersey in 1737, 1783, 1884 and 1927. The magnitude of these earthquakes were not monitored; however they have been assigned an intensity of VII based on their observed effects. VII on the Modified Mercalli intensity scale would cause minor damage to buildings and perhaps topple poorly constructed chimneys. (Dombroski, 1998)

Soil movements. The man-made embankments created adjacent to roadways and railroads are the steepest slopes occurring in Glen Rock. Slopes can become unstable and migrate under the force of gravity to a lower elevation. If the slope movement occurs very slowly, it is termed "soil creep" and the effects of the slow soil movement can be observed in the curved trucks of trees growing on a hillside or in concrete walls which appear to be toppling over. If the migration occurs quickly, the resulting ground movement is termed a "landslide." Landslides are not a typical occurrence in New Jersey; however, they can occur whenever the slopes are over-steepened, either naturally by erosion or by excavation and fill placement. There is one report of a recent landslide that occurred in Glen Rock in April, 2007. In this instance, the southern embankment of Route 208 failed during a heavy rainstorm which was probably the result of an over-steepened slope created during the construction of the roadway and excess pore pressures developed in the slope during the storm. (NJDEP and NJGS, 2008b)

Contamination sources. An environmental media is considered to be contaminated if the contaminant concentrations exceed the current standards established by the New Jersey Department of Environmental Protection (NJDEP). Both manmade and natural sources of contamination impact the quality of the soil, sediments, groundwater and surface water throughout New Jersey. Natural contaminant sources would typically include metals and radiological compounds. There is no limit to the creativity of humans and manmade contaminant sources can result from just about any activity undertaken. The NJDEP tracks the various known contaminated sites in New Jersey and as of May 2008, 16,670 active known contaminated sites were listed in the state. Of these sites, 1985 sites are listed in Bergen County and 17 sites are listed in Glen Rock. (NJDEP, 2008c) This listing of sites does not include those sites which are pending and those sites which have been adequately remediated as required by the regulations.

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SECTION IV: SOILS

INTRODUCTION TO SOILS

For many, soil can be simply defined as that stuff on the other side of the lawn. However, a more formal definition of soil is "the unconsolidated material found at the earth's surface that has been modified by physical, chemical and biological agents to the extent that the material will support plant growth." (American Geological Institute, 1976)

People have exploited the ability of soil to support plant growth for thousands of years and have congregated in those areas where the climate, water supply and soil conditions combine to support agriculture. Glen Rock is one of these places and was initially developed as a farming community. Over time, the character of Glen Rock has changed from an economy dominated by small farms to a suburban residential community. As a result, we are no longer as strongly tied to the natural resources found in our community to support our economic way of life. However, soil remains an important component in our ecosystem which continues to play a vital role in the overall quality of our environment.

As the character of Glen Rock has changed and our focus has migrated from woodlot and crops to floor area ratios and storm water management issues, the focus of the Natural Resource Conservation Service (NRCS), the agency within the USDA currently responsible for the soil survey, has also evolved. In response to the lifestyle changes which have occurred in our communities, the NRCS has expanded its initial agriculture mission to include aspects of emergency response, watershed management, wildlife habitat protection, wetlands protection and environmental issues related to soil, surface water and groundwater quality.

SOIL CLASSIFICATION SYSTEM

The first soil surveys were completed in the United States in 1899 by the U.S. Department of Agriculture (USDA) to aid in tobacco production on the east coast and to evaluate the feasibility of agricultural production in the dryer areas within the southwest. (NRCS Fact Sheet) Since that time, the USDA has continued its investigations to classify and map over 16,000 different soil types throughout the United States and Territories. (Soil Survey Division Staff. 1993)

Within the USDA Soil Classification System, eleven dominant soil "orders" have been identified throughout the United States. Each order is further divided into suborders, great groups, subgroups, families and finally soil series. (United States Department of

Agriculture, Soil Conservation Service, 1995) In this classification system, a soil series is the distribution of soil which was formed from a similar parent material, has similar physical and chemical characteristics and exhibits similar soil horizons in profile.

A soil series is named after a specific place or "type location" where the soil series was initially identified and studied. For instance, the type location for the "Pascack" soil series is "Borough of Old Tappan, 400 feet south of Willow Drive and 650 feet west of western end of Forest Avenue." (Soil Survey Staff, 2008) A soil sample from a type location can then be compared to soil samples from other locations and the extent of the soil series can be mapped.

Soil horizons are the various layers which naturally develop in soil due to physical and chemical weathering processes. (Schoenberger, P.J. et al. 2002) The major and most common soil horizons in a typical soil profile from top to bottom include the O, A, B, C and R horizons. Further sub-horizon designations within a profile are possible depending upon the factors influencing the soil development.

The O horizon is the surface layer of organic material which is actively decomposing and releasing its chemical constituents to the subsurface. The A horizon is the developed surface soil or topsoil which contains a significant amount of the organic material from the O horizon as well a mixture of soil minerals from the parent soil materials below. The B horizon, also termed the "subsoil", is the zone in the soil profile where active soil weathering is occurring from the release of acids and organic compounds from the overlying O and A horizons. The C horizon is the parent soil material, which in the case of Glen Rock, would include the glacial till and proglacial lake sediments deposited by the glaciers. The R horizon is weathered bedrock material.

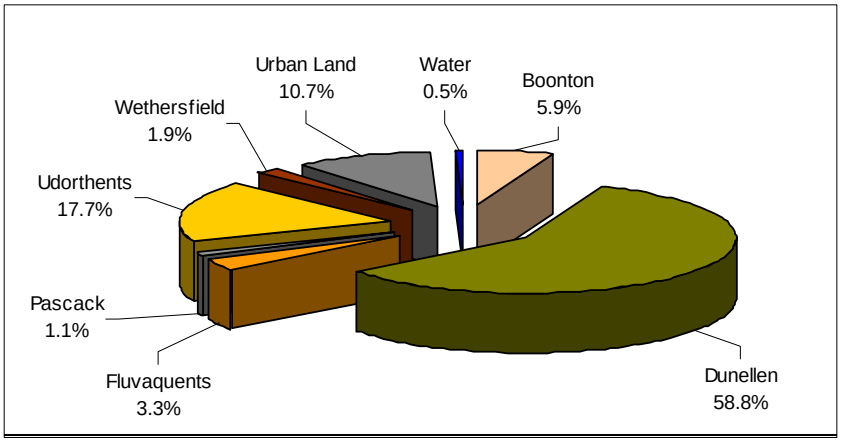
GLEN ROCK SOILS

The NRCS has identified at least sixteen soil series within Bergen County in its "Soil Data Mart", a digital Soil Survey for identifying soils throughout the United States. The six soil series identified in the Borough of Glen Rock include:

1. Boonton
2. Dunellen
3. Fluvaquents
4. Pascack
5. Udorthents
6. Wethersfield

As shown in the figure below, the majority of Glen Rock's soils are within four soil series: Dunellen (58.8%), Udorthents (17.7%), Urban Land (10.7%) and Boonton (5.9%), with the Dunellen series along accounting more than half of the soils in Glen Rock.

Figure 2
Percent of Each Soil Series in Glen Rock



The distribution of each type of soil found in the soil survey for the Borough is shown in the table below.

Table 7
Soil Distribution in Glen Rock

Symbol	Soil Description	% Slopes	Acres	Percent
BouB	Boonton-Urban land complex	0 to 8	34.5	2.0%
BouC	Boonton-Urban land complex	8 to 15	67.9	3.9%
DuuA	Dunellen-Urban land complex	0 to 3	28.9	1.7%
DuuB	Dunellen-Urban land complex	3 to 8	660.3	38.3%
DuuC	Dunellen-Urban land complex	8 to 15	323.3	18.8%
FmhAt	Fluvaquents, loamy	0 to 3	57.4	3.3%
PbuA	Pascack silt loam	0 to 3	18.9	1.1%
UdkttB	Udorthents, loamy	0 to 8	13.5	0.8%
UdwB	Udorthents, wet substratum	0 to 8	34.6	2.0%
UdwuB	Udorthents, wet substratum-Urban land complex	0 to 8	257.1	14.9%
WeuC	Wethersfield-Urban land complex	8 to 15	33.5	1.9%
UR	Urban land	--	185.0	10.7%
WATER	Water	--	7.9	0.5%
				100.0%

The USDA-NRCS has compiled the "Official Soil Series Descriptions" which provides general and detailed information about each recognized soil series in the United States. Sections of the Official Soil Series Descriptions describing Glen Rock soils are presented below. We have taken the liberty to edit the descriptions to provide definitions for some of the terms used in the USDA-NRCS descriptions.

Boonton

The Boonton series consists of deep or very deep soils on gently sloping to very steep uplands. Slope is usually smooth and regular and gradient ranges from 0 to 50 percent. The soils formed in glacial till composed mostly of red to brown shale, sandstone, basalt, and some granitic gneiss. The climate is humid temperate; mean annual temperature ranges from 50 to 57 degrees F and precipitation ranges from 40 to 45 inches. Frost free season is 130 to 150 days.

Boonton soils are moderately well and well drained. Runoff is slow to rapid. Permeability is moderate or moderately rapid above the fragipan and very slow in the fragipan. "Permeability" is a measure of how quickly water can pass, or permeate, through a material and "fragipan" is used to describe a layer of soil in which the permeability has been reduced due to weathering. (US Soil Survey Staff, 2006) Permeability in the substratum is very slow to moderately rapid. There is a perched water table at a depth of 1.5 to 3 feet from November to May of most years. Most Boonton soils are in areas that have become highly urbanized. Undeveloped sites are wooded or idle fields. Wooded areas have oaks, red maple, white ash, hickory, gray birch, and dogwood trees.

Dunellen

The Dunellen series consists of very deep soils on glacial outwash plains and stream terraces, formed in stratified materials. Slope ranges from 0 to 35 percent. Depth to bedrock is typically greater than 10 feet. The underlying bedrock is red, soft shale or siltstone. The growing season ranges from 160 to 190 days. Mean annual temperature is about 53 degrees F., and mean annual precipitation is about 44 inches.

Dunellen soils are well drained. Saturated hydraulic conductivity ranges from moderately high or high in the solum (weathered soils) and high or very high in the substratum (unweathered parent soils). Runoff is negligible to high. Dunellen soils are principally used for community development. Most remaining areas are idle on the urban fringe and some areas are used for pasture, hay or general crops. Trees in wooded areas include red, white and black oak, hickory, red maple, and ash.

Pascack

The Pascack series consists of very deep, moderately well drained and somewhat poorly drained soils formed in glacial outwash, , which in many places has a loamy

mantle. They are nearly level to undulating soils in slight depressions or broad drainageways on outwash plains and terraces. Slope ranges from 0 to 8 percent. The outwash is derived principally from red shales and sandstones, basalt, and granitic gneiss. Mean annual temperature is about 54 degrees F., and mean annual precipitation is about 44 inches. The growing season ranges from 160 to 190 days.

Pascack soils are moderately well and somewhat poorly drained. Surface runoff is slow. Permeability is moderately rapid in the solum (weathered soils) and rapid or very rapid in the substratum (unweathered parent soils). The soil has a seasonal high water table at a depth of 1 to 3 feet from October through May of most years. Most Pascack soils are used for community development. Some areas are idle or wooded. Common crops are corn, soybeans, vegetables, and nursery stock. Common trees are red, white and black oak, hickory, red maple and white ash.

Wethersfield

The Wethersfield series consists of very deep loamy soils formed in acid glacial till on uplands, derived mostly from reddish sandstone, shale, and conglomerate with some basalt.. The soils are moderately deep to dense basal till. Wethersfield soils are nearly level to steep and are on till plains, low ridges, and drumlins. Slope ranges from 0 to 35 percent. Mean annual temperature is about 50 degrees F., and mean annual precipitation is about 50 inches. The growing season ranges from 130 to 185 days.
Wethersfield soils are well drained and surface runoff is negligible to high. Permeability is moderately rapid or moderate in the solum (weathered soils) and slow or very slow in the substratum (unweathered parent soils). Many areas are cleared and used for cultivated crops, hay, or pasture. Some areas are used for vegetables, orchards, and nursery stock. Scattered areas are used for community development. Some areas are wooded. Common trees are red, white, and black oak, hickory, ash, sugar maple, red maple, beech, gray birch, white pine, and hemlock.

Fluvaquents

The Fluvaquents series consist of loamy very deep, poorly and somewhat poorly drained soils on flood plains. They formed in alluvium. Typically these soils have a reddish brown silt loam surface layer 7 inches thick. The mottled silt loam subsoil is reddish brown from 7 to 16 inches and pinkish gray from 16 to 35 inches. The substratum from 35 to 52 inches is pinkish gray sandy loam and below 52 inches is varigated pinkish gray stratified sand and gravel. Slopes range from 0 to 8 percent.

This component is on flats on uplands, fills. The parent material consists of loamy lateral spread deposits. Depth to a root restrictive layer is greater than 60 inches. The natural drainage class is moderately well drained. Available water to a depth of 60 inches is very low. Shrink-swell potential is low.

Urdothents

The Udorthents series generally consist of loamy material in the upper part and sandy to loamy material mixed with household and industrial refuse in the lower part. Slopes are 0 to 8 percent. This component is on fills, flats on uplands. The parent material consists of loamy lateral spread deposits. Depth to a root restrictive layer is greater than 60 inches. The natural drainage class is moderately well drained. Available water to a depth of 60 inches is very low. Shrink-swell potential is low.

Urban Land

Urban land is land mostly covered by streets, parking lots, buildings, and other structures of urban areas. Slopes range from 0 to 45 percent.

SOIL CHARACTERISTICS

In addition to mapping and identifying the various soil series found in an area, the USDA-NRCS has also quantified the specific characteristics and suitability for each soil type. These characteristics are compiled in tables which are included in each Soil Survey folio. The characteristics reported for each of the soil series include the following:

- Woodlot Management and productivity
- Erosion hazard, Equipment limitations, Seedling mortality, Wind-throw hazard, Common trees, Trees to plant.
- Recreational Development
- Camp Areas, Picnic areas, Playgrounds, Paths and trails, Golf fairways.
- Wildlife Habitat
- Grain and seed crops, Grasses and legumes, Wild herbaceous plants, Coniferous plants, Wetland plants, Shallow water areas, Openland wildlife, Woodland wildlife and Wetland wildlife.
- Building Site Development
- Shallow excavations, Dwellings without basements, Dwellings with basements, Small commercial buildings, Local roads and streets and Lawns and landscaping.
- Sanitary Facilities
- Septic tank absorption fields, Sewage lagoon areas, Trench sanitary fill, Area sanitary fill and Daily cover for landfills.
- Construction Materials

- Roadfill, Sand, Gravel and Topsoil.
- Water Management
- Pond reservoir areas, Embankments, dikes and levies, Aquifer fed irrigation ponds, Drainage, Irrigation, Terraces and diversions and Grassed waterways.
- Engineering Index Properties
- USDA texture, Unified and AASHTO Classification, Particles greater than 3 inches, Grain size, Liquid Limit and Plasticity Index.
- Physical and Chemical Properties
- Clay, Moist bulk density, Permeability, Available water capacity, Soil reaction, Shrink-swell potential, Erosion factors and Organic matter.
- Soil and Water Features
- Flooding, High water table, Bedrock and Risk of corrosion.
- Classification of the Soils
- Family or higher taxonomic class.

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SECTION V: WATER SUPPLY & PROTECTION

INTRODUCTION

Nowhere is the interaction of people and the environment more evident than in the study of water and water resources. These next chapters on water (Sections V, VI, and VII), will discuss Glen Rock's supply and quality of drinking water, as well as the various water resources in the Borough, including groundwater, surface waters, and wetlands. Chapter VI will open with a description of the Borough's streams (Diamond Brook and Ho-Ho-Kus Brook) and how surface water conditions, including urbanization, stormwater, and flooding, impact Borough drinking water. Chapter VI will close with a discussion on the Borough's place in the regional "watershed," as is dictated by its terrain and streams. Chapter VII will discuss types of wetlands in Glen Rock.

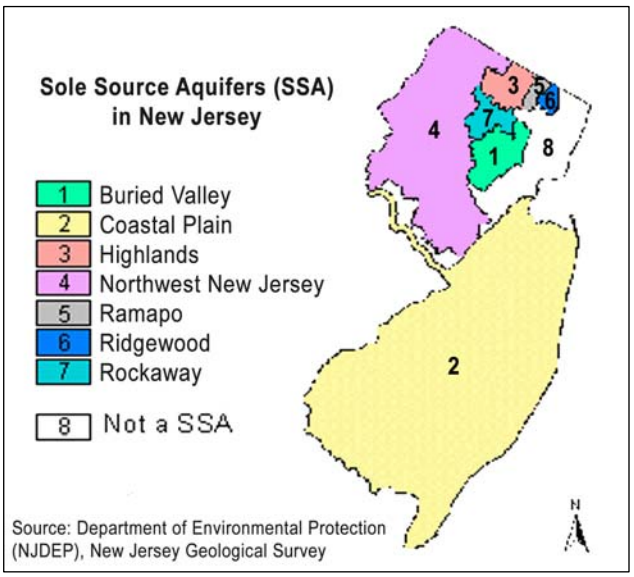
From this discussion, the dynamic and intrinsic relationship between human activity precipitation, water sources and our drinking water will become evident. The topic of water is not limited to these three chapters, however, as the prevalence and supply of water is a pervasive theme throughout this ERI: most of the Boroughs' natural resources (i.e., soils, habitat, vegetation, open space, etc…are dependent on water.

Some adverse effects of human behavior on our water resources will become evident from these discussions. One objective of this report is to inform Borough residents of the relationship between human activity and our natural resources so that people are better equipped to make the everyday decisions that affect these important resources. From knowledge comes understanding, and from understanding comes solutions.

GLEN ROCK'S DRINKING WATER

One of the most valuable resources that we as a community rely on is our drinking water. Drinking water may be derived from one of two sources: surface water, such as reservoirs, or ground water derived from wells. Groundwater is water located under ground in rock formations called aquifers. An aquifer is an underground formation of water-bearing permeable rock from which groundwater can be extracted using a well.. Aquifers are dependent on rainwater and precipitation to replenish their supply of drinking water. Aquifers supply wells and springs. In order to reach water, a drill must first pass through a layer of dirt and

Figure 3
The 7 Sole Source Aquifers in New Jersey



rocks (the "overburden"), and then through the layer of bedrock made of soft red shale, coarse grained sandstone and conglomerate. An aquifer is not the same as an underground stream or lake. The water within an aquifer is actually contained within fractures within the rock. Figure 4 shows the cross-section view of an aquifer.

Figure 4
Drinking Water Treatment Systems

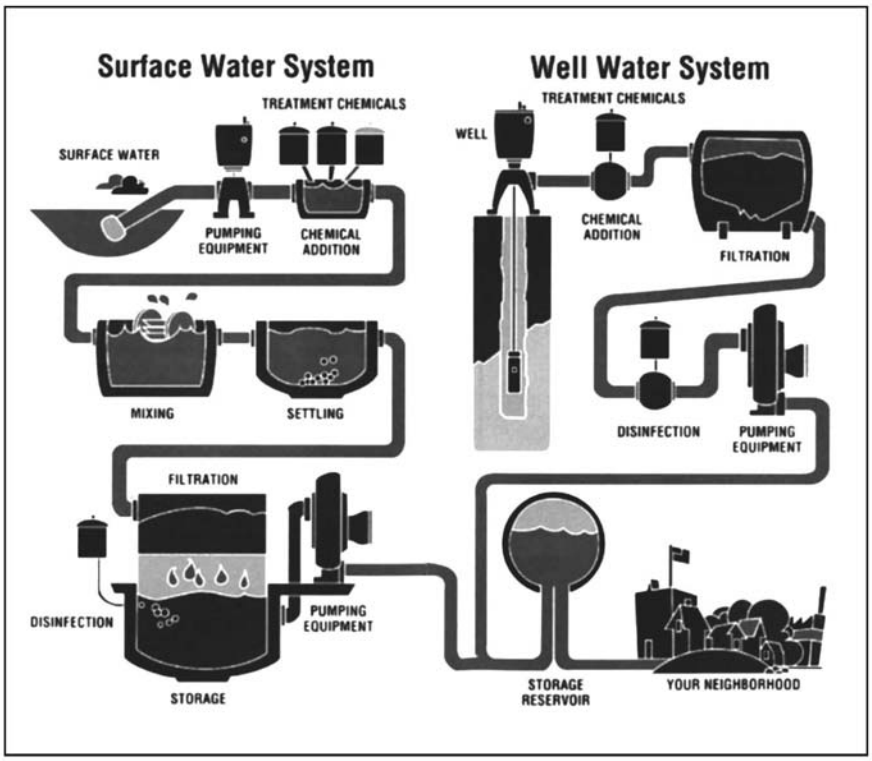
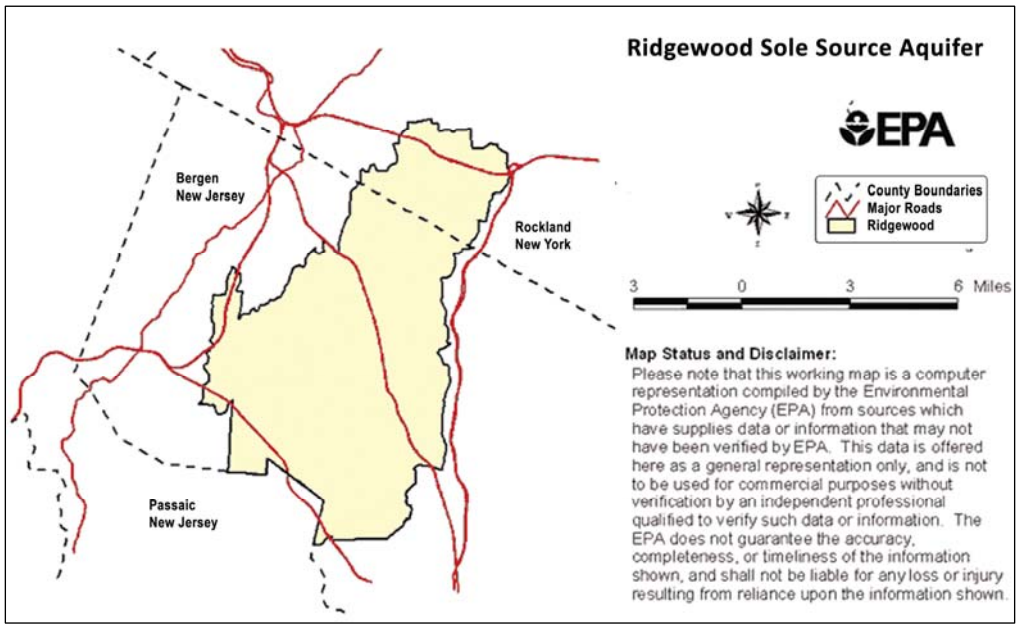


Illustration from "Safeguarding the Quality of Your Drinking Water", prepared by the Public Information Committee of the New Jersey Section of the American Water Works Association.

Ridgewood Water Public Utility

The Ridgewood Shale and Sandstone area aquifer system (Brunswick aquifer) supplies potable water to all of the communities of Glen Rock, Ridgewood, Midland Park and Wyckoff in Bergen County, New Jersey, encompassing a service area of approximately seventeen-point-five (17.5) square miles and more than 60,000 residents. The Village of Ridgewood Water Department ("Ridgewood Water") is the regulated public utility responsible for the 55 deep water supply wells in this area, which flow to 40 entry sites. Figure 5 below shows where the wells and other Ridgewood Water facilities are located across the four (4) municipalities.

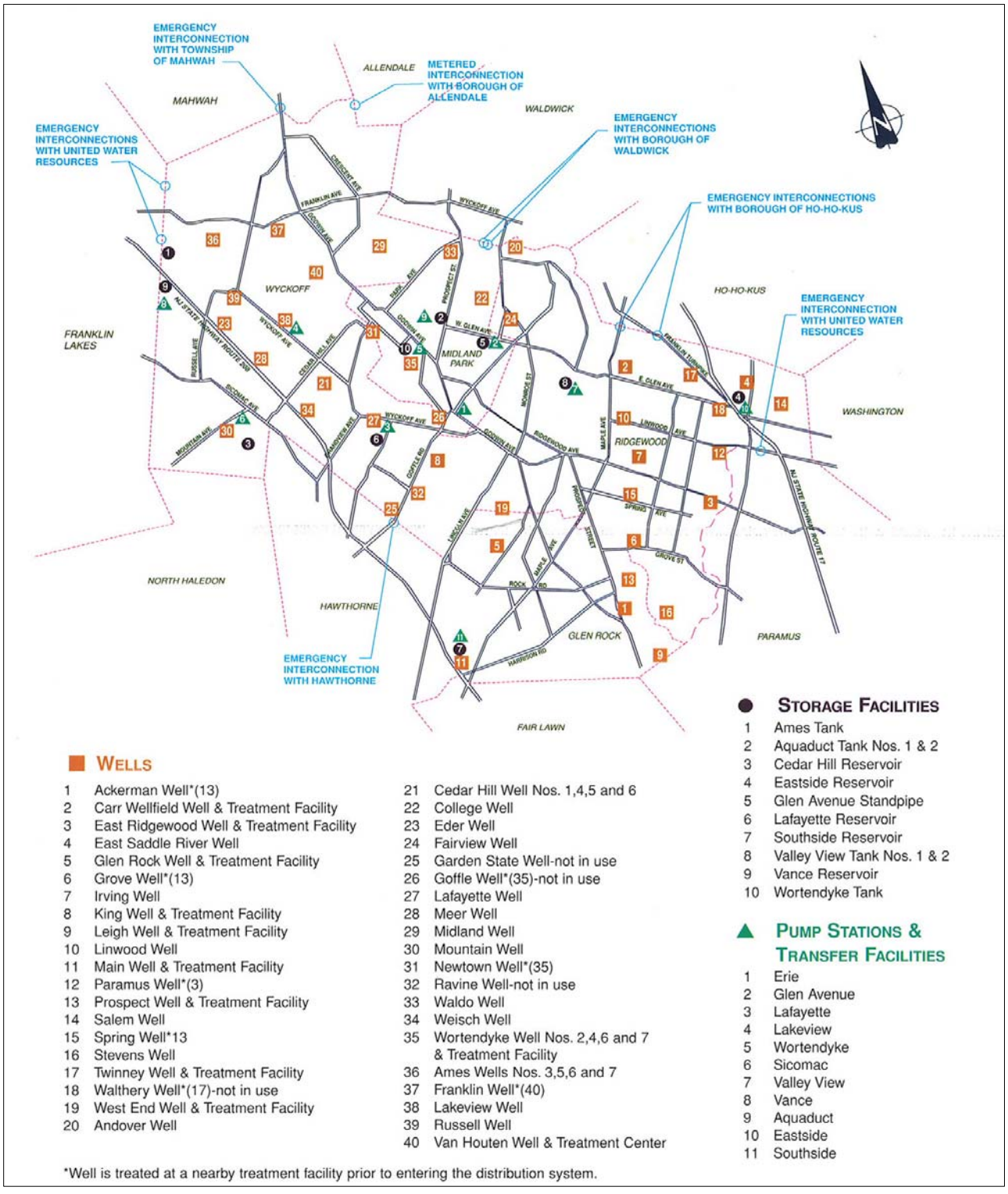
Figure 5
Ridgewood Sole Source Aquifer



The Ridgewood Water System is classified as an aquifer under *artesian pressure*. In an "artesian well," groundwater flows upwards without the need for pumping. The topography of the region and the pressure of the overburden are so high, that when underground water finds an outlet (i.e. a well), it is pressurized to flow upward, against gravity. The earliest wells were springs, natural fissures in the rock where the ground water flowed out naturally.

On July 4, 1979 the *Committee to Keep Our Water Pure*, composed of citizens who resided within the village of Ridgewood Water service area (Midland Park, Glen Rock, Wyckoff and Ridgewood, New Jersey), petitioned the Administrator of the United States Environmental Protection Agency (EPA) to designate the Shale and Sandstone (Brunswick) aquifer in the Ridgewood Area Sole Source Aquifer (SSA) under the provisions of the Safe Drinking Water Act. In January 1984, the *Shale and Sandstone (Brunswick) Aquifer of the Ridgewood Area, New Jersey* was designated as one of seven (7) sole-source aquifers (SSAs) in New Jersey. As mentioned, this aquifer is the source of Glen Rock's drinking water. SSAs are defined by the EPA as aquifers that contribute more than 50% of the drinking water to a specific area, and the water would be impossible to replace if the aquifer were contaminated. The sole source aquifer program is a federal program administered by the Environmental Protection Agency (EPA) under the Safe Drinking Water Act.

Figure 6
Map of Ridgewood Water Supply Well and Facility Locations



Wells

1 Ackerman Well*(13)
2 Carr Wellfield Well & Treatment Facility
3 East Ridgewood Well & Treatment Facility
4 East Saddle River Well
5 Glen Rock Well & Treatment Facility
6 Grove Well*(13)
7 Irving Well
8 King Well & Treatment Facility
9 Leigh Well & Treatment Facility
10 Linwood Well
11 Main Well & Treatment Facility
12 Paramus Well*(3)
13 Prospect Well & Treatment Facility
14 Salem Well
15 Spring Well*13
16 Stevens Well
17 Twinney Well & Treatment Facility
18 Walthery Well*(17)-not in use
19 West End Well & Treatment Facility
20 Andover Well
21 Cedar Hill Well Nos. 1,4,5 and 6
22 College Well
23 Eder Well
24 Fairview Well
25 Garden State Well-not in use
26 Goffle Well*(35)-not in use
27 Lafayette Well
28 Meer Well
29 Midland Well
30 Mountain Well
31 Newtown Well*(35)
32 Ravine Well-not in use
33 Waldo Well
34 Weisch Well
35 Wortendyke Well Nos. 2,4,6 and 7 & Treatment Facility
36 Ames Wells Nos. 3,5,6 and 7
37 Franklin Well*(40)
38 Lakeview Well
39 Russell Well
40 Van Houten Well & Treatment Center

*Well is treated at a nearby treatment facility prior to entering the distribution system.

Storage Facilities

1 Ames Tank
2 Aquaduct Tank Nos. 1 & 2
3 Cedar Hill Reservoir
4 Eastside Reservoir
5 Glen Avenue Standpipe
6 Lafayette Reservoir
7 Southside Reservoir
8 Valley View Tank Nos. 1 & 2
9 Vance Reservoir
10 Wortendyke Tank

Pump Stations & Transfer Facilities

1 Erie
2 Glen Avenue
3 Lafayette
4 Lakeview
5 Wortendyke
6 Sicomac
7 Valley View
8 Vance
9 Aquaduct
10 Eastside
11 Southside

From the months of October through April, Ridgewood Water pumps an average of 7 million gallons per day (mgd). From May to September, the water company pumps an average of 15-17 mgd. During periods with very high temperatures, the daily pump rate can rise to 20-22 mgd.

To meet the growing needs of the communities it serves, Ridgewood Water has contracted with United Water (formally known as Hackensack Water Company) to provide water for the public water utility from March through December. The hook-up for United Water enters in Wyckoff at the Franklin Lakes border. Ridgewood Water also has interconnections with most of the water companies in our region (e.g. HoHoKus, Allendale, Fair Lawn, Waldwick and Passaic Valley). The Hawthorne Water Company also provides Ridgewood Water with excess water supply when needed.

In general, consumers receive water from the wells that are located closest to their homes. Therefore, most of the water used in Glen Rock is pumped from wells located in Glen Rock.

There are four pump stations and treatment facilities in Glen Rock.

1. The Main Well, treatment facility and storage facility, near Rt. 208,
2. the Glen Rock Well and Treatment Facility,
3. The Leigh Well and Treatment Facility, located near Ackerman close to the Fair Lawn border, and
4. The Prospect Well and Treatment Facility which pumps water from the Ackerman, Spring and Grove Wells.

The water is routinely tested for over 100 regulated compounds before and after treatment. Depending on the potential contaminant and the well's history, testing may be done on a yearly, monthly or even on a daily basis as in the case of chlorine, which is added at the treatment facilities. The four pump station and treatment facilities each have aerators to remove volatile organic chemicals. Aerators are a very effective method to remove these compounds. Further discussion of Glen Rock's water contamination and treatment is provided in the "Drinking Water Contaminants" section below.

WATER SUPPLY WELLS

As shown on the *Areas of Critical Water Supply Map* (See Map Appendix), there are four (4) public water supply wells in the Borough of Glen Rock. They were originally installed by Rinbrand Well Drilling Company between 1955 and 1957, and are now owned by the Ridgewood Water Department.

The spatial location for the wells shown on the *Map* was obtained by GPS by the NJDEP, and the data associated with each well comes from well records and permits. The Table below shows general information for each well. The Well ID is also the permit number, which was assigned by the NJ Bureau of Water Allocation. The four wells reach depths of approximately 300 feet. The depth to the top of the water level in the well prior to pumping (static water level) is zero feet, or in the case of the Ackerman Well, 6.5 feet deep. The Glen Rock Well has the slowest pumping capacity at 150 gallons per minute, where the Prospect Well pumps at a rate of 400 gallons per minute.

Table 8
The Four (4) Water Supply Wells in Glen Rock

Well ID (Permit No)	Well Name	Date Complete	Surface Elevation	Total Depth	Depth to Top of Well	Static Water Level	Pump Rate	Geological Name (Passaic Formation)
23-01443	Main Well	3/9/1955	50 ft	300 ft	56 ft	-1 ft	350 gpm	quartzite-clast conglomerate
23-02227	Ackerman Well	9/30/1957	60 ft	303 ft	49 ft	6.5 ft	250 gpm	conglomeratic sandstone
23-01770	Prospect Well	10/1/1955	60 ft	300 ft	50 ft	0 ft	400 gpm	conglomeratic sandstone
23-01835	Glen Rock Well	3/3/1956	80 ft	300 ft	49 ft	-1 ft	150 gpm	quartzite-clast conglomerate

GROUND WATER RECHARGE

Ground water is the water that migrates below the earth's surface to support aquifer recharge, base stream flows or wetlands. Ground water movement throughout the Ridgewood area typically mirrors surface drainage patterns. The only source of "recharge" to the Brunswick Formation is in precipitation that infiltrates the ground and makes it way down to the water table. Groundwater recharge is completely dependent on rain and other forms of precipitation. Much of the precipitation, however, never makes it into the ground and is instead evaporated, taken for aquatic plant and animal life (transpiration), or ends up in surface water bodies. The quantity of ground water ultimately available to the bedrock wells will vary with amounts of short and long-term trends in precipitation.

The source of stream flow to the Ridgewood Aquifer is that portion of the drainage basins of Ho-Ho-Kus Brook and Saddle River Run located upstream of the ridged area. This includes all or a portion of the following New Jersey municipalities: Waldwick, Allendale, Ramsey, Mahwah, Franklin Lakes, Ho-Ho-Kus, Saddle River, Upper Saddle River, Woodcliff lake, Hillside, Washington, Montvale, as well as Ramapo Township, New York.

The porosity of soils and amount of impervious surface will also affect ground water recharge levels. Section VI further discusses the affects of urbanization and stormwater on recharge. There are highly permeable soils in our area covering the Brunswick Formation. Average rainfall in the area is slightly over 50 inches per year. Of this, approximately 28 inches, or 56 percent of rain water will reach the aquifer each year. The evapo-transpiration loss in the Ridgewood area is estimated at twenty-four inches (20-24") per year. A community with no alternative water sources should base their ground water supply on quantities available during minimum recharge conditions. Such a period occurred in the Ridgewood area from 1963 to 1966, where average precipitation was less than 35 inches.[1]

The *Groundwater Recharge Map* (see Map Appendix) shows how annual ground water recharge levels vary throughout the Borough's landscape, depending on the existing soil conditions and land uses. As shown in the table below, the areas experiencing the greatest recharge rate (upwards of 12 inches per year) are areas of the Dunellen soil series, which tend to be well-drained soils. More than 1,000 acres of the Borough's land area receives an average of 12.8 inches of groundwater recharge. There are no areas of the Borough that have a GWR of "A," which would yield 16 inches or more of GWR per year.

Table 9
Glen Rock Ground Water Recharge (GWR) Rank

GWR Rank	GWR Inches/Year	Soil Series	Acres
B	12 - 15	Dunellen	1,028
C	10 - 11	Boonton	149
D	1 - 9	Dunellen/Boonton	23
E	0	Urban Land / Udorthent	421
L	Hydric Soils	Fluvaquent	14
W	Wetlands/Water	Udorthent, Fluvaquent, Pascack	90
Total			*1,726*

The maximum recharge potential for the eight square mile Ridgewood Area is approximately 24 million gallons a day (MGD). Not all of this water is available to the existing well system which presently withdraws an average of 7 MGD, about 24% of the recharge potential. In the summer months this amount more than doubles to 18 MGD. When properly used, the amount of ground water pumped out for human purposes is less than what nature supplies to recharge the aquifer. If the consumption rate is higher than the recharge rate, there will not be adequate drinking water supply and mandatory use restrictions will be necessary.

[1] USEPA, Ridgewood Area Aquifer System (Brunswick Shale and Sandstone), Dec. 1983

WATER RESTRICTIONS

Because of the increased demand for water in the summer months, Ridgewood Water imposes mandatory water restrictions from May 1 through September 30 each year. Unrestricted use causes levels in storage tanks to drop considerably, which have the potential for creating emergency situations. Several factors influence the decision to impose stricter restrictions. These include a lack of rain precipitation, excessive heat waves, dangerously low levels of the water table, or increased usage. "Stage I," or normal restrictions, automatically go into effect on the first of May each year. The four (4) stages of water restrictions increase in severity, as follows:

Stage I (Normal)
Stage I restrictions are mandatory restriction limited to alternate days. The irrigation of properties with odd-numbered addresses are permitted on odd-numbered days, and the irrigation of properties with even-numbered properties are permitted on even-numbered days. Irrigation using a hand-held hose, however, is allowed at any time.

Stage II (Minor to Moderate)
Stage II restrictions are mandatory restrictions of irrigation limited to alternate days as defined above. In addition, no irrigation of any kind is allowed on Mondays.

Stage III (Moderate- Severe)
Stage III restrictions are mandatory restriction of irrigation limited to alternate days. In addition, manual sprinklers may only be operated between the hours of 7:00 A.M.- 9:00 A.M. and 7:00 P.M.- 9:00 P.M. Automatic in-ground sprinklers may be operated between the hours of 1:00 A.M.-4:00 A.M.. Irrigation using a hand-held hose is allowed on any day except Monday. No irrigation of any kind is allowed on Mondays.

Stage IV (Severe- Critical)
During a Stage IV restriction period, no irrigation of any kind is permitted.

WELL HEAD PROTECTION AREAS

In accordance with the 1986 and 1996 Federal Safe Drinking Water Act Amendments, all States must have a Well Head Protection Program (WHPP) in place for its public and nonpublic water supply wells. The goal of a WHPP Plan is to prevent contamination of ground-water resources, and delineation of Well Head Protection Areas (WHPA's) is one major component of the WHPP. A WHPA is the area from which a well draws its water within a specified time

frame[2]. More specifically, it is an area around a Public Community Water Supply (PCWS) well that delineates the horizontal extent of ground water captured by a well pumping at a specified rate over a two-, five- and twelve-year period of time.

Because of its high soil permeability and shallow depth to ground water, the Ridgewood Aquifer System is considered highly vulnerable to contamination. Potential sources of ground water contamination include storm water runoff, unsecured landfills, underground storage tanks and leaky drums, above ground storage tanks, chemical spills from industry, waste disposal lagoons, septic systems, highway deicers, road salt piles, etc…

Activities that introduce pollutants within the designated WHPA are most likely to contaminate drinking water sources. Therefore, these delineated areas become a top priority in efforts to prevent and clean up ground-water contamination. Furthermore, protective land uses, such as preserved open space should be targeted for these areas. As the remediation of groundwater or development of new groundwater sources is extremely difficult and cost prohibitive, pollution prevention is clearly the most economical approach to maintaining ground water resources.

A WHPA consists of three tiers, each based on the time of travel of the ground water to a pumping well. The time it takes a given particle of ground water to flow to a pumping well is known as the time of travel (TOT). The outer boundaries of these tiers have the following times of travel:

- Tier 1 = two years (730 days)
- Tier 2 = five years (1,826 days)
- Tier 3 = twelve years (4,383 days)

This distance varies for each well, depending on the rate of the pumping and characteristics of the aquifer, such as transmissivity, porosity, aquifer thickness, and hydraulic gradient. The tiers are used to assess the relative risk of contamination to the well by placing a higher priority on pollution sources, prevention and remedies in the tiers closest to the wells. The land coverage areas for each Tier of Protection in Glen Rock were delineated according to WHPP requirements, and can be seen on the *Areas of Critical Water Supply Map* (See Map Appendix). The protection areas span municipal boundaries. Well protection areas for the four Glen Rock wells extend into neighboring municipalities, and the protection areas for wells in adjacent municipalities extend into Glen Rock.

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o [2] Guidelines for Delineation of Well Head Protection Aras in New Jersey, NJ Geological Survey Open-File Report OFR 03-1, NJDEP 2003.

As shown in the table below, almost the entirety (99.1%) of Glen Rock's 2.72 acres of land area is covered by one of the three Well Head Protection Area (WHPA) Tiers. Approximately 43.4% of Glen Rock's land is in Tier 1, and should be considered a top priority for pollution prevention strategies.

Table 10
Well Head Protection Areas, Percent of Borough Land in each Tier

Tier	Acreage	Percent
Tier 1	753.0	43.4%
Tier 2	603.7	34.8%
Tier 3	361.7	20.9%
No Tier	16.4	0.9%
Total	1,734.8	100.0%

DRINKING WATER CONTAMINANTS IN GLEN ROCK

Drinking water, including bottled water, may reasonably be expected to contain at least small amounts of some contaminants. The presence of contaminants does not necessarily indicate that the water poses a health risk. In order to ensure that tap water is safe to drink, the Environmental Protection Agency (EPA) prescribes regulations that limit the amount of certain contaminants in water provided by public water systems.

The Safe Drinking Water Act of 1974, amended in 1986 and 1996, is the legal basis for regulating public drinking water in the United States. Its passage was spurred largely by mounting public awareness about contaminants in the environment, and concern for the safety of drinking water. The U.S. Environmental Protection Agency has primary enforcement responsibility.

The Safe Drinking Water Act (SDWA) of 1974 was the first federal law mandating drinking-water standards for all public water systems, from big cities to roadside campgrounds. It was enacted as a result of a federal survey of large and small public drinking-water systems that revealed poor water quality was endangering public health. The U.S. Public Health Service had set some drinking water quality standards in 1914, but these were merely voluntary for public systems. Under the 1974 SDWA, public water systems were required to follow water quality standards for particular contaminants. Water systems must be tested for these contaminants and, if necessary, the water is treated to reduce contaminants to the maximum contaminant levels (MCLs) set for each contaminant.

In 1996, the EPA proposed an amendment to the Safe Drinking Water Act requiring that all community water systems provide their customers with an annual water quality report. This report is designed to give consumers information about the quality of the water they are receiving and allow them to make personal health-based decisions regarding their drinking water consumption. Ridgewood Water follows this requirement in its annual report to Glen Rock customers.

According to the EPA, each report must provide consumers with the following fundamental information about their drinking water:

- The source of the water. This may include wells, rivers, lakes, reservoirs, or a combination of these sources.
- The levels of any contaminants found in the local drinking water. This may appear as an average level of a contaminant over the past year or as a range, with the highest and lowest levels of a contaminant over the past year.
- The likely source of any detected contaminants in the local water supply and the susceptibility of a water supply to potential contamination.
- The EPA Maximum Contaminant Levels (MCL) are the levels at which certain contaminants are considered to be potentially harmful. Consumers can compare the levels detected in their local water supply with these EPA health-based standards.
- Any violation of drinking water-related rules. This includes a violation of the MCL in which a contaminant exceeds the allowable limit. The report must also include an explanation of the water system's actions to restore safe drinking water.
- An educational statement regarding Cryptosporidium and the need for certain vulnerable populations to avoid exposure to these organisms.

In response to the Clean Water Drinking Act, the DEP has published a Source Water Protection Report (known as a SWAP). The DEP has identified the area that supplies water to a public drinking water system well or surface water intake and has inventoried the significant potential sources of contamination within the source water assessment area to determine how susceptible each drinking water source is to contamination. The ratings do not mean that a consumer will be ingesting these compounds; the ratings represent the potential for contamination, not the existence of contamination. The DEP's SWAP reports can be downloaded at http://www.state.nj.us/dep/swap/.

The SWAP reports on the susceptibility of contamination for the following eight contaminant categories:

1. Pathogens
2. Nutrients (nitrates)
3. Pesticides
4. Volatile Organic Compounds (VOCs)
5. Inorganics
6. Radionuclides
7. Radon
8. Disinfection Byproduct Precursors (DBPs)

One easy way for property owners to reduce unnecessary contamination to the water supply is to avoid excessive use of pesticides, fertilizers and other chemicals on lawns or in gardens, especially near the wellhead. Chemicals used to control weeds or fertilize lawns and gardens have the potential to leach into the regions drinking water supply.

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- An educational statement regarding Cryptosporidium and the need for certain vulnerable populations to avoid exposure to these organisms.

According to the *2008 Ridgewood Water Quality Report* the quality of ground water in the Ridgewood area is better than standards established by the Safe Drinking Water Act, and no violations were reported. Testing did reveal measurable amounts of various contaminants and their potential sources:

- Radioactive contaminants such as Radium or Uranium (from erosion of natural deposits),
- Inorganic compounds such as arsenic, barium, copper, lead, and nitrates (from erosion of natural deposits, corrosion of household plumbing systems, runoff from fertilizer use, and discharge from industry)
- Volatile Organic Contaminants (VOCs) such as tetrachloroene (from industry such as dry cleaners, or leaching underground gas or fuel oil tanks or gas or fuel spills), and
- Regulated disinfectants such as chlorine.

The 2007 Ridgewood Water Report also contains information on the Hawthorne Water Department and United Water. (Available for download at: http://water.ridgewoodnj.net/pdf/RIDGEWOOD WATERCCR2008.pdf)

Lead in our Drinking Water

In November 2008, Ridgewood Water sent a General Public Notice entitled "Important Information about Lead in Your Drinking Water." It notified residents that trace amounts of lead have been found in Ridgewood Water's source water and within the distribution system. Most of the exposure to lead discussed in the notice is the result of drinking water that has been in contact with household plumbing or service lines that contain lead.

Ridgewood Water routinely samples for lead. The utility is required to test homes or buildings that have copper pipes with lead soldered joints constructed between 1982 and 1987, or which have lead-based service lines.

Results of a September 2008 tap-water lead testing program showed that 13% of the samples had lead concentrations of 15ppb, or higher, where no more than 10% of samples should reach such concentrations. Ridgewood Water is performing the following tasks to help reduce lead exposure: increase the frequency of testing from yearly to semi-annually, develop and deliver public education, re-test water the sources of water to the system for lead and copper, monitor the corrosivity of the system, and if necessary initiate a lead service line replacement program.

Ridgewood Water recommends the following steps to reduce lead exposure from drinking water: run the faucet for 15-30 seconds if the water has not been used for several hours, use only cold water for consumptive purposes, do not boil water to remove lead, get your water tested, identify if your plumbing fixtures contain lead and look for alternative water sources or treatment of water:

KNOWN CONTAMINATED SITES

A brownfield is abandoned or underused industrial or commercial properties where redevelopment is complicated by actual or perceived environmental contamination. Brownfields vary in size, location, age and past use. They can range from a small, abandoned corner gas station to a large, multi-acre former manufacturing plant that has been closed for years.

A brownfield is defined under NJ state law (N.J.S.A. 58:10B-23.d) as "any former or current commercial or industrial site that is currently vacant or underutilized and on which there has been, or there is suspected to have been, a discharge of a contaminant." Generally, brownfields are properties that are abandoned or underutilized because of either *real or perceived* contamination. There are three (3) categories of Known Contaminated Sites (KCS) in New Jersey: Active, Pending and Closed.

- *Active Sites* are those sites having one or more active case with any number of Pending and Closed cases.
- *Pending Sites* are those sites having one or more pending cases, no active cases, and any number of closed cases.
- *Closed sites* are those sites having only closed cases. Sites in this category have no active or pending cases.

The New Jersey Department of Environmental Quality (NJDEP) Site Remediation Program manages the known contaminated sites in the state of New Jersey. At any one time, the DEP is charged with overseeing 23,000 known contaminated sites, of which an estimated 10,000 are brownfields.

Any property owner, developer or investor interested in redeveloping a contaminated site should contact the NJDEP Site Remediation Program for assistance with the remediation process. Any interested party may seek DEP oversight through the *Voluntary Cleanup Program* during the various phases of the process-preliminary planning, final planning or site remediation-to establish a scope and schedule of remedial activities. State financial assistance through the Hazardous Discharge Site Remediation Fund is available to eligible participants.

Brownfields in Glen Rock

The NJDEP continuously updates the list of KCS by adding new sites or re-classifying sites in its publicly available lists. Per the most recent (May 2008) update of this list by NJDEP, the Borough of Glen Rock had 15 "Active" sites, 4 "Pending" sites and 30 "Closed" sites on the KCS. Sites with an "active" status are still undergoing remediation under the management of the DEP. The locations of the 15 contaminated sites with an "active" status are shown on the *Areas of Critical Water Supply and Known Contaminated Sites Map* (See Map Appendix) and correspond with the list of sites shown in Table 11 below. The table sorts active sites by start date.

Table 11
Known Contaminated Sites in Glen Rock with "Active" Status

Map No.	Site ID	WHPA	Site Name	Site Address	Case Type	DEP Bureau	Start Date	Remedial Level
1	11992	Tier 2	GLEN ROCK SERVICE	390 MAPLE AVE	Regulated UST	BUST	12/2/86	C2
2	30968	**Tier 1**	TEXACO SERVICE STATION	531 PROSPECT ST	Regulated UST	BUST	9/11/89	C1; C2
3	11997	**Tier 1**	GLEN ROCK DEPT PUBLIC WORKS	473 DOREMUS AVE	Regulated UST	BUST	10/27/92	C1; C2
4	11994	Tier 3	EXXON R/S 3-2002	650 MAPLE AVE	Regulated UST	BUST	12/9/92	C2
5	46699	Tier 3	GLEN ROCK MUNICIPAL BUILDING	HARDING PLAZA RD	Regulated UST	BUST	9/21/98	C1
6	37509	**Tier 1**	HOME FUEL OIL CO INC	471 DOREMUS AVE	MOA	BFO-N	10/19/01	C2
7	167473	**Tier 1**	680 DOREMUS AVENUE	680 DOREMUS AVE	CEHA/ Homeowner	CEHA	1/20/04	C1
8	81488	Tier 2	TOSCANO & TACCETTA REALTY CO	464 BROAD ST	Regulated UST	BUST	2/3/04	C2
9	168402	Tier 2	72 ROCK ROAD	72 ROCK RD	CEHA/ Homeowner	CEHA	2/4/04	C1
10	181739	Tier 3	SERVICE STATION FORMER	672 MAPLE AVE	Regulated UST	BUST	10/1/04	C2
11	11994	Tier 3	EXXON R/S 3-2002	650 MAPLE AVE	CEA	BUST	10/13/04	C1
12	11986	**Tier 1**	RIDGEWOOD VILLAGE WD WELL	LEIGH TER	IEC/Pub. Funded/UNKSO	SA	5/3/05	C1
13	194453	Tier 2	112 OXFORD PLACE	112 OXFORD PL	CEHA/ Homeowner	CEHA	6/9/05	C1
14	354660	Tier 3	10 BERWYN PLACE	10 BERWYN PL	CEHA/ Homeowner	CEHA	11/21/06	C1
15	370986	Tier 2	44 CRESTWOOD DRIVE	44 CRESTWOOD DR	Fixed Fee /Homeowner	BFO-N	6/7/08	B

Legend: UST = Underground storage tank; CEHA = Center for Environmental Health Activities, MOA = memo of understanding, CEA = classification exemption area; IEC = Immediate environmental concern

As shown on the *Areas of Critical Water Supply and Known Contaminated Sites Map* and the table above, five of the active sites are located within the Tier 1, five are located within Tier 2, and five are located within Tier 3 of the Well Head Protection Areas. The highlighted Tier 1 sites should have a high priority of remediation, given their close proximity to the public water supply wells.

Most of the contaminated sites in the Borough are classified as a having a C1 or C2 remediation level, as described below.

- C1 No Formal Design - Source Known or Identified-Potential Ground Water Contamination
- C2 Formal Design - Known Source or Release with Ground Water Contamination
- C3 Multi-Phased RA - Unknown or Uncontrolled Discharge to Soil or Ground Water
- B Single Phase RA - Single Contamination Affecting Only Soils

There are also four sites on the DEP's list of "Pending Sites with Confirmed Contamination" as shown in Table X below.

Table 12
Known Contaminated Sites in Glen Rock with "Pending" Status

No.	Site ID	PI Number	Site Name	Site Address	Case Type	DEP Bureau	Start Date	Remedial Level
1	49006	022117	ASR BUILDING	21 HARRISTOWN RD	Awaiting Assignment	CAS	2/8/96	C2
2	64533	G000019989	FSI COMPANY	175 ROCK RD	Awaiting Assignment	BUST	7/27/94	C1
3	51878	017999	MANHATTAN INDUSTRIES, SALANT CORP	25 DE BOER DR	UNK SO	UNKSO	4/1/96	C3
4	85901	G000010999	SADDLE RIVER COUNTY PARK	PROSPECT ST	Awaiting Assignment	BFO-N	7/26/93	C1

There are 30 known contaminated sites in Glen Rock that have been remediated and are now considered "closed" by the NJDEP. These sites have received "no further action" (NFA) status from the NJDEP and are listed in Table X in the Appendix.

CONCLUSION

Glen Rock should give the highlighted Tier 1 sites a high priority of remediation, given their close proximity to the public water supply wells.

Glen Rock should pursue water conservation measures such as ordinances governing irrigation system use and standards to conserve current water supplies.

Since the use of lawn chemicals poses a threat to ground water and surface water supplies, Glen Rock should explore means of reducing use of fertilizers, pesticides and herbicides, such as the adoption of Integrated Pest Management policy.

Sources:

http://njaes.rutgers.edu/pubs/publication.asp?pid=FS555-

http://water.ridgewoodnj.net/pdf/RIDGEWOOD WATERCCR2008.pdf

Water Filter Comparisons website
http://www.waterfiltercomparisons.com/water_filter_comparison.php

SECTION VI: SURFACE WATER, STORMWATER & THE WATERSHED

GLEN ROCK'S WATERWAYS

The two streams that meander through Glen Rock are the Ho-Ho-Kus Brook and Diamond Brook.

The Ho-Ho-Kus Brook

The Ho-ho-kus Brook is an 18-mile stream that originates in Franklin Lakes. It flows southerly and meets up with the Ramsey Brook at White's Pond in Waldwick and flows through Ho-Ho-Kus and Ridgewood close to Graydon Pond. The Ho-Ho-Kus Brook delineates the eastern border of the borough where it joins the Saddle River in the County Park at the Glen Rock/ Fair Lawn border. The section of the Ho-Ho-Kus Brook that runs through Glen Rock is one of twelve Bergen County streams stocked with Trout in the spring by the New Jersey Division of Fish and Wildlife.

In 2004-2005, The League of Women Voters, in conjunction with the Lower Passaic / Saddle River Alliance (also known as Watershed Management Area 4 or WMA4), conducted a visual survey of the Ho-Ho-Kus Brook. The Glen Rock Environmental Commission was responsible for surveying the stretch of the brook that runs through Glen Rock. Repeated observations revealed stream bank degradation and erosion along the park side. The survey also revealed that hundreds of ducks and geese in the duck pond use the brook as a direct connection. High levels of fecal coliform found in samples from the adjacent section of the brook were attributed to the presence of geese.

In May 2006, the Bergen County Environmental Council assisted WMA4 in a project to discourage geese and improve the habitat of the park. Over 100 native shrubs were planted along the stream. This plant buffer serves as a barrier between geese and water and helps stabilize the stream bank by discouraging geese from climbing the stream banks.

"Geese Peace" is a Bergen County program that offers a humane solution to the Canadian Geese problem. Geese Peace uses a multi- pronged approach:

1. Population stabilization reduces the increasing numbers of resident geese at each site.
2. A nuisance abatement/site aversion program.
3. Educate the public about this issue.

In 2008 over 550 eggs were neutralized in 92 nests mostly in County Parks.

Diamond Brook

The Diamond Brook flows from the North to the South of Glen Rock, parallel to the western border. The Diamond Brook is approximately 2.6 miles long. It originates in Ridgewood from a series of springs just north of the Orchard Schoo,l and from there it flows through suburban properties, past the pool and Arboretum, under Rock Rd. past the Byrd School, through the Diamond Brook Park (also known as The Lower Doremus Woods). The Diamond Brook then flows under Rt. 208 and past the Opici warehouse and the industrial park at Glen Rock's southern border. The Diamond Brook then enters Fair Lawn and flows behind the Pathmark Shopping Center on Maple Ave. It continues underground through an industrial park before it empties into the Passaic River at a large outfall just west of the Maple Ave. Bridge.

The Diamond Brook was also known as the "The Bass Brook" because of the fish that were caught along its shady banks. The Diamond Brook appears on the same maps as "Cherry Blossom Brook." Lincoln Avenue appears on older maps as "Cherry Blossom Lane."

The Glen Rock Environmental Commission has had a series of reports prepared on the Diamond Brook to study the impact of suburbanization on the waterway and to address possible steps for remediation. In May 2006, William Paterson University biology professor Michael Sebetich PhD, prepared a report entitled "Ecological Assessment of the Diamond Brook." Over a three-year period, he took numerous samples of the Diamond Brook and studied the physical, chemical and biological make-up of the stream.

The results of the physical portion revealed a water temperature of 54.5 F- 66 F indicated a relatively low temperature influenced by springs. The stream averages about 13 feet in width. Water depth varies longitudinally due to the varied land use. Scour holes (indentations in the bank opposite an outfall caused by stormwater run-off), measure several feet, while riffles, formed in shallow areas by coarser materials such as gravel are under a half foot. The stream has many outfalls and in some backyard areas riprap, i.e. 4 X 4s have lead to channelization of the stream. Nonpoint source pollution in the form of plastic and glass bottles, tires, toys and plastic bags are in evidence.

An assessment of the organisms in a stream provides the most telling evidence of water quality. Stream macro invertebrates (animals without a backbone that can be seen with the naked eye) consist of insects (mainly in the larval stage), crustaceans, flatworms, leeches, snails, clams and mussels. Besides being an important link in the food chain, the study of macro invertebrates in a stream provides the most telling evidence of water quality.

Some stream-bottom macro invertebrates cannot survive in polluted water while others can survive or even thrive in polluted water. A healthy ecosystem supports diversity of organisms, so in a healthy stream, the stream-bottom community will include a variety of pollution-sensitive macro invertebrates. Conversely, an unhealthy stream will support only a few types

of nonsensitve macro invertebrates. Dr. Sebetich's sampling showed a preponderance of pollution tolerant species such as cranefly, black fly and midge larvae and scud (shrimp like creature). There were some pollution intolerant species sampled such as the Mayfly, but their numbers were minimal. Five species of fish sampled are fairly common to urban/suburban streams: White Sucker, Blacknose Dace, a small (2"-3") common fish. Green Sunfish (found in most streams and lakes in the eastern U.S) Mummichog, (up to 6 ") and a very small Largemouth Bass (3"). Fish that are stocked or dumped into the Arboretum pond may have escaped to the Diamond Brook.

Numerous factors affect the distribution and abundance of organisms. These include light, temperature, water discharge, velocity, substrate type (the material on the bed of the stream) and chemical composition of the water. The volume of stormwater that flows into the stream in turn affects all of the above factors. Erosion and scouring of stream banks degrades habitat. The increased run-off contains increased sediments such as pesticides and fertilizers, bottles, plastics, garbage, motor oil and other litter. The results of Dr. Sebetich's survey indicated that the Diamond Brook is a moderately impaired stream due as evidenced by low biological diversity and the paucity of pollution intolerant macro invertebrates. This is confirmed by monitoring by the state of New Jersey.

The New Jersey Department of Environmental Protection (NJDEP) has established an Ambient Biomonitoring Network (AMNET) to document the health of the states waterways. There are over 800 AMNET sites in the state. There is one such site on the Diamond Brook in Fair Lawn. This is a site map of the AMNET monitoring station in Fair Lawn.

Streams are classified as non-impaired, moderately impaired or severely impaired according to this data. Both the Diamond Brook and the Hohokus Brook are moderately impaired due to fecal coliform, suspended solids and/or macroinvertebrates. This means that the waterways are "impaired" and the NJDEP is required to develop a Total Maximum Daily Load (TMDL) for these pollutants for each waterway. A TMDL determines the greatest amount of a given pollutant that a water body can receive without violating water quality standards and designated uses. Once a TMDL is established the potential for remediation exists.

Spring-fed Ponds in Glen Rock

In addition to the two streams Glen Rock has 3 spring fed ponds. The largest pond borders the Diamond Brook Woods and is owned and maintained by the 14 homeowners on Boulevard that share access to the pond. The pond is used for swimming and boating by the residents. The pond has one aerator.

The second pond is located in the Carol Thielke Arboretum of Glen Rock. Ponds naturally fill in from plant debris. As the pond fills in, it gets shallower and wider. The Bergen County Mosquito Control Commission dredged the pond at the Glen Rock Arboretum in 2006. The

dredging helped to restore the health and depth of the pond. The pond has three aerators that put oxygen into the water. The staff at the Arboretum has been effective in maintaining the banks of the pond through native plantings.

The third pond is located behind the homes on Chatham Place. It has not been dredged and is not used for recreation.

SURFACE WATER QUALITY STANDARDS

All of New Jersey's surface waters, including rivers, lakes, streams, wetlands, estuaries, and near shore coastal waters, are regulated by NJ DEP's Surface Water Quality Standards (N.J.A.C. 7:9B). Surface Water Quality Standards (SWQS) are developed and administered in conformance with requirements of the Federal Clean Water Act (regulated by the USEPA), as well as pursuant to the New Jersey Water Quality Planning Act (N.J.S.A. 58:11A et. seq.) and the New Jersey Water Pollution Control Act (N.J.S.A. 58:10A et. seq.). The SWQS establish the designated uses and antidegradation categories of surface waters. They also classify surface waters based on those uses, and specify the water quality criteria and other policies and provisions (i.e., effluent limitation) necessary to attain those designated uses.

- *Designated uses* of surface waters specified by the SWQS include drinking water supply, fish consumption, shellfish resources, propagation of fish and wildlife, recreation, and agricultural and industrial water supplies.

- *Classifications* of surface waters are based on designated uses and are specified for New Jersey's fresh and saline waters. Freshwaters are classified as "FW1" (not subject to any man-made wastewater discharges) and "FW2" waters (all other freshwaters). Freshwaters are further classified based on trout status, including trout production (FW2-TP), trout maintenance (FW2-TM), and nontrout (FW2-NT). Saline waters are classified as saline estuarine "SE" and saline coastal "SC." SE waters are further classified into SE1, SE2, and SE3 based on the designated uses.

Glen Rock's two waterways are classified as Freshwater Nontrout production (FW2-NT) streams. Ho-Ho-Kus Brook, however is also classified as a Saline Estuary, which assigns it a different set of designated uses. The classification system is regularly updated as stream conditions change and was last amended June 16, 2008.

Table 13
Glen Rock Waterway Classifications

Waterway	Classification
Diamond Brook	FW2-NT
Ho-Ho-Kus Brook	FW2-NT/SE2

As an FW2 waterway, the designated uses of Diamond Brook are limited to:

1. Maintenance, migration and propagation of the natural and established biota;
2. Primary and secondary contact recreation;
3. Industrial and agricultural water supply;
4. Public potable water supply after conventional filtration treatment (a series of processes including filtration, flocculation, coagulation, and sedimentation, resulting in substantial particulate removal but no consistent removal of chemical constituents) and disinfection; and
5. Any other reasonable uses.

Having the classification of SE2 waterway, designated uses in Ho-Ho-Kus Brook are limited to:

1. Maintenance, migration and propagation of the natural and established biota;
2. Migration of diadromous fish;
3. Maintenance of wildlife;
4. Secondary contact recreation; and
5. Any other reasonable uses.

All waters of the State are classified and assigned with one of three antidegradation designations: Outstanding National Resource Waters (ONRW), Category One waters (C1), and Category Two (C2) waters. Glen Rock's two waterways are Category Two (C2) waterways. C2 waterways are simply all waterways that have not been designated as ONRW or C1 for purposes of implementing antidegradation policies.

Water Quality Criteria are developed for individual pollutants to protect aquatic plants and animals, and human health in both fresh and saline waters. Criteria are developed to protect water quality for designated uses, including survival, growth, and reproduction of aquatic life, and drinking water and fish consumption for human health protection.

URBANIZATION & STORMWATER

A definition and understanding of the term "impervious surface" is essential to comprehending two complicated relationships: the first is the connection between impervious surfaces and rainwater and our drinking water, the latter is effect of impervious surfaces on our Ridgewood Waterways (streams).

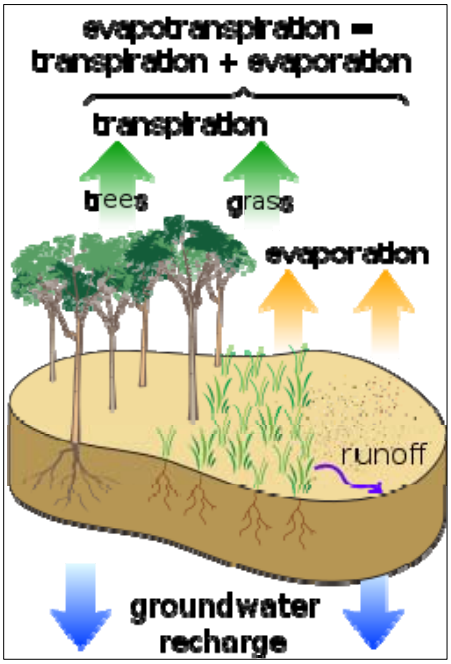
Impenetrable materials such as pavement, asphalt, concrete, brick and stone, prevent water from infiltrating the ground. These "impervious surfaces" can include rooftops, sidewalks, roads and parking lots, and are the result of human settlement and urbanization. Rainwater that enters the ground is the only means of replenishing our aquifer. Therefore, the more impervious surface coverage in an area, the less recharge there is to an aquifer.

The Borough is comprised of 1735 acres of land. According to the Maps for Mayors data, impervious surfaces (buildings, sidewalks, driveways, parking lots, etc.) covered 590 acres in 1985. By 1997, 10 more acres were added so that total area of impervious surface constituted 34.6% of the total acres in the municipality. Between 1985 and 1997 this showed an increase of a little over .6%. There are few undeveloped lots in Glen Rock.

The increase in impervious surface also leads to a reduction of trees and shrubs as there is less available land to plant on. Without trees to store and slow the flow of rainwater, the rate of "runoff" is greatly increased. This in turn leads to more flooding after storms and reduced flow in streams and rivers during dry periods.

"Stormwater" is precipitation that falls to the earth's surface as rain, snow, sleet or hail. Stormwater is best understood in terms of the water cycle. Under natural conditions, about 10 percent of precipitation runs over the land surface and about 50 percent infiltrates the soil to replenish groundwater flow and base flow to streams. Plant uptake and evapo-transpiration (the evaporation of water from plant leaves) account for about 40 percent.
http://en.wikipedia.org/wiki/File:Surface_water_cycle.svg

Figure 7
The Water Cycle



When natural conditions change because of development or land use alterations, the water cycle changes dramatically. As land is covered with more impervious surface, larger quantities of runoff, traveling faster, carry more pollutants from the pavement to our waterways . Rapid runoff and the paucity of vegetation reduce evapo-transpiration. Insolation (incoming solar radiation) is then simply heats the surface, rather than enabling evaporation.

With urban development, less than 15 percent of the rainfall infiltrates the soil and more than 55 percent of rainfall will become surface runoff. The amount of impervious surface in a watershed largely determines the quantity of pollutants in streams, lakes and rivers.

Detailed studies of the amount of particular pollutants found in waters show that when impervious cover is 10 percent or less of a watershed, water quality is very good. When impervious cover is between 10 percent and 25 percent of a watershed, the water quality is impacted and deteriorating. Where there is greater than 25 percent impervious cover in a watershed, surface water quality results tend to be badly deteriorated. As development

intensity increases, impacts to water quality increases and the need to carefully manage stormwater increases.

As stormwater runoff travels across the land, it picks up a number of pollutants that can pose serious health risks to humans and can disrupt and seriously damage water ecosystems. The U.S. Environmental Protection Agency (EPA) has identified nonpoint source pollution (NSP) as one of the most serious threats to water quality in the country.

Nonpoint source pollution is pollution from stormwater that travels through streets and storm drains, and discharges into streams, rivers and oceans. Nonpoint source pollution is often referred to as "people pollution," as it results from everyday activities such as fertilizing lawns or littering. People also contribute to NSP by disposing of hazardous household products or pet waste into storm drains.

After a rain, stormwater becomes polluted as it picks up oils, litter, salts, toxic metals that have accumulated on streets from cars, polycyclic aromatic hydrocarbons (PAHs) from driveway sealants, fertilizer and silt.

New Jersey has two regulations that address pollution from stormwater runoff: N.J.A.C. 7:8 Stormwater Management Rules and N.J.A.C. 7:14A Stormwater new (proposed) development. These performance standards for new development include groundwater recharge, runoff quality controls, and Category One (C1 waterway) buffers.

Stormwater: Harnessing a Valuable Resource

Stormwater can be viewed as a valuable resource that recharges ground water supplies rather than as a nuisance to be quickly channeled away and lost to the ocean. In the past, stormwater management was primarily concerned with flood reduction. The goal was to quickly eliminate stormwater from the watershed and send it downstream. One of the unfortunate consequences of this practice is the inability of the stormwater to affect ground water recharge.

Urbanization has a great effect on our local waterways. Development changes both the quantity and quality of water that flows into the Diamond and Hohokus Brooks. As our watershed has become increasingly populated, trees and shrubs have been replaced with impervious surfaces such as buildings, roads and parking lots. Without plants to store and slow the flow of stormwater, the rate of stormwater has increased. Increased water volume discharging into the Diamond and Hohokus Brooks has caused erosion of stream banks and scouring (the digging out of the bank). This means that a greater volume of water reaches our streams faster, leading to flooding during rain storms, but reduced flow in streams and rivers during dry periods.

The new state stormwater management regulations encourage imitation of the natural water cycle when new development is planned. Under natural conditions, over 50 percent of the runoff from stormwater soaks into the ground to replenish groundwater. As development covers the land, more and more water runs off the surface contributing to an increase in flooding and unrecoverable groundwater recharge. When planning a development project, an applicant should make sure that stormwater is able to infiltrate the surface as much as possible, and as close to the source as possible. Infiltration helps reduce runoff rates for smaller storm events, reduces runoff volumes for all storm events, increases ground water recharge, helps to sustain stream base flows, and significantly improves water quality.

Infiltration of stormwater is a relatively recent concept. For the past quarter of a century, stormwater management in New Jersey meant constructing "detention basins" to prevent increases in downstream "rates" of runoff and resulting flooding. Stormwater management today includes management strategies for controlling runoff "volumes" and water "quality" through a series of "Best Management Practices."

- Protect areas that provide water quality benefits such as wetlands, recharge areas, floodplains, woodland, stream and wetland buffers
- Maximize protection of natural drainage features and vegetation
- Minimize impervious cover and break up or disconnect runoff
- Minimize reduction in "time of concentration" from pre- to post-construction
- Minimize land disturbance including clearing and grading

LOCAL RESOURCES TO MANAGE STORMWATER

Municipal Stormwater Management Plan
In April 2006, Glen Rock prepared a Municipal Stormwater Management Plan prepared by Vollmer Associates of Rochelle Park as part of its Master Plan. It was approved by the Bergen County Planning Board in August 2006.

Stormwater Management Ordinance
Adopted on June 14, 2006. Based on the report, Glen Rock adopted a series of practices and several ordinances to comply with federally mandated requirements, the NJDEP's 2004 Stormwater Regulations (NJAC 7.8). The adopted ordinances include:

- Ordinance #1533-Establishes Stormwater Management Strategies for major developments)
- Pet Waste Ordinance – to immediately and properly dispose of pet waste
- Wildlife Feeding Ordinance—prohibits the feeding of non-confined wildlife on public property
- Litter Ordinance
- Illicit Connection Ordinance

- Ordinance #1519 – Nonstructural Stormwater Management Standards are based on BMPs and incorporate low impact development to control stormwater runoff and pollutants closer to the source.

The Borough has incorporated Nonstructural Stormwater Management Standards (NSMS) into Chapter 192 of the Borough Code, Subdivision of Land and Section 192-13 – Subdivision Design Standards and Section 192-14, Site plan Design Standards, as well as chapter 230, Zoning – Article VI. In all, twelve regulations have been modified to include Nonstructural Stormwater Management Standards.

Nonstructural Best Management Practices can be identified in three broad categories:

1. Dispersion - reduces stormwater velocity and allows for infiltration
2. Filtration - vegetation and swales allows particles and sediment to settle out of stormwater
3. Retention of Natural Vegetation - promotes filtration, disperses run-off and discourages geese.

More specifically, the regulations promote using pervious paving materials, native plants that reduce fertilizer and water use, maintaining vegetation, landscaping buffer zones between properties (including houses of worship,) and requiring sidewalks to discharge water onto lawns rather than streets. The Storm Water Management program includes:

- Retrofitting of stormwater drains during street paving (see Rock Rd.) The new storm drains have much smaller openings so that litter does not pass through. To spread the cost of this over several years, this is being accomplished on an on-going basis in conjunction with street repaving.
- Public education about nonpoint source pollution. The Glen Rock Environmental Commission distributes information on stormwater by providing a brochure, public information events and an educational workshop in the Glen Rock Public Schools.
- Mapping municipal storm sewer outfalls that discharge to surface water, and cataloging and counting storm sewers. The Glen Rock Environmental Commission mapped all stormwater outfalls in 2007.
- "Good housekeeping" practices in public works yards and municipal streets so that debris and contaminants do not enter the stormwater system.
- Runoff control for construction sites of an acre or larger to control soil erosion and sedimentation.

- Runoff controls for residential redevelopment projects using structural and non-structural stormwater management devices and emphasizing use of infiltration when possible. (see above)

FLOODING

In November 2007, the New Jersey Department of Environmental Protection adopted new rules for Flood Hazard Area Control (N.J.A.C. 7:13) These new rules incorporate more stringent standards for development in flood hazard areas and areas adjacent to surface waters in order to mitigate the adverse impacts to flooding and the environment that can be caused by such development.

Glen Rock also has regulations to deal with flooding.

- *Flood Damage Prevention Ordinance.*

The 2008 Master Plan Examination Report called for a review, and if necessary, a revision of this ordinance to comply with the new Flood Hazard Area Control Rules.

- *2008 Master Plan Reexamination Report.*

This report identifies the flooding in neighborhoods adjacent to the Diamond Brook and Ho-Ho-Kus Brooks as a concern and directs the Borough to continue to explore techniques to reduce the volume of stormwater runoff.

The Federal Emergency Management Agency (FEMA) categorizes geographic areas according to varying levels of flood risk into "flood zones." These zones are shown on a community's Flood Insurance Rate Map (FIRM) or Flood Hazard Boundary Map. Each zone reflects the severity or type of flooding in the area.

A Special Flood Hazard Area (SFHA) is an area delineated on the National Flood Insurance Rate Map (FIRM) as being subject to inundation by the base flood, or the "100-year flood." This is the flood that has a 1 percent chance of being equaled or exceeded in any given year.

The *Wetlands and Floodplain Map* (see Map Appendix) highlights flood zone AE, which is the Special Flood Hazard Area within Glen Rock. The rest of the Borough of Glen Rock is delineated as Zone X. The description of each zone is provided in the table below.

Table 14
Glen Rock FEMA Flood Zones

Zone	Zone Description	Flood Risk	Flood Insurance
Zone AE	Subject to inundation by the 100-year flood determined in a Flood Insurance Study by detailed methods. Base flood elevations are shown within these zones.	High Risk	Mandatory flood insurance purchase
Zone X	These areas have been identified in the community flood insurance study as areas of "moderate" or minimal hazard from the principal source of flood in the area. However, buildings in these zones could be flooded by severe, concentrated rainfall coupled with inadequate local drainage systems. Local storm water drainage systems are not normally considered in the community's FIS. The failure of a local drainage system creates areas of high flood risk within these rate zones. Flood insurance is available in participating communities, but is not required by regulation in these zones.	Moderate Risk	Available to Owners and Renters in this Zone

As shown on the Map, the areas immediately adjacent to Diamond Brook and Ho-Ho-Kus Brook are also located within the floodway. According to FEMA, the "Regulatory Floodway" is the channel of a river or other watercourse and the adjacent land areas that must be reserved in order to discharge the base flood without cumulatively increasing the water surface elevation more than a designated height. Development is not permitted in the floodway to ensure that there are no increases in upstream flood elevations.

The Borough does experience periodic localized roadway flooding at the Maple Avenue roadway low point beneath the railroad trestle during heavy rainfall. Flooding at this location is limited to the roadway and is the result of a combination of inadequate inlet and/or pipe capacity and increased stormwater volume. The Stormwater Management plan states that the Borough will consider the investigation of drainage improvements with the current Maple Avenue-Glen Road intersection improvements project.

GLEN ROCK IN THE GREATER WATERSHED

To manage the State's valuable water resources, the NJDEP's Division of Watershed Management further divides New Jersey into twenty (20) Watershed Management Areas (WMAs), which closely align with national watershed designations.

Glen Rock is in WMA4, also known as the *The Lower Passaic and Saddle River Alliance.* WMA 4 includes the **Lower Passaic River** (from the Pompton River to the Newark Bay) and its tributaries, including the **Saddle River**. The Lower Passaic drainage area is about 180 square

miles and lies within the portions of Passaic, Essex, Hudson, Morris and Bergen Counties, stretching from Upper Saddle River to Harrison WMA4 includes 66 municipalities.

Every land area is a part of a watershed. A watershed is an area of land that drains downhill into a body of water such as a river, lake, stream, reservoir, estuary, wetland or bay. Two factors serve to define watershed boundaries; the first is the terrain (ridges help to delineate watershed boundaries), the second is the flow of streams and rivers in the area to a common water body. The "drainage area" of a watershed includes the waterbody into which the water drains, as well as the land area over which the water flows into those channels. Both the Diamond Brook and the Ho-H-Kus Brooks (via the Saddle River) flow into the Passaic River. These two rivers establish Glen Rock's watershed "address."

Watersheds cross county, state and even national borders. Smaller watersheds join to form larger watersheds. Watersheds provide habitat to animals and plants, recreation opportunities for the human inhabitants and provide conditions and sites for water purification.

Figure 8
New Jersey Watershed Management Areas (WMAs)

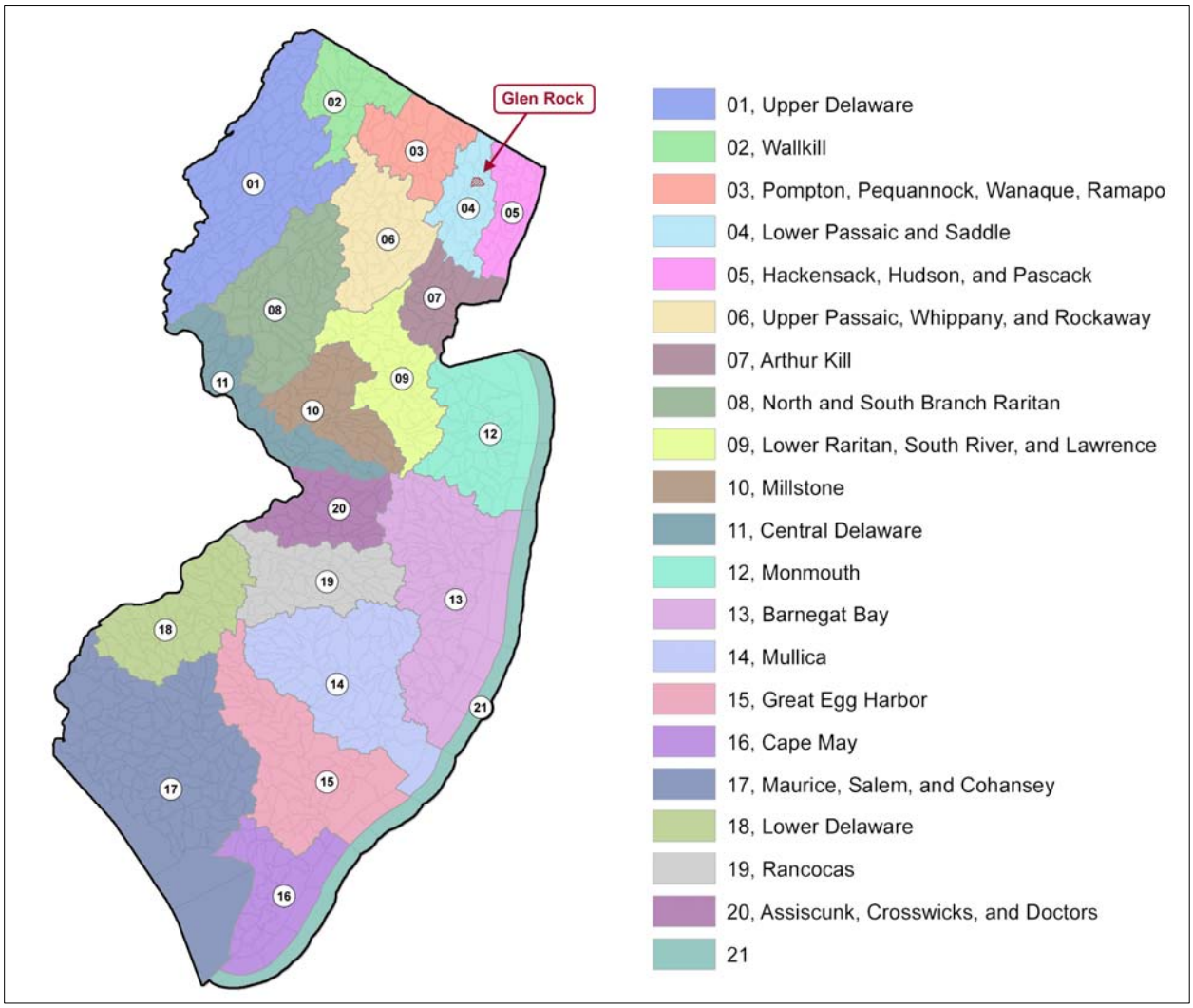
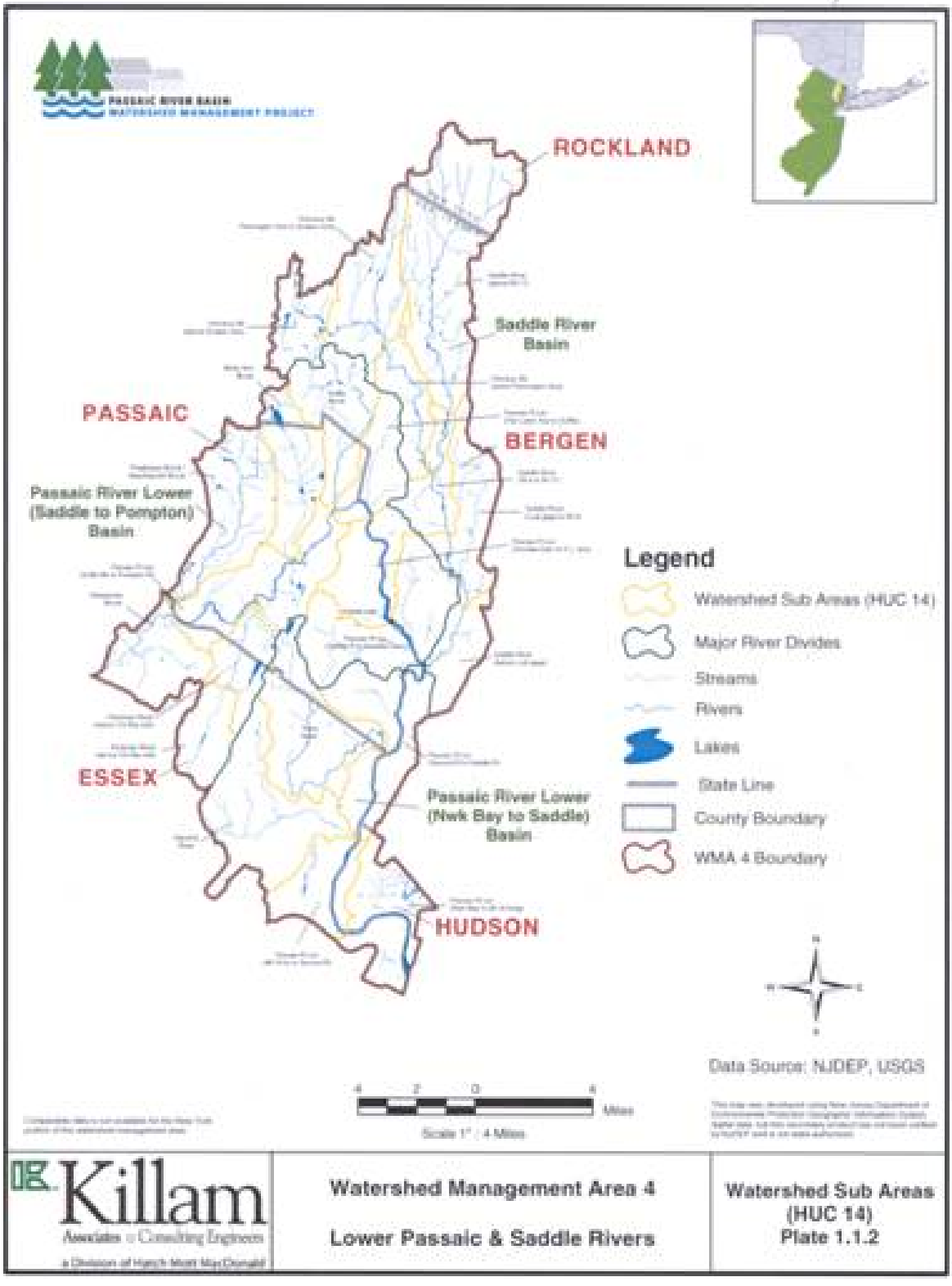


Figure 9
Watershed Management Area 4 (WMA4)



The Passaic River

Flowing, The Lower Passaic watershed flows through some of the most densely populated municipalities in New Jersey home to 1.2 million residents. The mighty Passaic River starts as a small stream in Mendham in Morris County and flows for some 800 miles before it terminates in the Newark Bay. The Passaic River is most notable for the Great Falls of Paterson. At 77 feet high and 280 feet wide, it is second widest fall east of the Mississippi.

As rivers and streams determine our place in the watershed, they also delineate boundaries between states, counties and towns. The earliest boundaries were in fact rivers or streams. In 1716, Glen Rock was part of Saddle River Township which included portions of Bergen County in an area defined as west of both the Saddle and the Passaic Rivers.

The Saddle River

At the time of the Revolutionary war, Saddle River Road was an Indian trail and during the Colonial Era was a well traveled wagon route to Newark. In those days, the road was called "Old Swamp Lane." The area in the vicinity of The Red Mill, at the intersection of Paramus Rd and Route 4, was known as Zabrisky's Mill or New Hamburgh. This region was home to many inns and taverns along the banks of the Saddle River in the late 18th- early 19th century.

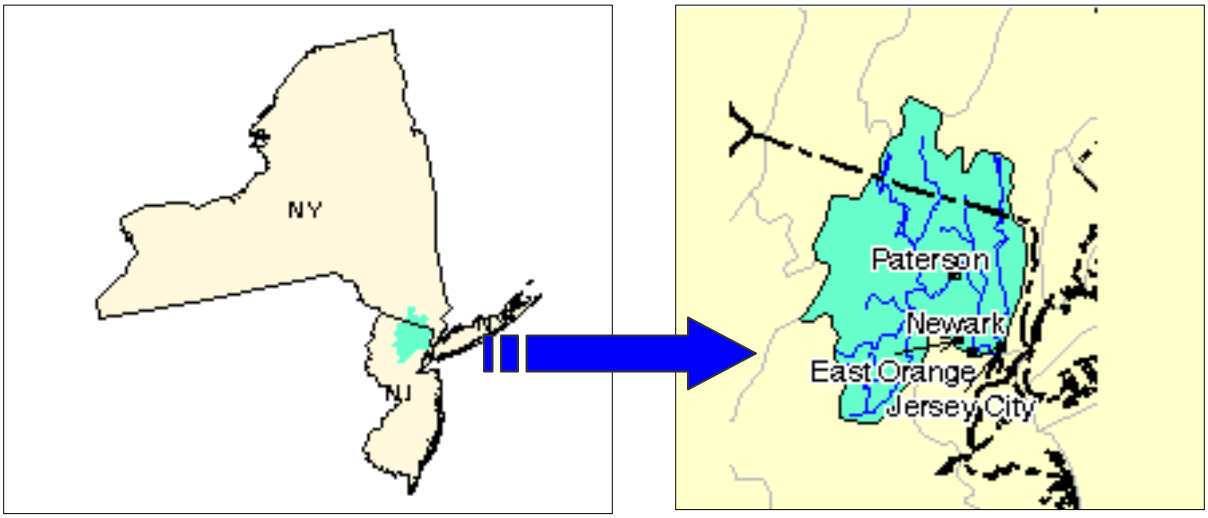
> "In winter, a steady procession of farmers trod across the frozen countryside with sled-loads of venison, pork and other farm products destined for city markets. Located upon the Albany post road, New Hamburgh also became a relay point for stage and mill coaches who stopped in the neighborhood overnight, the water and pasture hereabout being of the best quality. As many as a hundred rural travelers might put up for the night in hotels near the mill and bridge over Saddle River. The Bergen County militia held their periodical "trainings," often attended by thousands of onlookers, on the broad plains hereabout. The popular drovers' and stage hotels declined, however, with the rise of the railroads."

Some History of the Watershed

These two rivers played an important role in the social and economic growth of our town and this region beginning with the Lenapi, the indigenous peoples of our region. The Passaic River was a rich source of protein in the form of the many varieties of fish that thrived in its beautiful waters. There is a very interesting Indian relic in Fair Lawn, a fish trap (weir) in the Passaic River. It can be seen during low water 200 yards upstream from the Fair Lawn Avenue bridge. The trap consists of two rows of stones forming a V-shaped dam into which the Indians drove the fish during migration, closing the opening at the point of the V with weighted nets.

Nationally, Glen Rock is part of the Hackensack-Passaic watershed and is one of 2,110 watersheds in the continental United States. Twelve (12) national "HUC8" (8-digit hydrologic unit code) watersheds span the State of New Jersey, each ranging in size from 29 to 1,280 square miles.

Figure 10
Hackensack-Passaic Watershed



Regional Watersheds further break down into "HUC11" watersheds, which are watershed areas that are assigned 11-digit hydrologic unit codes. There are 150 HUC11 watersheds within New Jersey, ranging in size from 0.1 to 143.1 square miles. Glen Rock is located within the Saddle River and Passaic River Lower (Saddle to Pompton) HUC11 watersheds.

HUC11 watersheds further break down into "HUC14" watersheds. These sub-watersheds are named with fourteen-digit hydrologic unit codes and range in size from 0.1 to 42 square miles. Within Glen Rock's borders there are three (3) HUC14 sub-watersheds, or drainage basins areas, as shown on the Drainage Basin Map (see Map Appendix) and the table below. The Passaic River Lower sub-watershed is the drainage basin area for Diamond Brook, which covers nearly two-thirds of the Borough's land area.

Table 15
HUC14 Watershed Areas in Glen Rock

HUC14	Drainage Basin Name & Location	Acres in	Percent
02030103140030	Ho-Ho-Kus Brook (below Pennington Ave.)	540.8	31.3%
02030103120070	Passaic River Lower (Fair Lawn Ave to	1131.1	65.5%
02030103140050	Saddle River (Rt 4 to Rt 17)	53.9	3.1%
		Total 1,725.8	100.0%

CONCLUSION

The Glen Rock Environmental Commission and Department of Public Works should continue to implement Stormwater Management Plan requirements, with the Commission actively coordinating the education requirements. In particular, the Commission should ensure that the Fourth Grade Water Day continues, as it is an effective component of educating a wide group of students.

The use of Nonstructural Best Management Practices should be encouraged throughout the borough. This can involve education, demonstration projects and municipal support for projects such as rain gardens, native vegetation, stream bank restoration, and riparian corridors. The borough can take the lead by example, using native plantings on borough property and installing demonstration projects to be used in conjunction with public education efforts.

The use of rain gardens, a Nonstructural Best Management Practice, can be encouraged as a means to alleviate local flooding.

Sources:

- http://www.foxriverecosystem.org/PDFs/Streambank%20Shoreline.pdf-
- Protecting Streambanks Guide
- Diamond Brook Assesssment, October 2006
- http://www.gdrc.org/uem/water/watershed/index.html- Urban Watersheds
- http://www.state.nj.us/dep/watershedmgt/DOCS/WMAFactsheets/WMA04.pdf
- http://waterquality.ifas.ufl.edu/FAQs/FAQs-watershed.htm- watershed importance
- http://www.geesepeace.org/

- http://rkc.org/Weir
- http://nopoop07450.blogspot.com/
- http://james.borghoff.googlepages.com/home
- http://www.co.bergen.nj.us/Parks/Cultural%20and%20Historic/pdf/Easton%20Tower.PDF
- http://www.lowerpassaic.org/publications/historicsignificancegreatfalls.pdf
- http://www.glenrocknj.net/environment/pdf/DiamondBrookBrochure.pdf
- http://www.anjec.org/StormwaterRegs.htm#ordinances

http://waterdata.usgs.gov/nj/nwis/nwismap/?site_no=01389860&agency_cd=USGS&waswidth=0.03125&zoom=-2.

SECTION VII: WETLANDS

THE VALUE OF WETLANDS

Wetlands are land areas that function as natural sponges, retaining water as needed and releasing water slowly in dryer periods. They support distinctive types of vegetation that can grow and reproduce despite periodic inundation with water. Wetlands may appear as swamps, marshes, bogs, or just as forest. They contribute to the ecological health of our communities in vital ways. For example, wetlands:

- Protect drinking water by filtering out chemicals, pollutants, and sediments that would otherwise clog and contaminate our waters.
- Soak up runoff from heavy rains and snow melts, providing natural flood control.
- Release stored flood waters during droughts.
- Provide critical habitats for a major portion of the State's fish and wildlife, including endangered, commercial and recreational species.
- Provide high quality open space for recreation and tourism.

For these reasons, wetlands are a crucial component of a watershed. One of the most important reasons is their ability to function as natural water filters and to help improve water-quality downstream. Wetlands also provide an environment conducive for biogeochemical reactions to occur, which aids in the removal of nutrients such as nitrogen and phosphorus, by converting them from inorganic forms to organic forms. The location of a wetland in a watershed is very important to its function. For example, riparian wetlands (wetlands alongside of a water body) are very important in a watershed for their ability to control and improve water quality.

Through dredge and fill activities, drainage, development, pollution, and natural causes, wetlands across the country have decreased at an alarming rate. As a result, massive erosion, flooding, and sedimentation have occurred, as well as dramatic decreases in critical habitat. Protection of wetlands from these activities is therefore a top priority for the Borough.

NJDEP FRESHWATER WETLANDS PROGRAM

Wetlands in New Jersey are regulated by the NJDEP's Freshwater Wetlands Program, which protects freshwater wetlands, and upland areas within 150 feet of wetlands (the "buffers") from development or any activity that could damage a wetland. Any development within a wetland or within the area up to 150 feet of a wetland (the

"buffer" or "transition area") may require a permit or transition area waiver from the NJDEP. Most freshwater wetlands require a 50-foot transition area. Wetlands having threatened or endangered species require a 150-foot transition area.

WETLANDS IN GLEN ROCK

The *Wetlands and Floodplain Map* (See Map Appendix) shows the extent and approximate location of wetlands in Glen Rock, as delineated by the US Department of Fish and Wildlife Service (2006). The available GIS data indicates that nearly 77 percent of wetlands in Glen Rock are freshwater forested/shrub wetlands.

Table 16
Acreages of Wetland Types in Glen Rock

Wetland Description	Acreage in Glen Rock	Percent
Freshwater Forested/Shrub Wetland	126.99	76.7%
Freshwater Pond	6.61	4.0%
Riverine	31.89	19.3%
Total	**165.49**	**100%**

Wetlands are classified according to an alpha-numeric code (i.e., PFO1A) that largely corresponds to the habitat characteristics of a wetland. The classification system is known as the 'Cowordin System' and was developed in 1979 by the US Fish and Wildlife Service. The types of wetlands in Glen Rock are shown in the table below. The PFO1E wetlands are the most prevalent classification in Glen Rock. These areas are made up of deciduous forest and tend to flood seasonally.

CONCLUSION

Restoring riparian buffers along Hohokus Brook and Diamond Brook could help alleviate streambank erosion and flooding.

It is important for Glen Rock to preserve its existing wetlands since they play a crucial role in stormwater management and flood control.

Table 17
Types of Wetlands (Cowordin Classifications) in Glen Rock

Symbol	Wetland Type	Acres	Description
PFO1A	Freshwater Forested/Shrub	39.31	Palustrine, Forested, Broad-leaved Deciduous, Temporarily flooded
PFO1Ad	Freshwater Forested/Shrub	1.33	Palustrine, Forested, Broad-leaved Deciduous, Temporarily flooded, partly drained
PFO1E	Freshwater Forested/Shrub	84.82	Palustrine, Forested, Broad-leaved Deciduous, Seasonally Flooded/Saturated
PSS1A	Freshwater Forested/Shrub	1.53	Palustrine, Scrub-Shrub, Broad-leaved Deciduous, Temporarily flooded
PUBHx	Freshwater Pond	6.61	Palustrine, Unconsolidated Bottom, Permanetly flooded, excavated
R2UBH	Riverine	20.47	Riverine, Lower Perennial, Unconsolidated Bottom, Permanently flooded
R2UBHx	Riverine	3.59	Riverine, Lower Perennial, Unconsolidated Bottom, Permanently flooded, excavated
R3UBH	Riverine	7.65	Riverine, Upper Perennial, Unconsolidated Bottom, Permanently flooded
R3UBHx	Riverine	0.05	Riverine, Upper Perennial, Unconsolidated Bottom, Permanently flooded, excavated
R4USCx	Riverine	0.13	

Sources:

- NJDEP Fresh Water Wetlands Program http://www.nj.gov/dep/landuse/fww.html
- Freshwater Wetlands Protection Act - N.J.S.A. 13:9B
- Freshwater Wetlands Protection Act Rules - N.J.A.C. 7:7A
- GIS Layer: NJDEP Wetlands of Bergen County, New Jersey, 1986
- http://water.ridgewoodnj.net/pdf/08NovPNF.pdf

SECTION VIII: AIR QUALITY

Air quality is negatively affected by pollution that originates from numerous sources, including stationary sources such as factories, power plants, and smelters; smaller sources such as dry cleaners and degreasing operations; mobile sources such as cars, buses, planes, trucks and trains; and naturally occurring sources such as windblown dust and volcanic eruptions. Air pollution is found all over the United States and is becoming a global problem that has disrupted the natural balance of the environment. The most well-known and controversial issue is that of the global warming: the increase in carbon dioxide (CO2) in the atmosphere that traps solar energy, raising the earth's temperature.

LOCAL RESOURCES GOVERNING AIR QUALITY

Municipal Code

Chapter 59 of Glen Rock's code prohibits air pollution and **OPEN-AIR** burning, and regulates smoke emission from fuel-burning equipment and incinerators.

The Bergen County Department of Health Services

The BCDHS works to enact statewide strategic environmental goals, including clean air, by:

- inspecting minor and B source facilities to determine compliance with the state's air pollution control regulations,
- inspecting at least 20% of gas stations, dry cleaners, boilers and emergency generators,
- responding to citizens' complaints, and
- developing the capability to integrate GIS into clean air activities.

The Glen Rock Board of Health

The board is empowered by the State statutes to enact, entirely independent of the Council, codes regulating all matters of public health.

Borough of Glen Rock Resolution

In April 2009, Glen Rock passed an anti-idling resolution.

NJ State law

New Jersey has an anti-idling law limiting vehicle idling to three minutes.

AIR POLLUTION CRITERIA: SIX MAJOR POLLUTANTS

The Clean Air Act (CAA) provides the principal framework for national, state, and local efforts to protect air quality. Regulations, known as National Ambient Air Quality Standards (NAAQS), serve to control the release of pollutants which are considered harmful to people and the environment. The EPA Office of Air Quality Planning and Standards (OAQPS) works to ensure that these air quality standards are met, or attained, through national standards and strategies to control pollutant emissions from automobiles, factories, and other sources. The New Jersey Department of Environmental Protection's Bureau of Air Monitoring addresses these issues on the state level.

The EPA has classified six principal, or criteria, pollutants:

1. Carbon Monoxide,
2. Nitrogen Dioxide,
3. Sulfur Dioxide,
4. Lead,
5. Particulate Matter, and
6. Ozone (or smog).

The EPA calls such pollutants "criteria air pollutants" because permissible standards are based on health risk (scientifically-based) factors. Primary standards are set based on a pollutant's risk to human health whereas secondary standards are set based on risk of environmental or property damage. A geographic region that meets or exceeds the primary standard for a particular pollutant is called an "attainment area." Regions that do not meet the primary standard are called "non-attainment areas."

AIR MONITORING: THE AIR QUALITY INDEX

The EPA monitors and reports on air quality using an Air Quality Index (AQI). The AQI allows the EPA to use a uniform system for seven of the eight criteria pollutants. Lead is not reported using the AQI because lead tests take several weeks, and the AQII is meant to report real time data. Data is recorded in parts per million (ppm) and then converted to an AQI value. The AQI does not report each individual pollutant, but rather assigns a measure of air quality based on the sum of the multiple pollutants. The scale spans from zero to five hundred, assigning a degree of air quality to ranges within (Table X).

Table 18
Health Cautions for Pollutant Standard Index

Index Value	PSI Descriptor	General Health Effects	Health Cautions
0-50	Good	None for the general population	None required
50-100	Moderate	Few or none for the general population	None required
100-200	Unhealthful	Mild aggravation of symptoms among susceptible people, with irritation symptoms in the healthy population .	Reduce physical exertion and outdoor activities. General population should reduce vigorous outdoor activity.
200-300	Very	Significant aggravation of symptoms and decreased exercise tolerance in persons with heart or lung disease; widespread symptoms in the healthy population.	Elderly and persons with existing heart or lung disease should stay indoors and reduce physical activity. General population should avoid vigorous outdoor activity.
Over 300	Hazardous	Early onset of certain diseases in addition to significant aggravation of symptoms and decreased exercise tolerance in healthy persons. At PSI levels above 400, premature of ill and elderly persons may result. Healthy people experience adverse symptoms that affect normal activity.	Elderly and persons with existing diseases should stay indoors and avoid physical exertion. At levels above 400, general populations should avoid outdoor activity. All people should remain indoors keeping windows and doors closed and minimize physical exertion.

Source: Data modified United States Environmental Protection Agency: Office of Air and Radiation, Office of Air Quality Planning and Standards

Table 19
Air Quality Index

Category	Good	Moderate	Unhealthy for Sensitive Groups	Unhealthy	Very Unhealthy	Hazardous	
Index Value	0-50	51-100	101-150	151-200	201-300	301-400	401-500
Pollutant Concentration Ranges							
CO	0.0-4.5	4.5-9	9-12	12-15	15-30	30-40	40-50
NO_2	--	--	--	--	--	1.2-1.6	1.6-2.0
O_3 1-hour	--	--	--	--	.20-.40	.40-.50	.50-.60
O_3 8-hour	.00-06	.06-.08	.08-.10	.10-.12	.12-.37	--	--
PM 2.5	0-15	15-40	40-65	65-150	150-250	250-350	350-500
PM 10	0-50	50-150	150-250	250-350	350-420	420-500	500-600
SO_2	0.0-03	.03-.14	.14-.22	.22-.3	.3-.6	.6-.8	.8-1.0

USEPA Air Quality Index, 2000

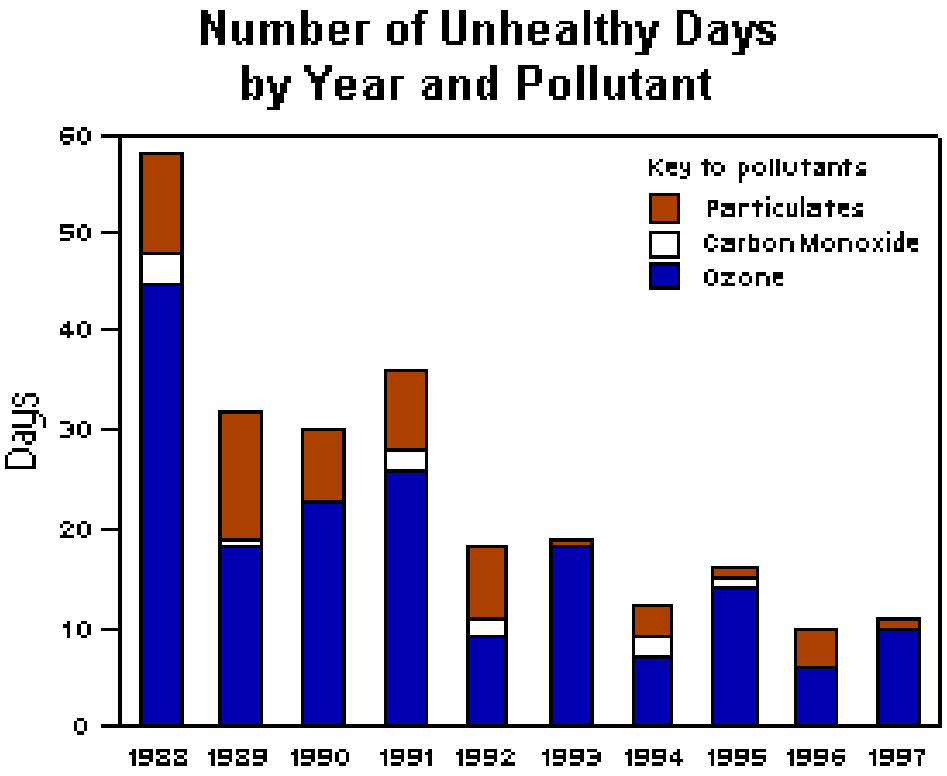
Air quality monitoring is a tricky and expensive undertaking. Due to the way wind influences air quality and the fact that Glen Rock does not have its own air monitor, data was obtained for Bergen County as recorded by the EPA (Table 20). Although air quality appears to be improving since 1984, there was a decline in 1998. However, there were no days reaching the unhealthy level.

Table 20
Air Quality Measurements for Bergen County, NJ

Year	Number of days monitored	Percent of days monitored AQI Good	Percent of days monitored AQI Moderate	Percent of days monitored AQI Unhealthful
1994	60	87	13	0
1995	60	87	13	0
1996	50	100	0	0
1997	52	92	8	0
1998	205	70	30	0

Measurements obtained at the Ramapo Air Quality Station. Table modified from data on EPA AIRS website.

Figure 11



Trends in Air Quality: An Overall Improvement in New Jersey

Over the years, air quality in New Jersey has been improving. Unhealthy ratings were recorded on fewer than one day in thirty over the 1995 - 1997 period, compared to ten years before that, when unhealthy ratings were recorded on about one day in eight. New, more-stringent federal health standards for both ozone and particulates went into effect in 1998. These standards are more difficult for New Jersey to meet: under the new ozone standard, there were 47 unhealthy days in 1998; only 4 days would have been rated unhealthy that year under the old ozone standard.

Lead and sulfur dioxide regularly reached unhealthy levels 15 to 20 years ago. These pollutants now meet the national health standards throughout the state and are considered to be well under control. We don't expect to be able to meet the new, more stringent particulate standard that's now in effect, even if actual pollutant concentrations don't worsen.

Air pollution levels also change during the day and from one season to another. These changes are due to variations in the weather and in the types and amounts of pollution that are released into the air, both in New Jersey and in states that are upwind of us. Here's an example of how carbon monoxide levels changed over several days in January 1995 at North Bergen, Hudson County. A strong temperature inversion formed, trapping the pollution close to the ground and causing it to reach unhealthy levels. There haven't been any unhealthy days due to carbon monoxide in New Jersey since this episode.

Glen Rock Fails to Meet Clean Air Standards

Despite this improvement, many urban areas, including Glen Rock, are classified as non-attainment for at least one criteria air pollutant. It has been estimated that about 90 million Americans live in non-attainment areas Bergen County is a non-attainment area for ozone and particulate matter.

An August 2000 study by INFORM, Inc. (Golden 2000) reports that “95 percent of New Jersey’s 8.1 million residents live in areas that fail to meet federal public health standards, compared to 38 percent of the U.S. population as a whole.” The report also claims “18 of New Jersey’s 21 counties are in non-attainment of federal ground-level ozone standards.” Results are shown in Table 21. In addition, twelve counties, including Passaic, were ranked as being in ‘severe’ non-attainment just below the ‘extreme’ level.

Table 21

County	Pollutant	Nonattainment in Year	Classification	Population
Bergen Co	8-Hr Ozone	04 05 06 07 08	Moderate	884,118
Bergen Co	CO	92 93 94 95 96 97 98 99 00 01 02	Moderate > 12.7ppm	884,118
Bergen Co	PM-2.5	05 06 07 08	Nonattainment	884,118

Source: EPA Green Book, March 12, 2009

Understanding smog, green house gases and acid rain

Ground-level ozone is the primary component of smog. Ozone can be good or bad depending on its location in the atmosphere. Ozone in the stratosphere protects human health and the environment. Ground-level ozone is the main harmful ingredient in smog. Ground-level ozone is produced by the combination of pollutants from various sources, including smokestacks, cars, paints and solvents. When a car burns gasoline, releasing exhaust fumes, or a painter paints a house, smog-forming pollutants rise into the sky. Often, wind blows smog-forming pollutants away from their sources. The smog-forming reactions take place while the pollutants are being blown through the air by the wind.

Since smog travels across county and state lines, when a metropolitan area covers more than one state (for instance, the New York metropolitan area includes parts of New Jersey and Connecticut), their governments and air pollution control agencies must cooperate to solve their problem. Governments on the East Coast from Maine to Washington, D.C., are working together in a multi-state effort to reduce the area's smog problem.

The Greenhouse Effect

Water vapor and several other gases such as carbon dioxide, methane and chlorofluorocarbons (CFCs), warm the Earth's atmosphere by absorbing and reemitting radiation. They trap some of the heat energy radiating from the Earth's atmospheric system, heating the earth. This process is known as the greenhouse effect. Human activity contributes certain gases including carbon dioxide, methane, nitrous oxides and ozone, all of which have significantly increased in recent years but began with the Industrial Revolution. This increase of gases in the atmosphere is hypothesized as being responsible for global warming- the increase in average global temperature near the Earth's surface.

Acid Rain

Glen Rock, much like the rest of the United States is experiencing acid deposition, more commonly known as acid rain. Acid rain is the result of sulfur and nitrogen oxides in addition to several other acids produced from stationary sources such as power plants that burn fossil fuels and mobile sources such as automobiles. Pure rainfall has a pH of 5.0-5.6 (Miller 1996), which is slightly acidic- neutral being a pH of 7.0 on the pH scale of 0.0-14.0; a pH greater than 7.0 being alkaline. Areas most sensitive to acid deposition are those in which the bedrock or soil cannot buffer (neutralize) the acid input. Glen Rock's precipitation range for pH is 4.0-4.5 (Pardi and Swanson, unpublished data). These values are concurrent with much of the pH values throughout the Northeast United States from which 80 percent of sulfur dioxide emissions and 65 percent of nitric oxides for the country come (Botkin and Keller 1995). High acidity can damage structures and ecosystems and threaten human health with respiratory problems. Acid deposition is known to cause bronchitis and asthma sufferings to be more severe (US EPA 2000).

Mobile Emissions: The main cause of air pollution in New Jersey

Mobile emissions were identified as the main cause of pollution levels in New Jersey. The state's 5.8 million vehicles are responsible for 43 percent of the volatile organic compounds and 44 percent of the nitrogen oxides, the product of combustion of fuel, utilities, and industries, which contribute to smog. Major contributing trends include:

- A higher density of truck traffic traversing the state,
- A 36 percent increase in vehicle miles traveled between 1970 and 1997,
- Sprawl development (the number of automobile-dependent office developments quadrupled between 1990 and 1997 while the number of transit-accessible offices remained unchanged), and
- The growing popularity of sport utility vehicles, which emit 40 percent more pollutants per vehicle.

Motor vehicles are also major contributors to carbon monoxide and carbon dioxide emissions among other greenhouse gases. They contribute up to 70 percent of carbon monoxide emissions throughout the Northeast. In addition, New Jersey as a whole has the highest percentage of carbon dioxide emissions from transportation than any other state. Carbon dioxide makes up 82 percent of all greenhouse emissions in New Jersey, 38 percent of which arise from mobile sources.

Diesel soot is probably the most important environmental health issue in New Jersey. According to NASA (National Aeronautics and Space Administration), one of the quickest ways to curb global warming is to control soot in the air. The NJ Department of Environmental Protection says diesel soot is killing more than a thousand people

each year in New Jersey (about three funerals every day of the year). So reducing diesel soot would save lives right away and reduce global warming. Diesel soot can be controlled by:

- funding mass transit to move people and goods,
- requiring filters on truck exhausts (truck drivers have high rates of lung cancer)
- enforcing N.J.'s anti-idling law, and
- insulating homes in cities to reduce the burning of home heating oil.

LOCAL SOURCES OF AIR POLLUTION

In addition to mobile sources of pollution cited above, there are also other sources of outdoor air pollution in Glen Rock including:

- lawn mowers and leaf blowers,
- non-green dry cleaners,
- idling at school and train stations, (See the transportation section I), and
- factory emissions.

Lawn Mowers

Each weekend, about 54 million Americans mow their lawns, using 800 million gallons of gas per year and producing tons of air pollutants. Garden equipment engines, which have had unregulated emissions until very recently, emit high levels of carbon monoxide, volatile organic compounds and nitrogen oxides, producing up to 5% of the nation's air pollution and a good deal more in metropolitan areas.

According to the U.S. Environmental Protection Agency (EPA), a traditional gas powered lawn mower produces as much air pollution as 43 new cars that are driven 12,000 miles each.

The EPA has finalized a new emission control program to reduce hydrocarbon emissions from small spark-ignition engines by about 35 percent. The new exhaust emissions standards will take effect in 2011 or 2012, depending on the size of the engine. The final rule also includes new standards to reduce evaporative emissions from these fuel systems. These standards will reduce the harmful health effects of ozone and carbon monoxide from these engines.

Dry cleaners and perchloroethylene:

Environmental Protection Agency regulations for perchloroethylene drycleaners cover large industrial drycleaners as well as smaller neighborhood drycleaners and those located in apartment buildings. Freestanding small dry cleaners (which emit less than 10 tons of perchloroethylene each year) are covered by emissions standards (known as Generally Available Control Technology or GACT standards) which require existing typical area source dry cleaners to:

- Eliminate all machines requiring the movement of wet clothes from one machine to another for drying (called transfer machines).
- Transfer machines are considered the highest-emitting type of dry cleaning equipment. Use specialized equipment monthly to detect perc leaks, repair such leaks and maintain records.

New typical area source dry cleaners:

- Are not permitted to install transfer machines.
- Must add carbon adsorbers (devices that reduce perc vapors exiting the dry cleaning machine as the machine door is opened) to the closed-loop machines with refrigerated condensers that are required under the 1993 rule.)
- Must use the same type of specialized equipment as existing typical dry cleaners to monthly detect perc leaks, repair such leaks and maintain records.

This is an issue in Glen Rock, which has over seven neighborhood drycleaners.

Factories

Located in Fair Lawn but adjacent to Glen Rock's southern border, Kraft Foods factory on Route 208 is the largest single source of air pollution in Glen Rock. It released 137,389 pounds of eight different pollutants from 71 sources, according to a 2002 draft of the EPA Emissions Inventory (source: Planet Hazard.com)

CONCLUSIONS

Glen Rock's commuter shuttle is a good first step toward reducing mobile emissions, which are the main cause of air pollution levels in New Jersey. Possible additional steps include:

- Expanding the commuter shuttle,
- Converting to a natural gas or hybrid shuttle vehicle,
- Enforcing anti-idling laws,

- Encouraging students and commuters to use alternatives transportation (walking, riding bicycles, or car pooling), and
- Converting municipal fleet (police, municipal and DPW) to lower-emission vehicles where possible.

Soot (particulate matter from diesel exhaust) is a major contributor to global warming and human respiratory illnesses. To the extent that Glen Rock can reduce diesel emissions, it can improve resident's health and reduce our town's carbon footprint. Enforcement of the state's idling law would be a good place to start.

Since gasoline powered lawn mowers and leaf bowers are a significant source of highly polluting emissions, reducing their use would improve local air quality, while reducing noise pollution. Since many Glen Rock lawns are relatively small, using push or reel mowers is a viable option for many home owners. Reducing lawn size is another option which would reduce lawn mower emissions, in addition to offering other environmental benefits.

The Borough can adopt alternative-fueled vehicles (plug-in electric hybrid, electric hybrid, compressed natural gas or bio-diesel) for use by municipal officials, emergency officials, the Shuttle, and other vehicles.

The Borough can also encourage residents to purchase fuel efficient cars. One source of information on environmentally-friendly cars is the EPA SmartWay/SmartWay Elite Web site. http://www.epa.gov/SmartwayLogistics/consumer/vehicles.htm

EPA SmartWay is a designation earned by those vehicles that score a 6 or better on each of the Air Pollution and Greenhouse Gas Scores and achieve a combined score of at least 13 when added together. Scores indicate vehicles with reduced levels of emissions that cause smog and health problems. Higher greenhouse gas scores indicate vehicles with reduced levels of emissions that cause greenhouse gases and have improved fuel economy.

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SECTION IX: VEGETATION AND TREES

INTRODUCTION

Vegetation includes plants like trees, shrubs, herbs and grasses. There are three major ecosystems found in Glen Rock: woodland, open land, and wetland. Most of Glen Rock's original forests are second or third growth and are largely located near stream corridors or are patches of woodlands on less desirable soils. Wetlands are crucial to the environment because they help control flooding, improve water quality, replenish drinking water, provide critical habitat, *and* allow for education and recreation opportunities.

Table 22

Glen Rock Land Use	Acres	Total Land
Forests	54.2	3.1
Wetlands	83.6	4.8
Barren Land	2.9	0.2

The overall vegetative composition of Glen Rock can be attributed to a multitude of environmental factors such as climate, soil, hydrology, and geology. In addition to these larger and more encompassing factors, the type of vegetation at a particular site is governed more by localized conditions such as soil fertility and moisture, temperature, and available sunlight (Collins and Anderson). All of these influencing factors are considered "abiotic," or nonliving (Miller). Conversely, "biotic," or living factors, influence the growth of vegetation (Miller). Biotic factors include the interaction between different plant species, the influence of animals on plant growth, and finally the influence of humans on the growth and distribution of plants. As abiotic and biotic factors change, plant communities must adapt and evolve to new conditions.

Human influence, beyond all other mentioned factors, has brought about the greatest and most significant changes to plant communities in Glen Rock (Collins and Anderson). Human intrusion on natural ecosystems through development, air pollution, and water pollution has all had a negative effect on plant communities in Glen Rock. These factors combined make plant communities more susceptible to naturally occurring disease and insect infestation. The human tendency to change the landscape to suit its needs has significantly changed the vegetation of Glen Rock. One prime example of this is the societal tendency to replace native vegetation with lawns, ornamental plantings and turfgrass.

COMMUNITY FORESTRY MANAGEMENT RESOURCES

Several organizations in the Borough work to manage and protect the vegetation in Glen Rock.

Glen Rock Department of Public Works

The Borough of Glen Rock's Director of Public Works (DPW) is primarily responsible for the management of the public trees in the Borough of Glen Rock. However, the Director of Public Works operates with the advice and consent of the Shade Tree Advisory Committee and in cooperation with various other governmental bodies. Its duties involve the care, maintenance, and removal of shade trees along town streets and parks, and keeping municipal trees healthy and attractive, and the public safe. The DPW also assists the Thielke Arboretum of Glen Rock with the care of their forest population including the trimming, planting and removal.

Glen Rock Director of Parks and Recreation

The Director of Parks and Recreation is responsible for maintaining the vegetation in the town parks, the playing fields at all Glen Rock Public Schools (under the direction of the Athletic Director), the Glen Rock Pool, the municipal playing fields at Faber Field, Fischer Field, Wilde Memorial Park and Main Street Park.) He reports to the borough administrator.

The Shade Tree Advisory Committee

The Shade Tree Advisory Committee is responsible for:

- Advising the Borough Council and the Director of Public Works as to future plans for the planting, pruning, removal, and care of trees and shrubs in Borough rights-of-way and on public lands.
- Assisting in the development and implementation of solutions for problems and issues relating to public trees.
- Reviewing plans before the Planning and Zoning Boards

Bergen County Extension Agent

Rutgers NJAES Cooperative Extension of Bergen County, is a science-based education resource available to residents, landscapers, the municipalities, Shade Tree Committees, and other groups.

Bergen County Master Gardeners

Volunteers trained by Rutgers University work throughout the County's Parks and municipalities. They operate a Garden Helpline April through October and provide adviceto homeowners on solving garden and landscape problems by applying Integrated Pest Management tactics to minimize the use of pesticides.

COMMUNITY / PUBLIC PROGRAMS

Glen Rock's Shade Tree Program

Glen Rock has reaped the benefits of having had a well-structured and effective shade tree program in place for decades. Streets are heavily treed and the positive effects of ongoing planting and proactive maintenance programs are obvious throughout the Borough.

Street trees are comprised primarily of Norway Maples and London Planes and, to a lesser extent, Red Maple, Pin Oak, Sweet Gum, Bradford Pear, Honey locust, Greenspire Linden, Zelkova, Regent Scholartree, and Ash.

Although the Shade Tree Program currently enjoys strong Borough and citizen support, it recognizes that ongoing public education, awareness and outreach programs are necessary to ensure continued success over the long term. Specifically, such programs:

- Maintain and further increase interest and active support for Glen Rock's Shade Tree Program.
- Encourage public assistance in implementing various programs, protecting public trees, and beautifying the Borough.
- Encourage the planting, protection and care of trees on private property for the benefit of the entire community.
- Educate all citizens in the importance of environmental stewardship.

The Planting Program

The primary species that are presently being planted include October Glory Maple, Pin Oak, Village Green Zelkova, Greenspire Linden, Honey Locust, Summit Ash, and Sweet Gum (for wet areas).

From 2000-2003, the DPW planted an average 205 trees per year. But due to a decrease in resident requests and budget cuts, DPW planted an average 65.5 trees per year from 2004-2007. This reflects a 68% decrease. In the past four years (2004-2007), the DPW has removed 571 trees, and trimmed 1,981 trees.

Table 23

Year	Trimmed	Planted	Removed
2000	1621	126	369
2001	252	276	221
2002	2159	220	130
2003	2015	199	126
2004	353	73	104
2005	561	63	181
2006	566	64	195
2007	501	62	91

The size of newly planted trees is approximately 1.75"-2" trees Dbh (diameter at breast height). Where most towns are planting 2-2.5" or 2.5-3" Dbh, Glen Rock's DBH standard is smaller than typically used by municipalities in order to purchase more specimens within the tree acquisition budget. The DPW reports that the one-year survival rate of the planted trees is excellent.

Arbor Day

Formal Arbor Day celebrations are conducted annually by the Borough. Programs are run in cooperation with the Friends of the Arboretum and Borough schools and include a formal proclamation and ceremonial tree plantings.

Tree City USA & Other Awards

Glen Rock has received the Tree City USA award through the National Arbor Day Foundation every year since 1990. To qualify for Tree City USA, a town must meet four standards established by The Arbor Day Foundation and the National Association of State Foresters.

- A Tree Board or Department
- A Tree Care Ordinance
- A Community Forestry Program with an annual budget of at least $2 per capita
- An Arbor Day Observance and Proclamation

SIGNIFICANT/HISTORIC TREES

NJ State Champion- Catalpa bignoides, Northern Catalpa.

This Catalpa is located at 348 Prospect Ave. It borders the neighbor's property at the rear.

Meta Sequoia, Dawn Redwood

Three Meta Sequoia "Dawn Redwoods" are found in Glen Rock. The Meta Sequoias came from a seed brought back from the first expedition to China in 1942 in search of Dawn Redwoods. The expedition returned to the Arnold Arboretum with seeds. They were propagated and distributed to various supporting organizations (or the search expedition). One was Brooklyn Botanic Garden. The late Wm. Maynard, GR historian, purchased three small meta sequoias from this original expedition.

One was planted in the rear yard of the former home of Mr. Wm. Maynard at 320 Harristown Rd. Mr Maynard planted a second Meta Sequoia at 320 Harristown Road a few years later to celebrate the birth of his daughter, one in a rear yard off of Radburn Rd and the other at the Thielke Arboretum in 1948.

American Beech and London Plane

These significant specimens are located at 24 Bradford Street. They are located at the right side of the property.

HISTORICAL VEGETATION

Before European settlement, most of New Jersey, including Glen Rock was covered by a large continuous deciduous forest (Collins and Anderson). But within this deciduous forest, there was and still is, a wide variety of plant communities based on topography, soil fertility and soil moisture. The predominant plant communities which are found in Glen Rock include oak and maple forests and wetland and wooded floodplains along the rivers and streams. Interspersed through out these communities there is also a wide variety of evergreen trees such as pine and spruce trees.

The size and maturity of the trees in the oak and maple forest depends upon the time of the most recent disturbance and at what stage of succession the forest is in (Robichaud and Buell). As a result of this, there is a wide variety in maturity levels of forest through out Glen Rock. Before human encroachment, the forests of Glen Rock where composed of oak and chestnut trees. Over time, the forest of Glen Rock succeeded to a mixed-hardwood forest which is the "climax," or final forest type. Due to the great degree of human encroachment, the mixed-hardwood forest of today could be found at any stage of succession. In a typical mixed-hardwood forest there are red, white, black, scarlet oaks, red and sugar maple, hickories, beech, ash, tulip, black cherry, dogwood, and sassafras (Robichaud and Buell)

Along the riparian corridors and floodplains the dominant vegetation is water-tolerant, adapts to seasonal fluctuations in water level, and adapts to soil with poor drainage (Collins and Anderson). Typical trees found in this type of environment are pin and swamp white oak, red and silver maple, river birch, and sycamore (Robichaud and Buell). In addition to these trees there are also many varieties or shrubs and grasses which are also water tolerant and tolerant of soil with poor drainage.

As humans began to migrate into and settle northern New Jersey, the native vegetation was cleared and removed to make way for farming, pastures for grazing livestock, timber for building, and firewood (Collins and Anderson). Only in the areas which were the most difficult to reach were the native deciduous forests left intact. This is not to say that all trees were cut down, many smaller patches of forest remained as well as many large trees. As development continued and residential growth expanded into neighborhoods, more and more native vegetation was replaced by ornamental plants and turfgrass. The new vegetation was chosen for its aesthetic value and not for its ecological value. As a result, many of the ornamental species of trees and shrubs as well as the monoculture of turfgrass use of little use to the native animal populations.

BENEFITS OF VEGETATION

Vegetation plays a vital role in the preservation of the landscape and provides a habitat for most wildlife. Vegetation offers natural services such as the control of polluted surface

runoff, the prevention of soil erosion, flood control, carbon sequestration, cooling, oxygen production, and aesthetic value (Collins and Anderson). The root systems of vegetation provide structural integrity of the soil and prevent erosion by wind and by water. They also act as living filters which absorb nutrients and pollutants which would otherwise runoff and disrupt the delicate balance of natural aquatic ecosystems.

Carbon Sequestration

It is widely accepted that carbon dioxide is a greenhouse gas which increases the temperature of the planet. Vegetation provides a very important service in the long term carbon cycle by acting as a "carbon sink" for atmospheric carbon dioxide (Miller). Plants help to reduce carbon dioxide concentrations in the atmosphere by sequestering it in their plant tissue. As man continues to pump higher concentrations of carbon dioxide into the atmosphere through the burning of fossils fuels, the preservation of vegetation will be important to stem the tide of global warming (Miller).

Plants also play a vital role in absorbing potentially harmful pollutants which are released into the atmosphere through the burning of fossils fuels. In addition to storing carbon dioxide and other potentially harmful pollutants, plants produce oxygen. It hardly needs to be stated that this is a good thing for humans and the animals which live on our planet.

Cooling

Plants are also very influential in creating and maintaining microclimates, which are small localized climate patterns (Miller). The upper canopy of leaves from mature trees can effectively reduce the amounts of incoming solar radiation which reaches the ground, thus decreasing local temperatures. This upper canopy also reduces temperatures by providing shade and through the increased transpiration of leaves (Collins and Anderson). This is extremely important in moderating the "urban heat island effect," which is caused by the large areas of human made structure such as buildings and paved surfaces which act to absorb and retain heat, thus increasing local climates. In addition to effecting local temperatures, trees can also be used as a nature barrier against the sun, thus reducing energy demand and lowering summer cooling bills.

Aesthetic Value

Vegetation is also important role in creating aesthetic value for citizens, providing natural boundaries between houses and buildings. The aesthetic service that plants provide is very important to the well-being of many Glen Rock residents. Trees and shrubs can also be used as visual barriers between neighbors and between residential houses and business.

Wildlife Habitat

In addition to being pleasant to look at, vegetation also provides a vital habitat for most of the wildlife in Glen Rock. This wildlife is also crucial in maintaining the natural ecosystems. Pollination, seed dispersal, and the natural pruning of trees and shrubs are of the utmost

importance in maintaining natural ecosystems. Plants need animals just as much as animals need plants. Besides providing habitat for animals, animals also use continuous vegetative coverings for migration and for moving around in the search for food and for mates

Privacy and Sound Abatement

Trees and other vegetation can also be used a natural sound abatement between individual residential houses and between residential houses and busy roadways. Lastly, trees provide a protective barrier between the busy roadways and sidewalks. The overhead canopy of trees provides a comfortable space for pedestrians and also provides a small degree of noise abatement.

Economic Value

Tree and forest loss is more than sentimental; it also has an economic impact. Tree-smart development can save money and help maintain a livable, sustainable community.

Our community forest is the "green" infrastructure of the town, providing tangible benefits and values that enhance quality of life, safety and public health. A healthy community forest is one of the only municipal capital investments that will appreciate in value over time. As community forests grow, their environmental, social, and economic benefits increase. They enhance property values, provide energy savings, reduce costs associated with poor air quality, and increase commercial activity.

The "green infrastructure" of Glen Rock provides the following economic benefits.

- Increases property values. The Center for Urban Forest Research estimates that properties with trees are valued 5-15% higher than comparable properties without trees. Increased value depends on the species, maturity, location and quality of trees.

- Defers street maintenance costs. Paved surfaces that are shaded by trees have a longer life span

- Energy savings. According to the Center for Urban Forestry, if you plant a tree today on the west side of your home, in 5 years your energy bills should be 3% less.

- Reduces healthcare costs associated with poor air quality. Planting trees is one of the least expensive ways to decrease unhealthy amounts of air pollution.

- Stormwater and water quality benefits. By reducing runoff flows and improving water quality, trees benefit cities in avoided stormwater treatment and flood control costs.

- Commercial benefits. Street trees improve economic stability of retail environments by attracting businesses and consumers. Well-maintained landscaping, including

canopy trees, attracts consumers and increases their rate of return by setting a positive mood and sending messages of quality.

- Using the Urban Forest- Towns can utilize their urban forest material. Towns have the possibility of breaking-even, or even make a profit if they take advantage of the most economically valuable uses of their urban trees. For example, Glen Rock could: mill any valuable timber using a local portable mil, sell firewood, or chip and mulch the biomass of the urban forest.

THREATS TO VEGETATION

Human influence, beyond all other mentioned factors, has brought about the greatest and most significant changes to plant communities in Glen Rock (Collins and Anderson). Human intrusion on natural ecosystems through development, air pollution, and water pollution has all had a negative effect on plant communities in Glen Rock. These factors combined make plant communities more susceptible to naturally occurring disease and insect infestation. The human tendency to change the landscape to suit its needs has significantly changed the vegetation of Glen Rock. One prime example of this is the societal tendency to replace native vegetation with lawns, ornamental plantings and turfgrass.

The threats that face facing the vegetation of in Glen Rock today, come form from many different sources, have varying degrees of severity, and have require different remedies.

Threats to the Urban Forest

Shade trees require special care and attention because of the harsh environment in which they live.

Some of the biggest threats to Glen Rock's tree and vegetation resources are:

- Invasive plant species
- Insects, animals, and diseases
- Pollution
- Habitat fragmentation and loss.
- Utility trimming and topping (cutting the central main stem of the tree at the top), perhaps one of the top causes why trees fail and ultimately die
- Age
- Drought stress
- Severe weather conditions
- Improper planting

- Impervious surfaces (pavement, building structures)

Invasive plant species

Invasive plant species, whether introduced purposefully or accidentally, pose a threat to the native vegetation in Glen Rock, as well as to many other New Jersey ecosystems. Since these species are not part of the natural ecosystem, they have no native wildlife to feed on them and as a result their growth goes unchecked. As a result of their growth, many invasive species may out-compete, and in some cases, eliminate native species (Collins and Anderson). Invasive species also do not offer appropriate living habitat as does native vegetation, and therefore animals may find it difficult to locate suitable vegetation. Botanists estimate that as many as 25% of all plant species found in New Jersey are exotic or nonnative species (Collins and Anderson). Finally, these invasive species upset the delicate balance of the native ecosystems which took thousands of years to establish. The table below lists some of the invasive plant species that have been identified in the Glen Rock Arboretum.

Table 24
Invasive Plants found in the Glen Rock Arboretum

TREES	**SHRUBS**
White mulberry	Privet
Mimosa	Burning bush—p
Bradford pear--p	Barberry
Norway maple--p	Amur honeysuckle
	Butterfly bush—p
HERBACEOUS PLANTS	Wine berry
Japanese stilt grass	Jet bead
Japanese knotweed	Multiform rose
Moonwort	
Purple loosestrife	**VINES**
Garlic mustard	Japanese wisteria—p
Lesser celandine—p	Japanese honeysuckle
phragmites	English ivy—p
Daylily	Mile-a-minute
Canada thistle	Vince (periwinkle)—p
Exotic bamboo—p—ours is *Sasa veitchii*	Creeping euonymus—p
	Oriental bittersweet

- Only plants listed in *Plant Invaders of Mid-Atlantic Natural Areas* by the National Park Service are named above.
- p—means deliberately planted in the Glen Rock Arboretum
- Source: E. Wallace 09/10/06

Insects, animals, and disease

Introduced insects have played a role in eliminating vegetation on Glen Rock. The gypsy moth, the pine looper, and the hemlock woolly adelgid are three species of insect that damage vegetation and are found in the Glen Rock area (Collins and Anderson). Since these introduced species exist without natural predators, humans usually turn to pesticides to control their numbers, which can have a negative impact on natural ecosystems (Collins and Anderson).

Animals also play a role in harming plants. Over time, plants have evolved many elaborate mechanisms of defense against animal predation. But in the past there were controls over these herbivores through the presence of natural predators. Since many of the predators need large areas of uninterrupted habitat, many of them no longer reside in our area (Collins and Anderson). In addition, many of these predators are viewed as dangerous to humans and their domestic pets, and have since been removed from the area. As a result of this, many herbivore populations have risen without control over the past few hundred years. This has had a negative impact on the vegetation in our area and many native plants are threatened by this scenario.

Disease plays a significant role in decreasing natural vegetation. The American chestnut, the elm tree and the flowering dogwood are all species in our area which have been negatively affected by disease (Collins and Anderson). While diseases have various causes, one common factor in the three above mentioned species is that they have all been affected by human activity and stress, therefore making them more susceptible to disease.

Pollution

Pollution is a threat that is primarily caused by human industrial and transportation activities, both of which require the burning of fossil fuels (Miller). When these fossil fuels are burned, they release pollutants into the atmosphere such as nitrogen oxides, sulfur oxides, metals such as zinc and cadmium, particulate matter, and ozone (Robichaud and Buell). All of these pollutants affect vegetation in negative ways such as damaging their leaves and other plant structures and interfering with the plant-absorbing nutrients in the soil. As a result, the overall health of the plants is negatively affected (Robichaud and Buell). One of the most harmful pollutants is ozone, which forms “smog” when close to the earth’s surface. Ozone damages leaves by decreasing photosynthesis, which limits the amount of food a plant can produce (Collins and Anderson). This in turn makes the plant more susceptible to disease from bacteria, viruses, and fungus as well as making them more susceptible to insect damage.

Other forms of detrimental pollution include pesticides, fungicides, and weed killers commonly used in residential homes by citizens and lawn services (Collins and Anderson). The use of pesticides to control insect pests is a widely used practice in our community. These pesticides succeed in killing their intended target, but in doing so, often kill beneficial insects as well (Miller). Since pesticides are used so commonly in lawn maintenance and in

many instance used without care, they migrate far from there original point of application, thus affecting a very wide area. These chemicals upset the natural and delicate balance in our ecosystem, thus placing a great deal of stress on the natural vegetation (Miller).

The runoff of harmful chemicals from residential and industrial properties, such as spills, can have a detrimental affect on plants (Robichaud and Buell). During rain storms and through the melting of snow and ice, these chemicals leach into soil or escape as runoff into local waterways. In both cases, these pollutants enter the ecosystem untreated and have harmful effects on vegetation and wildlife. Road salt, which is commonly used to melt ice and snow, is also finding its way into soils and local waterways.

All of these chemicals interfere with the ecosystem's delicate balance and not only effect vegetation, but all life in the terrestrial ecosystem (Collins and Anderson). Harmful pollutants also have negative effects on the vegetation which surround local waterways as well as affecting the wildlife which residents in these waterways (Robichaud and Buell).

Habitat Fragmentation and Loss

Habitat fragmentation and loss play a significant role in decreasing the ecosystem's ability to support plant and animal life (Miller).

Habitat fragmentation is the subdividing of land, mostly through the building of roads and buildings which divides a habitat into smaller pieces of lesser size and quality (Miller). This has led directly to the decrease of vegetative species diversity and quantity, which can lead to a decrease in animal diversity and quantity, which in turn, can affect the stability of the entire ecosystem.

Habitat fragmentation reduces the *quality* of the remaining vegetation (Collins and Anderson). Instead of having a large and continuous area of high-quality vegetation, smaller, fragmented areas of lower quality vegetation remain. As a result, many of the important, native plant species are out-competed by lesser quality and sometimes exotic species. This has negative consequences on native wildlife, thereby reducing their number and quality (Robichaud and Buell).

The largest continguous wooded areas in Glen Rock are the Arboretum, Diamond Brook Park and Saddle River Park. The PSEG right of way also provides vegetative corridor.

Another and more obvious impact on the vegetation of Glen Rock is habitat loss. If vegetation is reduced through the development of human structures, than the services that the vegetation offers is eliminated. This habitat loss once again decreases the biodiversity of plants in Glen Rock and in turn negatively affects wildlife.

Impervious surfaces

The Borough is comprised of 1735 acres of land. According to the Maps for Mayors data, impervious surfaces (buildings, sidewalks, driveways, parking lots, etc.) covered 590 acres in 1985. By 1997, 10 more acres were added so that total area of impervious surface constituted 34.6% of the total acres in the municipality. Between 1985 and 1997 this showed an increase of a little over .6%. Data for 2002 shows an increase of ?%. At this time, there are 8 undeveloped lots in the Borough. 3 are owned by the Borough (of which one has no access from the street). One wooded lot is before the Zoning Board for a driveway variance and a home will be built on it. 4 are privately owned—one of those has no access to the street. Two lots butt the Recycling Center and Doremus Avenue Ball Field. And one is located on Rock Road and is for sale.

THE FUTURE OF THE GLEN ROCK'S COMMUNITY FOREST

Despite all of the positives, many of today's trees are aging and inevitably will require replacement. The over-planting of Norway maples is taking its toll. With age and deterioration, come increased needs for hazard identification and abatement. As a result, segments of the public tree population are demanding a higher level of attention than before and removal and replacement needs are increasing.

In 2003, the Borough of Glen Rock formulated a forestry management plan. The management plan is created every 4 years to identify goals and objectives and provide guidance on how funds should be spent. The plan is an essential guide to successfully achieving a healthy and safe community forest. With the Forestry Management Plan in place, the town is able to reduce or eliminate their exposure to litigation due to the drastic decline and poor condition of the community tree resource according to the New Jersey Shade Tree and Community Forestry Assistance Act.

The first plan's objectives were very similar to the updated 2008 plan. An essential goal of the 2008 plan is an inventory of all trees along the Borough's streets and on Borough property. Another is the purchase and implementation of a computer program and database to manage the inventory and tree maintenance information. This computer management program will greatly increase data keeping functions and enhance the ability of the DPW to maintain shade tree population and formulate a more comprehensive management plan.

CONCLUSION

The introduction of monoculture has had a negative impact on the biodiversity of Glen Rock. The preponderance of turfgrass in private residences, schools and parks severely limits the habitat available to local wildlife. Introduction of non-native plants has compromised the quality of habitat for native wildlife.

- The Borough could create a more comprehensive Street and Park Tree Master Plan.

- The Borough would benefit from developing an updated Tree Ordinance that reflects the goals of the Master Plan.

- The Borough should conduct a Street Tree Inventory as per the 2008 Forestry Management Plan.

- The Borough should create a coalition of civic and governmental organizations to coordinate efforts to develop and promote sustainable policies to promote native vegetation, tree canopy goals and create a strong, long-term education program. These organizations could include the Planning Board, Environmental Commission, Shade Tree Advisory Committee, Dept. of Public Works, Dept. of Parks & Recreation, Thielke Arboretum of Glen Rock, a representative from the Borough Council, Green Up Glen Rock, and The Garden Club.

- The Borough could create a significant new vegetation management and tree planting plan, with an emphasis on long-term funding and technical assistance to residents. This would help the Borough:

    - Achieve tree canopy goals,
    - Avoid adverse impacts particularly through vegetation clearance,
    - Minimize impacts by careful planning, design and management if impact cannot be avoided, and
    - Require that if clearing must occur, the loss of trees must be offset by replacement.

- The Borough could make the Shade Tree Advisory Committee a commission, which would make the Borough eligible for liability protection granted by the State.

- The Borough should pursue its plans to create a tree trust fund to fund an established planting program.

- The Building Department and Planning Board can explore measures to protect existing trees during construction.

- The Borough can research grant or funding sources outside of the town budget.

- The Borough should discourage wide-spread use of pesticides on public and private property. The Departments and Parks and Recreation and Department of Public Works should adopt and Integrated Pest Management (IPM) approach. Widespread use of

fertilizers, herbicides and pesticides by homeowners, landscapers, and borough to maintain turfgrass, residential vegetation and playing fields harms humans, water quality, pollinators and wildlife. IPM calls for the use of all appropriate techniques of controlling pests in a coordinated manner that enhances, rather than destroys, natural controls. If pesticides are part of the program, they should be used sparingly and selectively so as not to interfere with natural competitors and protects water quality.) www.ecoagriculture.org/page.php

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SECTION X: HABITAT AND WILDLIFE

INTRODUCTION

Since the time of Glen Rock's settlement, the Borough has undergone extensive development which converted the area from a native Northeastern forest to a suburban/urban community. As a result of this development, much of the original native habitat has been eliminated, thus reducing the ability for much of the original wildlife to flourish. Despite this development, Glen Rock is still home to a wide range of different species of plants and animals due to their ability to adapt to their altered environment.

GEOGRAPHIC REGION

Glen Rock is a suburban Borough located in northern New Jersey in an area of the state known as the Northern Piedmont Plains (NJDEP Landscape Project). This area also includes the Hackensack Meadowlands, The Great Swamp National Wildlife Refuge, and The Sawmill Creek Wildlife Management area. Due to its latitudinal location this region is a transition zone between southern species and northern species of animals. For many migratory animals, especially birds, northern New Jersey is the northern most limit for many southern species. This area of New Jersey is also the southernmost limit for many northern species, in addition to being a temporary resting ground (Hawthorne ERI). For this reason, the fauna of Glen Rock varies from season to season.

The vegetation of the region is dictated by both climate and soil, which in turn provides a variety of habitats for animals of the area to survive. Even though much of the original habitat has been developed in Glen Rock, there still remain a few wooded areas as well as several riparian, lake, and wetland habitats, such as the Carol Thielke Arboretum and pond, Diamond brook, Saddle River County Park and Doremus Park.

HABITAT LOSS AND FRAGMENTATION

Habitat loss, habitat fragmentation, and the presence of humans have led to:

- Decreased biodiversity;
- Noise, air and soil pollution, domestic predators;
- Cultural eutrophication of waterways;
- Edge effects; and
- Increased vulnerability to pests and disease.

Since the early days of colonial settlement, Glen Rock has undergone extensive habitat fragmentation (which is the subdividing, mostly through roads and buildings, of habitat into small pieces of a lesser size and quality, Miller). This has lead to the loss of species diversity, quantity and size. One can easily imagine a time when Glen Rock was undeveloped and large mammals like bear, bobcat, deer, and foxes abounded. Due to habitat fragmentation, much of the former biodiversity (biodiversity is the number and abundance of different species, Miller) has been diminished. Biodiversity is an important indicator of any healthy ecosystem. It provides essential services such as the absorption of atmospheric carbon dioxide, the pollination of flowers by insects and birds, and the purification of air and water, to name just a few. The aesthetic value of plants, birds, and other wildlife is extremely important to the well being of many people (Protect Nature in Your Community). Uninterrupted, contiguous open space leads to a greater degree of biodiversity (Miller). This conservation of uninterrupted, contiguous open space can be brought about through a careful conservation plan, by public land purchases, and through individual citizen involvement by the establishment of backyard habitats (NJDEP's Wildlife Action Plan).

Much of the vegetation surrounding residential property in Glen Rock is composted of lawns, which are considered a "monoculture," and are not very good at supporting wildlife. Native vegetation planted around a residential home would result lead to a wider variety of wildlife living in "natural habitat" conditions. In addition to conserving as much open space as possible, it is beneficial to retain as much of older growth forests as possible. Older growth forests provide the best and most stable habitats for indigenous animal species. Many of these animals require uninterrupted and contiguous swaths of forest which no longer exist in Glen Rock. This fragmentation has resulted in small patches or "islands" of wildlife throughout Glen Rock.

Fragmentation is mostly due to development of houses, businesses, roads and many other manmade structures, which interfere with a species ability to breed, find food, and seek refuge. In addition to the impacts of physical infrastructure, human presence and lifestyle influences wildlife in our area. Animals are affected by noise, automobiles, domesticated animals, and toxic and dangerous chemicals released into the environment. Every effort should be made to lessen or prevent cultural eutrophication (this is the addition of human made chemicals into natural waterways, Miller).

Many lawn chemicals commonly used to maintain pristine lawns, such as fertilizers and pesticides, run off of these treated lawns and make their way into the local waterways untreated. Everyday chemicals found in homes and in garages also find their way into

the local waterways, without ever being treated. Cultural eutrophication has a detrimental effect on natural waterways and makes this water habitat less fit for aquatic and terrestrial species.

Since there are few uninterrupted forests remaining in Glen Rock, and much of the wooded areas consist of many small patches, we see a phenomenon known as the "edge effect". This is where there is a decrease in soil moisture and relative humidity as well as an increase in temperature in the affected "edge" area (Miller). Habitat fragmentation can also make plants more vulnerable to pests and disease (NJDEP Wildlife Action Plan). These factors dramatically affect the forest composition, thus in turn affecting the quantity, diversity, and size of the species in that area.

In January 2008, the NJDEP's Wildlife Action Plan identified the following goals to increase the number and health of wildlife in our area.

- Protect critical habitats identified in the NJDEP's Landscape Project.
- Protect suitable aquatic/wetland/riparian habitats and water quality for wildlife and fish species of conservation concern.
- Inventory and monitor endangered, threatened, and special concern wildlife and fish.
- Prevent and reverse the decline of wildlife populations.
- Assess large-scale habitat change every five years.
- Maintain natural biodiversity, community integrity and structure and ecosystem function by controlling invasive and over abundant species.
- Prevent the illegal collection of reptiles and amphibians.
- Protect and enhance important and unique habitats.
- Promote public education and awareness and wildlife conservation.
- Collaborate with local, state, and federal agencies as well as local organization, businesses, and academic institutions to conserve wildlife.

Of these goals, the most relevant to Glen Rock are; the protection of terrestrial and aquatic habitats, the maintenance of natural biodiversity, prevent and reverse the decline of natural wildlife populations, and promote public education and awareness of wildlife conservation. Instituting these goals will most likely prevent the further loss of natural habitat for wildlife and promoted the welfare and success of natural wildlife populations.

Terrestrial Species

As previously mention, the intrusion of humans and the subsequent destruction of the natural ecosystem have greatly reduced the diversity, size, and abundance of terrestrial and aquatic species. Although species diversity and abundance have been negatively impacted by the urbanization and subsequent fragmentation, many species have adapted and flourished in this new environment. Species which are considered generalist species (species that can utilize a wide range of habitats and food sources, Miller) have tended to flourish. While species which are considered to be specialists (species which have a narrow range of habitats and food sources, Miller) have had their numbers greatly reduced or have been completely removed from the area.

While urbanization has been detrimental to most species, species such as squirrels, Canadian geese, raccoons, skunks, and opossums, have greatly increased their numbers due to the influence of humans. This is partly due to the removal or reduction in numbers of natural and large predators, such as coyotes and foxes. Another factor which has increased the number of some species is the ability of these animals to obtain human food. As a result of these two factors, the above mentioned species are sometimes referred to as "pests".

The Canadian goose has done especially well under human influenced conditions. In many areas, the goose droppings can have a detrimental effect on the water quality and could have negative impacts on the number and diversity of other aquatic species (see chapter on Water Quality). Chipmunks, squirrels, and mice often fall victim to raptors (predatory birds) as well has domestic cats, which generally keeps their numbers in check.

In addition to the species of animals which are commonly seen by humans there are many other small species such as moles, shrews, and bats which are common in this suburban/urban landscape. These animals reduce the number of insects in the ecosystem, therefore, decreasing the need for pesticides. Since these species are small and inconspicuous, many of them have lived side by side with humans and seem to not as negatively affect as their larger and more iconic comrades.

Bird Species

Birds offer the greatest species diversity in Glen Rock for three main reasons. First, many of the Borough's bird species are considered "generalist" species and have adapted to coexist with humans. These birds use many of our manmade structures to build their nests, and in some cases, use manmade materials to build their nests. Also, many birds utilize human leftovers from garbage cans and dropped pieces of food to derive some of their sustenance. Many Glen Rock residents have bird feeders, which supply the birds with a year-round food supply. The second reason is that many migratory birds use Glen Rock as a stop along their migratory paths as they travel from

North to South and vice versa (Wild Birds Unlimited). There are several ponds and streams where migrating water fowl can feed on small fish and invertebrates. In addition to the waterways, there are many open fields which birds can use to find insects and other invertebrates as a source of food. Finally, due to the wide vary of endemic and non-endemic plants, birds can find a wide variety of seeds and flowers which they can feed upon (Wild birds Unlimited).

Although there has never been an official bird or mammal census in Glen Rock, it does not take a great deal of imagination to see that as the amount of natural vegetation decreases due to development, the number of animal species will further decrease. As previously mentioned, habitat fragmentation decreases the quality of the ecosystem, thus making it less livable to most remaining species in the area. In addition to habitat loss and fragmentation, chemicals released into the environment further decreases habitat quality and will continue negatively impact the animals of Glen Rock.

Aquatic Species

Glen Rock is also home to many aquatic species of fish and amphibians as well as many semi-aquatic species of amphibians and reptiles. While the diversity of fish, amphibians, and reptiles is much less than the diversity of birds and mammals, they still represent an important component of our local ecosystem. Amphibians and fish can be considered indicator species (this is a species which can indicate the health of an ecosystem, Miller). When one looks at the diversity of fish and amphibians in an aquatic ecosystem, one can basically tell the quality of the water. Since fish and amphibians depend on water to live, if the water is unfit, then the fish, amphibians, and invertebrates will die. Runoff from road salt, fertilizers, pesticides, and other common harmful chemicals enter the Glen Rock waterways untreated, therefore decreasing the quality of the water for all life forms (see chapter on Water Quality). It is once again easy to imagine the past waterways of Glen Rock with much richer species diversity before the impacts of humans.

INVASIVE AND OVERABUNDANT SPECIES

Most of the invasive species found in Glen Rock are plants, as discussed in the chapter on vegetation. Glen Rock has only a few invasive and overabundant animal species, such as squirrels, Canadian geese, and feral or wild cats. This is mostly due to habitat fragmentation and the poor quality of the undeveloped land. Increased numbers of squirrels and Canadian geese are also due to the lack of predators. This is due to their long-standing residential status in this region.

The main invasive and overabundant species in Glen Rock and the surrounding area is the Canadian Goose. This species has thrived in the since humans have developed this

region due to two major factors. First humans have eliminated the natural predators of the Canadian Goose, thus allowing its population to grow without control. Second, by removing the natural vegetation and planting vast expanses of grass, we have given the Canadian Goose an abundant supply of food. The result of these two factors have caused to population of geese to grow to the point that they are overabundant and in many cases invasive.

There are two impacts that this situation has created. First, the goose droppings, which contain fecal bacteria, can have a negative effect on local waterways by adding more nutrients and fecal bacteria than the natural ecosystem can absorb. This can decrease the quality of the waterways, thus making it less livable for fish, amphibians, and other aquatic organisms. Second, since the goose droppings contain fecal bacteria, they can have a negative impact on human health if the bacteria are indirectly ingested. This is most prevalent in the local schoolyards, athletic fields, and any other public area which contains large expanses of grass.

To date there have only been a few attempts to control the geese populations in Glen Rock. At many of the athletic fields, fake dogs and coyotes have been placed in hopes to scare off the geese. These measures seem to be ineffective. A second method which has been done from time to time is the oiling of eggs with vegetable oil, which kills the embryo without the mother goose knowing, thus not stimulating her to breed again. There is no set system of egg oiling in place and it is done in sporadic basis. A third method which has been attempted is the stream bank plantings along the Saddle River Park and the cessation of mowing of grass along the riverbank, thus allow natural vegetation to grow and not grass, thus providing less food for the geese. There has been talk of using trained dogs to scare away geese in overpopulated areas, but no definite plans have been implemented.

The other invasive species is the feral or wild domestic cat. Throughout Glen Rock there are several populations of feral or wild cats living in some of the wooded areas. These are cats that were abandoned by their owners in Glen Rock or adjacent towns. Since some of these cats were not spayed or neutered, they have set up several breeding populations within Glen Rock. One of the major problems associated with these populations is the killing of birds and other rodents in Glen Rock. House cats, both domesticated and feral, are responsible for killing more than a billion birds, small mammals, amphibians, and reptiles each year in the United States (Protect Nature in Your Community). This is bad news of course for the bird or rodent that was killed, but it is also bad news for the other species, like hawks and owls, which depend on birds and rodents for their survival.

RARE, ENDANGERED AND THREATENED SPECIES

An endangered species is a wild species with so few individual survivors that the species could become extinct in all or most of its natural range (Miller). A threatened species is a wild species that is still abundant in its natural range which is a risk of becoming endangered because of a decline in numbers (Miller). In the Northern Piedmont Plains area of New Jersey, there are 14 State endangered species, 12 State threatened species, and 71 special concern species (NJDEP's Wildlife Action Plan). To date, no rare, endangered, or threatened species have been reported in Glen Rock. There is the possibility that from time to time a rare or endangered species may take up temporary residence in Glen Rock. Due to the large degree of disturbance to most natural ecological habitats this situation is unlikely, but has not been ruled out. Several species which are on the NJ Wildlife Action Plan's non-game species of special concern have been identified in Glen Rock such as the Eastern Box Turtle, the American Kestrel, the Northern Flicker, and the Great Blue Heron.

CONCLUSION

Glen Rock can strive to prevent additional habitat loss through development and habitat fragmentation. This can be achieved through careful management of development and through the planting of native plant species which encourage the growth of natural wildlife populations.

The best way to decrease edge effect is to maintain, if not increase, the amount of open contiguous space available to vegetation and wildlife. This can be achieved by regulating the amount of land available for building and increasing the planting of vegetation, thus connecting the habitat fragments. Individual home owners can preserve vegetation on their property by planting native plant species and reducing usage of pesticides, fertilizers, and other chemicals.

Schools, houses of worship and residents can participate in the *National Wildlife Foundation's* backyard habitat program, which increases the amount of natural habitat on their property, thus increasing the number and diversity of species.

Citizens can participate in the annual Christmas bird count, a program which catalogs the different bird species found in Glen Rock. This count, when done on an annual basis indicates increases and decreases in bird populations and species diversity.

It is important to educate Glen Rock citizens that their actions do affect vegetation and wildlife populations in negative ways. Residents can be encouraged to utilize non-dangerous lawn care practices which will not damage natural wildlife.

Glen Rock could also adopt a Canadian Goose population control program. As discussed previously, overpopulations of geese can have negative impacts on the natural ecosystem as well as on human health.

Glen Rock can work with neighboring communities strengthen existing green ways, such as Saddle River Park, and explore the feasibility of developing new greenways that would extend along Diamond Brook from the Recycling and Compost Center, along the Arboretum, Byrd School, Diamond Brook Woods down to the Opici Wines facility. Greenways, a system of parks, protected natural and historic lands, help maintain and improve the quality of life for residents.

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SECTION XI: HISTORIC SITES AND CULTURAL SITES

HISTORIC SITES

The Borough of Glen Rock is named after a 570-ton boulder situated at the northern end of Rock Road, the Borough's main thoroughfare. The Rock, which is believed to have been deposited by a glacier, once served as a base for signal fires by the Delaware Indians, and later as a landmark for colonists traveling on foot[3]. The Glen Rock was declared an official landmark by the State Office of Historic Sites in 1964. A time capsule was buried just behind it in 1969, the Borough's 75th anniversary, and will be ceremonially unearthed in 2044. The story of "The Rock" is one of the Borough's many historic and culture-rich treasures.

In an ever-changing society, history and culture are important to preserve for today's and future generations. Without appropriate preservation measures in place, many historic buildings and neighborhoods are torn down for new development, or allowed to deteriorate beyond repair. As such, a piece of the past disappears forever. A sense of historical relevance is important for communities to retain as they continue to modernize. By designating historic sites or Historic districts, communities can then preserve their local character through preservation programs. Historic preservation programs can also be an economic development tool in developing a tourism market.

LOCAL HISTORIC PRESERVATION RESOURCES

Several organizations in the Borough help to ensure that the history is preserved in Glen Rock.

- *Glen Rock Historical & Preservation Society*
  The Glen Rock Historical Society is located at the Main Line Railroad Station. There are archives, documents, photos, memorabilia, artifacts and ephemera of Glen Rock, including the period prior to its incorporation, within its collection.

- *Glen Rock Historic Sites Committee*
  The Glen Rock Historic Sites Committee helped to prepare the Historic Preservation Plan Element of the 2002 Glen Rock Master Plan. The Plan lists the historic sites in the Borough that were designated prior to 2002. The group is a part of the Historical Society.

- *Local Historian*
  The Local Historian Enabling Act enacted in 1979 permits municipalities to establish the position of "Local Historian," whose job is to promote and preserve the history of

[3] The New York Times, "If You're Thinking of Living in Glen Rock," By Janet Elder, May 5, 1985

the municipality. The Mayor appoints Glen Rock's Historian to a three year term. The Local Historian is a part of the Historic and Preservation Society and is the liaison to the public.

The New Jersey Municipal Land Use Law defines a historic site as any real property, man-made structure, natural object or configuration or any portion or group of the foregoing that is of historical, archaeological, cultural, scenic or architectural significance. The Borough of Glen Rock, Bergen County, the State of New Jersey and the Federal Government all maintain separate listings and publications of historic sites. The listings are a critical resource for enabling the adoption of historic preservation ordinances and in establishing preservation commissions.

OFFICIAL (AND NON-OFFICIAL) REGISTERS OF HISTORIC PLACES

Several properties and structures in Glen Rock are listed on the official *Federal Register of Historic Places* and the *New Jersey Register of Historic Places*. There are also a host of additional properties in Glen Rock that are cataloged in the *Bergen County Historic Sites Survey*. The Glen Rock Historic Preservation Sites Committee also documents sites that do not meet the criteria for inclusion on these lists, but which deserve recognition as having historic significance.

State and Federal Registers of Historic Places

The National Register of Historic Places is the official list of the nation's historic resources worthy of preservation. The first historical registry was established by Congress in 1935, and designated properties of national importance as National Historic Landmarks. In 1966, the National Historic Preservation Act (80 Stat. 915, as amended) established a National Register of Historic Places to include districts, sites, structures, buildings, and objects of local, state, and national significance.

The New Jersey Register of Historic Places is the official list of New Jersey's historic resources of local, state, and national interest. Created by the New Jersey Register of Historic Places Act of 1970 (N.J.S.A. 13:1B-15.128 et seq.), the New Jersey Register is closely modeled after the National Register program. Both Registers have the same criteria for eligibility, nomination forms, and review process. Historic properties and districts on the New Jersey and National Registers must meet specific "criteria for significance in American history, archaeology, architecture, engineering or culture, and possess integrity of location, design, setting, materials, workmanship, feeling and association[4]."

[4] NJDEP, Historic Preservation Office, New Jersey and National Registers of Historic Places, http://www.state.nj.us/dep/hpo/1identify/nrsr_lists.htm

The Historical Preservation Office within the NJDEP maintains the *New Jersey and National Registers of Historic Places* listing. The listing is made up of properties and historic districts in New Jersey for which a formal action was taken by the State Historic Preservation Officer (SHPO) or designee. The Historic Preservation Office updates the list periodically to reflect ongoing additions and corrections. The listing itemizes the buildings, structures, sites, objects, and districts on the New Jersey Register of Historic Places ("SR") and National Register of Historic Places ("NR"). They also include sites that have received either Certifications of Eligibility (COE), an opinion of eligibility from State Historic Preservation Office in response to a federally funded activity that will have an effect on historic properties not listed on the National Register (SHPO Opinion), or Determinations of Eligibility from the Keeper of the National Register (DOE). The properties and Districts within Glen Rock listed on the New Jersey and National Registers of Historic Places are shown in Figure 12 and in Table 25 below.

Bergen County Historic Sites Survey

In addition to the State and Federal registers, Bergen County and the Borough of Glen Rock maintain separate inventories of historical resources. The *Bergen County Historic Sites Survey* (1983-84) contains an inventory of buildings, streetscapes, districts and sites of historical and architectural interest throughout the County. The Survey is currently being updated town by town. A copy of the Glen Rock Survey is available at the municipal library. The properties listed on the Bergen County Survey are shown in Table 26 below.

Glen Rock Inventory

The Glen Rock Historic and Preservation Society also maintains a general inventory of properties of historical interest to the Borough. These are residential and non-residential sites throughout the Borough that typically pre-date 1900, yet are not listed on the County, State or Federal Inventories. The buildings may have undergone come form of renovation, but the original structure is still intact. The Society's inventory is listed in Tables 27 and 28 below.

Figure 12
Glen Rock Sites on NJ & US Register of Historic Places

NJ DEP - Historic Preservation Office
New Jersey and National Registers of Historic Places

Glen Rock Borough

Ackerman-Hopper House (ID#514)
652 Ackerman Avenue
NR: 1/9/1983 (NR Reference #: 83001455)
SR: 10/3/1980
(#58 - Thematic Nomination of Early Stone Houses of Bergen County)

Bergen County Line (ID#4677)
Rail line extends from Glen Rock thru East Rutherford
SHPO Opinion: 3/6/2006
Also located in:
Bergen County, East Rutherford Borough
Bergen County, Elmwood Park Borough
Bergen County, Fair Lawn Borough
Bergen County, Garfield City
Bergen County, Wallington Borough

Erie Railroad Main Line Historic District (ID#218)
Erie Railroad Right-of-Way westward from Hudson, Jersey City at Coles Street to undetermined extent
SHPO Opinion: 2/20/2003
(Previous Opinion: 3/10/1999)
See Main Entry / Filed Location:
Hudson County, Jersey City

Andrew H. Hopper House (ID#515)
762 Prospect Street
NR: 1/9/1983 (NR Reference #: 83001521)
SR: 10/3/1980
(#56 - Thematic Nomination of Early Stone Houses of Bergen County)

Garret Hopper House (ID#516)
470 Prospect Street
NR: 1/9/1983 (NR Reference #: 83001522)
SR: 10/3/1980
(#55 - Thematic Nomination of Early Stone Houses of Bergen County)

Hendrick Hopper House (ID#517)
724 Ackerman Avenue
NR: 1/9/1983 (NR Reference #: 83001526)
SR: 10/3/1980
(#57 - Thematic Nomination of Early Stone Houses of Bergen County)

HISTORIC DISTRICTS

A historic district is a group of buildings, properties or sites that have been designated as historically or architecturally significant. Buildings, structures, objects and sites within a historic district are considered either "contributing" or "non-contributing" to the historical significance of the District.

Districts can vary greatly in size; some have hundreds of structures while others may have just a few. The National Park Service within the U.S. Department of Interior designates historic districts on the National Register of Historic Places. The State Register currently lists one (1) Historic District in Glen Rock: The Erie Railroad Main Line District, which received a State Historic Preservation Office (SHPO) Opinion in 2003.

FINANCIAL RESOURCES & BENEFITS

Inclusion in the State and National Registers enables property owners to take advantage of financial benefits. There is a 20% federal income tax credit for a substantial rehabilitation of an income-producing building, for example. For properties listed in the New Jersey Register, the New Jersey Historic Trust Fund offers matching grants and low-interest loans for rehabilitation and restoration to state, county and municipal agencies and nonprofit organizations. The Trust provides financial support, protection and technical assistance through a

U.S. Department of the Interior, National Park Service

NATIONAL REGISTER CRITERIA FOR EVALUATION

The quality of significance in American history, architecture, archeology, engineering, and culture is present in districts, sites, buildings, structures, and objects that possess integrity of location, design, setting, materials, workmanship, feeling, and association, and:

A. That are associated with events that have made a significant contribution to the broad patterns of our history; or

B. That are associated with the lives of significant persons in or past; or

C. That embody the distinctive characteristics of a type, period, or method of construction, or that represent the work of a master, or that possess high artistic values, or that represent a significant and distinguishable entity whose components may lack individual distinction; or

D. That have yielded or may be likely to yield, information important in history or prehistory.

CRITERIAL CONSIDERATIONS

Ordinarily cemeteries, birthplaces, graves of historical figures, properties owned by religious institutions or used for religious purposes, structures that have been moved from their original locations, reconstructed historic buildings, properties primarily commemorative in nature, and properties that have achieved significance within the past 50 years shall not be considered eligible for the National Register. However, such properties *will qualify* if they are integral parts of districts that do meet the criteria or if they fall within the following categories:

a. A religious property deriving primary significance from architectural or artistic distinction or historical importance; or

b. A building or structure removed from its original location but which is primarily significant for architectural value, or which is the surviving structure most importantly associated with a historic person or event; or

c. A birthplace or grave of a historical figure of outstanding importance if there is no appropriate site or building associated with his or her productive life; or

d. A cemetery that derives its primary importance from graves of persons of transcendent importance, from age, from distinctive design features, or from association with historic events; or

e. A reconstructed building when accurately executed in a suitable environment and presented in a dignified manner as part of a restoration master plan, and when no other building or structure with the same association has survived; or

f. A property primarily commemorative in intent if design, age, tradition, or symbolic value has invested it with its own exceptional significance; or

g. A property achieving significance within the past 50 years if it is of exceptional importance.

host of programs that provide grants, loans and matching funds.

Bergen County offers matching grants for the acquisition, stabilization, rehabilitation, restoration, preservation, and preparation of plans and reports for capital historic preservation projects from the county's Open Space, Recreation, Farmland and Historic Preservation Trust Fund. Eligible applicants for the competitive grants are the County, municipalities, and qualified non-profit organizations. All properties for grant-funded activities must be located in Bergen County and listed on or eligible for listing on the New Jersey Register of Historic Places, either individually or as a contributing part of a historic district.

CULTURAL RESOURCES

Glen Rock is a culturally-diverse community with highly active and participatory residents. The Borough is home to religious institutions that span at least seven (7) denominations, including Episcopalian, the Baha'i faith, Reformed Christian, Judaism, Skikhism, Lutheran, and Roman Catholic. Residents of Glen Rock can join any number of clubs and organizations based in the Borough, including a variety of sports clubs and associations, as well as:

- Glen Rock Jaycees
- Rock Riders Motorcycle Club
- Glen Rock Women in Community Service
- Glen Rock Triathlon Club
- MOMS Club
- Garden Club
- Womens Club
- Stamp Club
- High School Booster Club
- Activities Club of Glen Rock
- Senior Citizens Club
- Athletic Club
- Fifty-Plus Club
- Newcomers & Neighbors
- Poverty Awareness Project
- American Legion
- High School Alumni
- League of Women Voters of Glen Rock
- Historical and Preservation Society
- Arts Council
- Friends of the Arboretum, Inc.
- Friends of the Library
- Northwest Bergen Chapter of Hadassah
- National Assoc. of Retired Federal Employees
- Community Meals
- Community Relations Advisory Board

The Borough is also host to a year-round calendar of community-gathering events. Municipal service and meetings are also posted on the calendar at:
http://www.glenrocknj.net/calendar.asp

Every three (3) years, the Bergen County Department of Parks publishes a free "Bergen County Cultural Directory," which offers a county-wide listing of non-profit arts, heritage and preservation organizations. The directory provides accessibility to the arts for the general

public and educators, and promotion and audience development for the arts constituency. The publication is funded in part by the New Jersey State Council on the Arts.

The *Historic and Cultural Sites Map* (See Map Appendix) shows the location historic properties currently listed on the Federal Register, State Register or Bergen County Sites Survey, as well as many of the cultural resources throughout the Borough.

Table 25
Glen Rock Properties on the State and National Registers of Historic Places

Name	Address	Block/Lot	Register / Year / Number	Notes	Known Year
National & State Historical Registers					
Ackerman-Hopper House	652 Ackerman Ave.	108/4B	NR 1983 # 83001455; SR 1980 # 514; BC Survey # 0222-2	BCSHS: #58	1763
Hendrick Hopper House	724 Ackerman Ave.	102/19A-BN, 20	NR 1983 # 83001526; SR 1980 # 517; BC Survey # 0222-3	BCSHS: #57	--
Garret Hopper House	470 Prospect St.	9/1	NR 1983 # 83001522; SR 1980 # 516; BC Survey # 0222-5	BCSHS: #55	1788
Andrew H. Hopper House	762 Prospect St.	162M/32A	NR 1983 # 83001521; SR 1980 # 515; BC Survey # 0222-6	BCSHS:: #56	1767
State SHPO Opinions					
Bergen County Rail Line	Glen Rock thru E. Rutherford	--	SHPO Opinion 3/6/06 # 4677	--	--
Erie Railroad Main Line Historic District	Erie Railroad ROW	--	SHPO Opinion 2/20/03 # 218	--	--

- SR = State Register of Historic Places
- NR = National Register of Historic Places
- BC Survey = Bergen County Historical Sites Survey
- SHPO = State Historic Preservation Officer
- BCSHS = Bergen County Stone House Survey
- RR = Thematic Group of Operating Rail Road Stations in New Jersey, Jan-1979

Table 26
Glen Rock Properties on the Bergen County Historical Sites Survey (1982-1983)

Site Name	Address	Block/Lot	Bergen Co. Survey #	Notes	Known Year
DISTRICT					
Prospect Street District	Maple Ave (300, 306, 314, 320, 326, 334, 342, 348) & Prospect Ave (304, 348, 364, 374, 380, 386, 390, 400)	13/4A -11, 1/1, 2, 3/2- 7	0222-D1		
INVENTORY					
F. Snyder House	326 Harristown Rd.	125/5	0222-4		1867
Glen Rock Station of the Erie RR Line	Rock Road (SW Corner) & Main Street	75/1A	0222-7 (RR Survey # 5-9)	Stone Building	
Glen Rock Station of the Shortcut Line	Rock Road & West Plaza	82/1A	0222-8 (RR Survey # 5-3)	Hoboken Div., Bergen Line; Stone Bldg	
Anthony Nazzaro House	600 Doremus Avenue	74/8	0222-11	BCDCHA Recommendation	
D.H. Wortendyke Springhouse	410 Grove Street	129/24	0222-12		
Municipal Building	Harding Plaza	104/1	0222-13		
Tomas G. Snyder House	289 Harristown Rd.	177/26	0222-14		1852
Junior-Senior High School	600 Harristown Rd.	162/1	0222-15		
Anthony Thurston House	648 Harristown Rd.	159/15	0222-16		
George Doremus House	403 Maple Ave.	22-Jul	0222-17		1870
C. F. Marinus House	844 Maple Ave.	95/5	0222-18		1794
Wagner Hotel	1007 Maple Ave.	177/23, 24	0222-19		
George Berdan House	32 Rock Road	82/8	0222-20		1839
Carl Kemm Loven House	119 Rock Road	57/9.01	0222-21		1934
The Rock of Glen Rock	Rock Road & Doremus Ave.	73/1	0222-22	BCDCHA Recommendation	
Former Gas Station	224 Rock Road	112/9	0222-23		
Schoolhouse of District #44	497 Rock Road	119/11	0222-24		
Brown-Catherine Fee House	139 S. Highwood Ave.	18-Nov	0222-25		
Midwood Road Streetscape	Midwood Rd (2, 12, 26, 42, 54, 66) & 11 Forest Ave.	3/11, 8/4, 7/2, 7/3, 8/2, 8/5	0222-59		

- BCDCHA = Bergen County Department of Cultural and Historic Affairs
- RR = Thematic Group of Operating Rail Road Stations in New Jersey, Jan-1979

Table 27
Glen Rock Historic & Preservation Society: Early Homes, Prior to 1900

	Property Address	Known Year
1	521 Prospect Street	1830
2	497 Rock Road	1846
3	448 South Maple Ave	1850
4	415 Lincoln Ave	1850
5	25 Clifton Place	1850
6	285 Hamilton Ave	1850
7	100 South Highwood	1859
8	909 Prospect St	1860
9	749 Prospect St	1860
10	648 Harristown Rd	1861
11	139 South Highwood Ave	1865
12	481 Prospect St	1866
13	649 Ackerman Ave	1870
14	367 Lincoln Ave	1870
15	78 Highland Ave	1874
16	404 South Maple Ave	1876
17	126 S. Highwood Ave	1880
18	6 Ferguson Place	1880
19	366 Harristown Rd	1880
20	783 Lincoln Ave	1880
21	663 Lincoln Ave	1880
22	181 Hamilton Ave	1880
23	91 East Gramercy Place	1880
24	20 Stonefield Road	1883
25	18 South Highwood Ave.	1885
26	168 Hamilton Ave.	1886
27	384 Grove St	1886
28	110 Harding Rd	1887
29	454 South Maple Ave.	1888
30	410 Grove St	1890
31	80 South Ave	1890
32	14 South Highwood Ave	1890
33	441 South Maple Ave	1890
34	14 High Street	1890
35	590 Doremus Ave	1890
36	150 South Highwood Ave	1890
37	348 Prospect Street	1894
38	364 Prospect Street	1894
39	237 Hamilton Ave	1894
40	203 Hamilton Ave	1896
41	400 Grove Street	1896

Table 28
Glen Rock Historic & Preservation Society: Other Sites of Historical Interest

	Name/Notes	Address	Known Year
1	Hopper Cemetery	Spotswood Road	Earliest Burial 1804
2	J. G. Hopper House	98 Valley Road	1805
3	David Marinus-Simonson House	10 Boulevard	1876
4	Abram Christopher House	70 South Highwood Ave	1900

Sources

- New Jersey DEP Historic Preservation Office
- US Department of the Interior, National Parks Service, National Register of Historic Places
- Glen Rock Historic & Preservation Society
- Bergen County Historical Sites Survey
- Bergen County Stone House Survey
- Bergen County Department of Parks, Bergen County Cultural Directory

SECTION XII: ENERGY RESOURCES

INTRODUCTION

All communities need energy to operate and municipal governments are often the largest users of it. Street lighting, the operation of government vehicles, watering of parks and the cooling /heating of large buildings all require that municipalities buy and use various types of energy. Unfortunately, energy utilization is not always as efficient as it could be.

There are many causes of inefficient energy use. They range from lack of individual control over the source or use of energy (such as the inability of employees to set indoor temperatures) to limited availability of efficient vehicles or alternative energy sources. The most important element in achieving energy efficiency, however, is obtaining "knowledge," that is, becoming aware of just where our energy comes from and how much of it our municipality uses.

One of the objectives of this Environmental Resources Inventory ("ERI") is to identify the key sources of energy in Glen Rock and develop an understanding of how energy is used. This information represents a critical first step in inventorying our energy usage quantitatively, that is, to measure the impact on a more specific level (types of municipal vehicles, street lighting, etc.) and to eventually identify the most appropriate ways to reduce energy use and to use it more wisely.

This section also aims to provide a qualitative analysis of Glen Rock's municipal government's energy use as a first step to becoming more efficient and wise energy consumers.

MUNICIPAL AND SCHOOL ENERGY USE

Glen Rock's main schools include four elementary schools (Byrd, Hamilton, Central and Coleman) and one Middle/High School. Most of their energy use is for lighting/powering equipment (such as those found in offices) and for heating.

Similarly, municipal buildings (the Public Library, the Annex, the Pool buildings, the Fire Department and the Ambulance Corps, and the Borough Hall) use most of their energy to light and heat structures. In addition, those departments that rely on vehicles (such as the Police, Fire Department, Ambulance Corps, and Borough vehicles) use fuel to power such equipment.

Lighting is ensured through electricity while heating uses oil burners or natural gas boilers. All borough vehicles rely on unleaded gasoline and diesel (for trucks) to operate. This information is summarized in the table below:

Table 29
Municipal Structures and Vehicles and Energy Sources

Structure or Equipment	Lighting	Heating	Fuel
Schools	Electricity	--	n/a
Municipal Buildings	Electricity	--	n/a
Police Vehicles	n/a	n/a	Gasoline
Fire Department Vehicles	n/a	n/a	Gasoline and diesel
Municipal Vehicles	n/a	n/a	Gasoline and diesel
Street and Traffic Lights	Electricity	n/a	n/a

The table above does not list water as it is not typically considered an energy source although the Borough of Glen Rock relies on water to provide services.

Some attempts to improve energy efficiency in Borough buildings include:

- All the computers in Borough schools are set to shut off at a certain time
- Some schools have switched to energy efficient lighting.

ENERGY SUPPLIERS

Sources of energy in Glen Rock vary depending on the final use and include electricity, natural gas (methane), gasoline and diesel. The means of production of such sources (such as electricity) may vary depending on the provider's ability and planning. The table below summarizes the means of generating energy for the major energy sources:

Table 30
Energy Production

Type of Energy	Provider	Means of Production	Sole Provider
Electricity	PSE&G	Carbon, Nuclear	Yes
Natural Gas	PSE&G	Natural Gas	Yes
Gasoline and Diesel	Various vendors	Petroleum	No
Water	Ridgewood Water	Water	Yes

RENEWABLE SOURCES OF ENERGY

Use of renewable source of energy are a growing trend in municipalities and may take a number of forms, depending on geography, availability of land, zoning regulations and residents' concerns. For communities like Glen Rock the most common form of renewable energy generation could be the use of solar panels to generate electricity thus offsetting the amount that is drawn from the grid. Updated Ordinances that govern and encourage the installation of solar panels are recommended.

Some residents are currently utilizing solar electric generation. The Board of Education is also looking into the installation of solar panels at Coleman, Hamilton, the Middle School and High School.

Glen Rock should consider tracking how much renewable energy is generated in the Borough so that success can be measured over time.

Clean Power Choice Customers

The CleanPower Choice Program from the New Jersey Board of Public Utilities' Office of Clean Energy is a statewide program that allows users to choose clean, renewable sources of energy such as solar power, wind power, low-impact or small hydro power and landfill gas power. The Borough should identify the number of Clean Power Choice customers are in Glen Rock and incent residents to join the program. Government buildings should select Clean Choice Power, as well, if not currently doing so.

CONCLUSIONS

To reduce energy consumption and increase energy a detailed municipal energy audit is recommended. Funding sources available for municipalities include those here and should be considered for Glen Rock:
http://www.njssi.org/uploaded_documents/EnergyAudit1-25-08.pdf

Such data, especially if collected over the period of at least one year (to account for seasonality, but a three-year period would be more appropriate) would provide sufficient information to observe the following:

- Trends such as increases or decreases regardless of seasonality
- Adjustments to be made due to extreme weather conditions
- Relationship of energy use against other metrics such as number of students in school or the square footage of buildings

- Connection of energy use against other "environmental" metrics such as tonnage of solid waste produced or water consumed

Such an effort would require defining specific parameters to measure, and the cooperation from borough officials who may maintain such information. The key objective of such an inventory should also be clearly stated as going beyond mere measurement to include specific and actionable steps the borough – and its residents – could take to reduce emissions, usage and, of course, costs.

Some additional sources to evaluate include:

- NJ Energy Master plan and its goals of 20 20-20 by 2020

- Energy Washington Week - Mayors' Building Codes Resolution Seen As Major Energy, Climate

- The nation's mayors have adopted a policy to encourage major changes in local building codes that would encourage energy efficiency and reduce greenhouse gas emissions, a move that proponents say could amount to the single most important governmental action this year to address climate change and rising energy prices. The proposal is widely supported by utilities and environmentalists as a way to reduce electricity and natural gas demand over the next several decades. However, the effort faces substantial opposition from home builders, who say the costs involved are too high and will disproportionately affect low-income home buyers at a time when the housing market is in turmoil.

- On June 23, the U.S. Conference of Mayors at its annual meeting in Miami, FL unanimously adopted a resolution supporting the so-called "30% Solution," a proposal crafted by the Energy Efficient Codes Coalition (EECC) that would require residential buildings to be 30 percent more energy efficient. The mayors adopted the plan hoping to pressure an influential group of building code experts meeting in September in Minneapolis, MN, that will vote on recommended changes to local building codes. The mayors' support is significant in that many of the code officials meeting this fall are city employees.

SECTION XIII: RECYCLING AND SOLID WASTE

INTRODUCTION

In 2008, Glen Rock generated 10,546 tons of solid waste. Of that, 6,109 tons were recycled and 4,436 tons were disposed of as garbage in out of state landfills.

Recycling offers a number of economic and environmental benefits. Recycling not only saves resources and energy, but also reduces the need for landfills and resource recovery facilities. Recycling can save money on disposal costs for generators, especially for businesses. Recycling saves money for manufacturers by reducing energy costs. Because it requires less energy to produce products from recycled materials than from virgin materials, recycling is a powerful way to reduce greenhouse gases and fight climate change. It also creates "green jobs." A recent study conducted by the Northeast Recycling Council and United States Environmental Protection Agency found that almost 27,000 people in New Jersey are employed in recycling and reuse establishments and that total receipts from these establishments are valued at over $5.9 billion annually.

The savings become even greater at the state level. In 2006, New Jersey recycled over 12 million tons of its total solid waste. In 2006, New Jersey's recycling efforts saved over 235 trillion BTUs of energy. This is equivalent to almost 2 billion gallons of gasoline. It represents the amount of energy that would be required to power over 2,000,000 homes for one year in New Jersey. Over 2 million tons of iron ore, coal, limestone, sand, soda ash, and feldspar were saved by recycling scrap metal and glass in New Jersey in 2006.

Increased recycling can be an effective way for municipalities to achieve the New Jersey's 2009 Energy Master Plan goals of reducing the state's energy consumption by 20% and reducing greenhouse gases to 1990 levels.

STATE RECYCLING GOALS AND REQUIREMENTS

In 1987, mandatory recycling began in New Jersey with the enactment of the New Jersey Statewide Mandatory Source Separation and Recycling Act. This Act created a statewide goal of achieving a 25% recycling rate of the municipal waste stream. In 1992 this recycling goal was doubled to 50% of the municipal waste stream with the goal for the overall waste stream established at 60%.

If New Jersey's municipal solid waste recycling rate increased from 34% to 50%, our state could avoid a total of 7.7 million metric tons of CO2 equivalent (avoided greenhouse gas emissions).

In addition to establishing and periodically raising the recycling goals, the New Jersey legislature has imposed other requirements on each municipality within the state. Each municipality must designate a recycling coordinator and distribute information about its recycling program at least twice a year. The collection of recyclable materials from the curbside must also occur on a repeated schedule.

The Solid and Hazardous Waste Program made substantive changes to the recycling rules at NJAC 7:26A in Jan. 2008. During the development of these rules, the legislature developed and signed the Recycling Enhancement Act.
http://www.nj.gov/dep/dshw/recycling/whatsnew/Recycling%20Act%20Signed.htm

In January 2008, bringing changes to the existing Statewide Mandatory Source Separation and Recycling Act at NJSA 13:1E-99.11. Both the regulations and the Act clarify prior statutory language and demand more of municipal recycling coordinators. New Jersey's Recycling Rules - New Jersey Administrative Code (N.J.A.C.) 7:26A (February 2009).

The legislation details a number of expanded responsibilities for a municipality's recycling coordinator.

Recycling Plan Element
The Municipal Land Use Law (MLUL) requires a recycling element as a mandatory component of a community's Master Plan. A recycling plan element should incorporate the State Recycling Plan goals, including provisions for the collection, disposition and recycling of recyclable materials designated in the municipal recycling ordinance, and for the collection, disposition and recycling of recyclable materials with any development proposal for the construction of 50 or more units of single-family residential housing or 25 or more units of multi-family residential housing and any commercial or industrial development proposal for the utilization of 1,000 square feet or more lf land.

Source Separation Act
The separation of recyclable materials is mandated by law under the NJ Source Separation and Recycling Act. Source separation promotes the removal of all designated recyclable materials from the waste steam and therefore helps in achieving high reduction rates. Recyclable materials are generally broken down into the major categories, or "markets," when it is collected.

LOCAL RECYCLING REGULATIONS

Recycling Plan Element
The 2002 Glen Rock Master Plan includes a Recycling Plan Element.

Ordinance Number 1218

The Borough of Glen Rock adopted a recycling ordinance on September 27, 1993 by Ordinance Number 1218. It is included in Article II, Chapter XXVIII of the 1971 revised General Ordinance as Section 184-6 through Section 184-14.

All owners, tenants or occupants of residential and non-residential premises (Including retail and commercial establishments, government, schools and other institutional locations) must separate designated recyclable materials from all solid waste. Designated recyclable materials must be deposited separate and apart from other solid waste and placed separately at the curb in a manner and on such days and times established by regulations by the Borough.

All schools must recycle newspaper, mixed paper and cardboard and also aluminum, glass, steel and plastic bottles and cans. Bins must be provided in every class for recycling paper and a bin for bottles and cans in the cafeteria and lunchroom. As of the 2007-2008 school year, schools must provide written notice to all students, teachers and other staff on the recycling requirements.

The DPW only provides solid waste and recycling disposal services to residents. All others are required to engage private haulers.

Enforcement

According to the NJ DEP, municipal recycling ordinances can be enforced by local or county health department officials as per the County Environmental Health Act or by other municipal staff empowered by the municipality for this purpose. Of course, police officers can also enforce recycling ordinances although they typically are not involved in this municipal function.

In Glen Rock, the DPW employees are on the front lines of recycling enforcement. When they discover recyclables in a resident's solid waste, the garbage is marked with a sticker and not collected. They report residents to the DPW director who meets with the offenders and explains the borough's recycling requirements.

BENEFITS OF RECYCLING

When Glen Rockers recycle, the Borough saves money through landfill costs and prevents tons of recyclable products from clogging our landfill. In 2008, Glen Rock saved $4,887,887 by averting material from landfills. Savings come in two ways:

- Recycling at the Recycling Center pays because products are separated, and recyclers pay for separated products
- Recycling at curbside does not generate income, but it saves the borough in landfill costs.

LOCAL RECYCLING AND SOLID WASTE DISPOSAL RESOURCES

Residential Curbside Recycling Collection

The DPW provides curbside pick up of:

- All bulk metal and white goods (on the first and third Wednesdays)
- Commingled aluminum, tin, plastic and glass containers, jars and bottles without caps that are rinsed clean of food (on the second Wednesday)
- Corrugated cardboard, newspapers, magazines and junk mail can be commingled and may be placed in a reusable plastic container with cover, cardboard box or paper bag. (On the fourth Wednesday).

Residents were last provided with three recycling bins (green, brown and white) for sorting recyclables 1988.

Compost Center

Glen Rock accepts three types of yard waste: grass clippings, leaves and yard waste including limbs less than 6 inches; and trees and large tree limbs over six inches in diameter. Glen Rock co-owns a tub grinder with Ridgewood which is used to convert these materials to wood chips/mulch. This is disposed of by private contractor, with a contract negotiated annual mulch is provided free of charge to residents. Professional landscapers may purchase a book of tickets to dispose of grass clippings at the municipal compost center.

Recycling Center

In addition to curbside pick-up, resident have the option of taking the materials to the Recycling and Compost Center on Doremus Ave. The center is open six days a week closed on Wednesdays, year round.

- Glass bottles and jars,
- Paper,
- Corrugated cardboard, brown paper bags, other cardboard boxes,
- Aluminum and tin cans,

- Plastic bottles and jars,
- Metal and household batteries (which the Glen Rock DPW takes to the BCUA),
- Clothing, and
- Electronics: monitors, CPUs, printers, keyboards, fax machines, scanners, copiers, laptops and components such as hard drive, circuit boards, speakers, modems, motherboards, power supplies, cell phones and VCRs. No TVS are accepted.

Additional local recycling options

A number of Glen Rock businesses offer additional opportunities for recycling.

- Automobile Batteries and Tires: Best to recycle with seller of new item. Maple Rock Exxon will accept automobile batteries during regular business hours. Maple Rock Exxon will also accept used tires at $2 per tire.
- Cell Phones: US Post Office, Glen Rock, NJ
- Eye Glasses: US Post Office, Glen Rock, NJ.
- Plastic Bags: Kings, Stop & Shop, Shop-Rite and Whole Foods Supermarkets.
- Printer Cartridges: US Post Office, Glen Rock, NJ supplies envelopes to mail cartridges.
- Polystyrene Peanuts (Styrofoam packaging): Please call your local Mail & More locations prior to bringing them down.
- Used Motor Oil: Maple Rock Exxon, during regular business hours, up to two gallons per person.

G.R.E.E.N.: Glen Rock Ecology and Environmental Committee

The Borough has established the "GREEN" Recycling Program: the Glen Rock Ecology and Environmental Committee. Organized by volunteers, GREEN recruits community groups which assist with the baling plastic recyclables to earn money for their organizations.

Bergen County Utilities Authority

The Bergen County Utilities Authority supports municipal efforts and provides recycling options for hazardous waste materials not accepted at the municipal level. Glen Rock does not pick up: used motor oil, used tires and other automotive parts, used batteries and household hazardous waste material, defined as paints, solvents, insecticides, acids, chemicals, poisons and any other material known to be toxic to man or the environment. These materials must be disposed of through the Bergen County Utilities Authority (www.bcua.org) and State law prohibits the Borough from accepting these materials. Residents can call the Household Hazardous Waste Hotline and the Paint Hotline for information regarding the disposal of these materials. The Borough will, however, pick up completely empty and dried up latex paint cans on the normal rubbish pickup day.

STATE RECYCLING RESOURCES

New Jersey Clean Communities Grants

New Jersey Clean Communities is a statewide litter-abatement program created by the passage of the Clean Communities Act. The program is managed by the NJDEP, Department of Treasury, and Clean Communities Council. It is supported by local governments, businesses, community organizations, schools and individuals who work together to keep New Jersey clean.

For FY 2009, Bergen County is slated to receive $89,295.99 through the Clean Communities grants. Glen Rock expects to receive approximately $13,000 in 2009, and received $13,005 in 2008. Glen Rock uses this grant money to hire summer employees, typically high school students, to pick up litter in town.

According to grant guidelines, municipalities and counties accepting grant funds should:

- Designate a Clean Communities coordinator,
- Organize volunteer cleanups of public properties,
- Adopt and enforce anti-littering ordinances,
- Develop a public information and education program, and
- Recycle recyclable litter.

New Jersey WasteWise Business Network

NJDEP operates the New Jersey WasteWise Business Network, a public-private partnership devoted to helping the state's businesses and organizations including municipalities to reduce waste, recycle, and procure more recycled products. WasteWise partners are asked to establish goals and file an annual report regarding the status of the goals set forth. WasteWise partners have access to a wide variety of resources, as well as to one-on-one technical assistance to help develop and implement program strategies. There is no cost to join the New Jersey WasteWise Business Network.
Source http://www.nj.gov/dep/dshw/recycling/brbn03.htm

CURBSIDE COLLECTION RATES

Listed below are the town of Glen Rock's Curbside Collection Rates

Table 31
Curbside Collection Rates

Year	Collected Solid Waste (Tons)	Recyclables Collected Including yard & Waste Vegetative Waste (Tons)	Total Municipal Solid Waste Stream (Tons)	Recycling Rate
2007	5,969	5301	11,270	47%
2006	4,821	10802	15,623	69%
2005	4,915	8003	12,918	62%
2004	4,890	5625	10,515	53%
2003	4,891	4967.5	9,859	50%
2002	4,645	5342.5	9.987	53%
2001	6,626	7600	14,226	53%
2000	7,109	6970	14,079	50%
1999	5,616	6656.5	12,272	54%

Under the Recycling Enhancement Act, the NJ DEP State Recycling Plan goals call for the recycling of 50 percent of the municipal solid waste stream and 60 percent of the total solid waste stream, which are among the most ambitious in the nation.

PUBLIC EDUCATION

The Borough of Glen Rock supports recycling as is evidenced by its efforts to stress the importance of recycling to the community. In addition, the Borough:

- Promotes recycling by publishing the Solid Waste Service schedule in the Borough calendar,
- Worked with the Environmental Commission to create a recycling brochure that was sent to all households in the borough in 2008,
- Posts recycling information and county recycling events on the borough website glenrocknj.net,
- Provides recycling bins in public places when sporting events occur, and
- Piloted a triple stream recycling bin in downtown business district.

In 2008, the Borough of Glen Rock with the Glen Rock Environmental Commission and the Public Schools worked to expand recycling efforts in all the schools.

RECYCLING COSTS AND FUNDING

In 2008, the Borough paid an average of $80 per ton for disposal of solid waste. The cost of disposing of recyclable trash ranges between $10 and $20 per ton, a fraction of the cost of sending it to the landfill.

Recycling Tonnage Grants

Each year, Glen Rock received a recycling tonnage grant, which are funds based on the total number of tons of recycled material reported. In 2008, Glen Rock received $14,617.48. This program is intended to provide an incentive to counties and municipalities to increase their recycling activities and reduce their overall percentage of disposal.

Recycling Vendors who service Glen Rock

The following companies purchase or dispose of Glen Rock's recyclables:

- Newspapers: Greenstar, 59-85 Florida Ave. Paterson, NJ 07503
- Junk Mail: Marcal Paper Mills, Market Street, Elmwood Park, NJ 07407
- Cardboard: Jos. Damato Paperstock, 59-85 Florida Ave. Paterson, NJ 07503
- Glass: Greenstar, 59-85 Florida Ave. Paterson, NJ 07503
- Metals: United Scrap Iron, 147-163 E. 7th St. Paterson, NJ 07524
- Yard material: Atlantic Grinding Services, POB 826, Franklin Lakes, NJ 07417
- Electronics: Urban Renewal Corp. 53 Hackensack Ave., South Kearney, NJ 07032

CONCLUSION

State's recycling rate has dropped significantly in New Jersey during the past several years, from a high of 61% in 1996 to a level of 54% in 2002. Glen Rock's overall municipal solid waste recycling reaches/falls below the state goal. This shortfall offers Glen Rock the opportunity to increase its recycling rate which would both reduce the borough's carbon footprint and increase savings on tipping fees for solid waste disposal. Recycling helps reduce greenhouse gas emissions because less energy is used to create products from recycled materials than from virgin materials. The following steps are recommended.

- Recent legislation has increased responsibilities of the municipal recycling coordinators. The Borough needs to review and assess the current coordinators qualifications in light of these changes.

- Disposing of vegetative waste is a costly challenge to the Borough. The amount of green waste generated exceeds the Borough's storage capacity, and the Borough spends an average of $100,000 annually to dispose of leaves. Encouraging homeowners to mulch their grass clippings offers a number of benefits.

- Grass clippings are a natural fertilizer can help to create a thicker, healthier lawn that is more resistant to weeks and certain lawn diseases. Homeowners who mulch grass clippings can reduce mowing time by 35%, need to water and fertilize a lawn less frequently; and don't need to purchase as many lawn waste bags. Since grass clippings are a natural fertilizer, mulching greatly reduces the amount of fertilizer required. Lawn fertilizers are a significant contributor to non-point source pollution.

- Given the expanded responsibilities of municipal recycling coordinators, the Glen Rock borough council and mayor with assistance from their environmental commission, should review the job description and qualifications of the current recycling coordinator and work to address any gaps. These groups need to support this appointee with training, computer access, and, most importantly, authority to enforce.

- It is not clear that all town groups (especially businesses and schools) are fully complying with recycling ordinances. Glen Rock must accept the responsibility of reprimanding residents and businesses who refuse to obey local ordinance and state law. Local action should precede county and state enforcement. The Environmental Commissioners can supply manpower as well, by visiting schools and ball fields to assure the existence and use of recycling bins, inspecting random trashcans around town, placing hangtags on the doorknobs of people who don't participate in curbside pickups, writing letters to the editor, alerting the town council to problems in compliance, or coordinating shared business recycling. The commissions may reach out to residents between official communications from the coordinator.

- Knowing the current municipal recycling rates for each group (residents, businesses, schools, etc.) would provide a baseline and allow the borough to monitor trends.

- Tree waste disposal, including leaves, comprises a large cost item for municipal waste removal. This offers a significant area for improvement and cost reduction.

- The DPW could seek out best practices and external support through membership and participation in organizations such as the NJ WasteWise partnership and Association of New Jersey Recyclers.

Sources:

The Glen Rock Master Plan

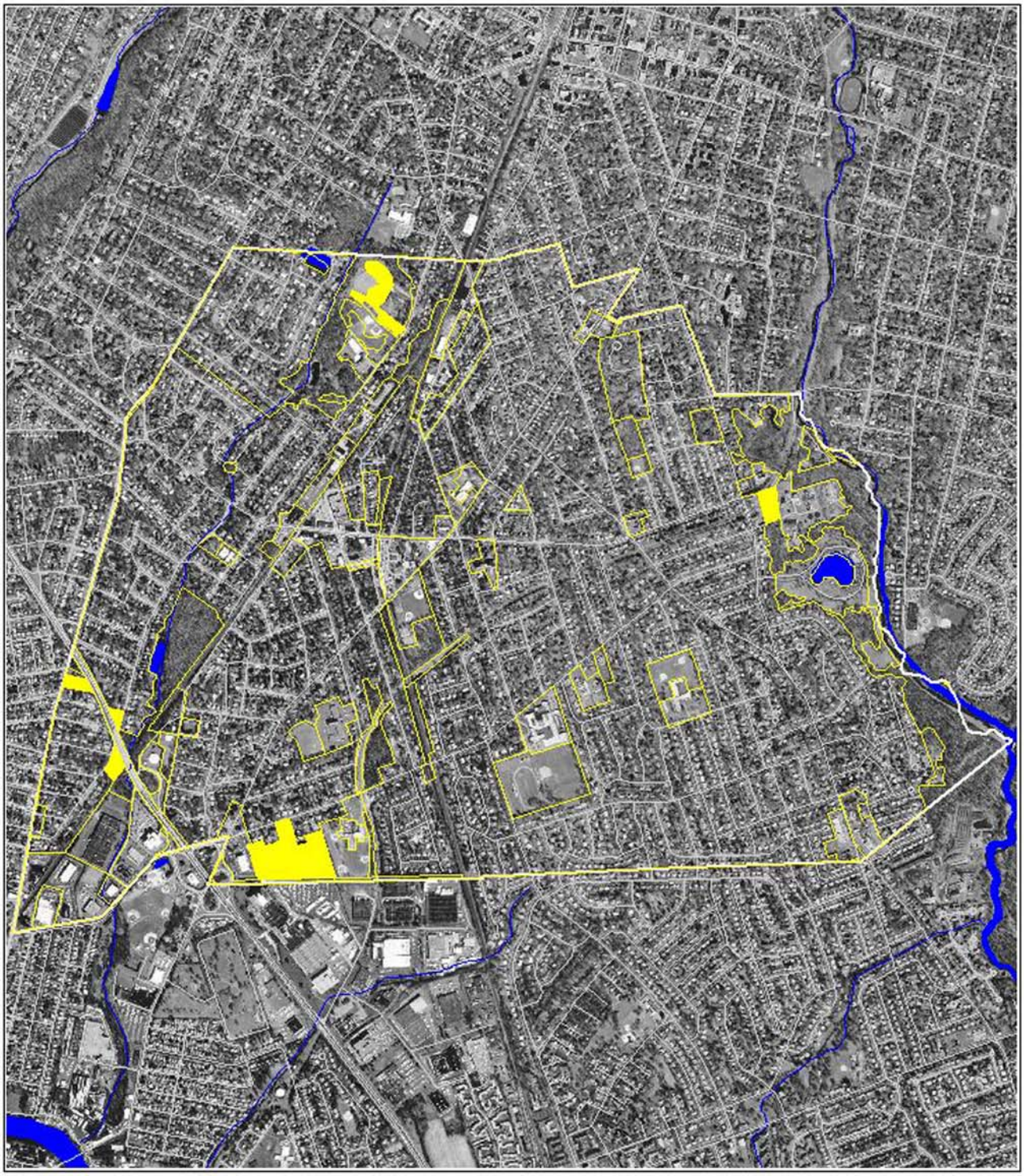
ANJEC publication: NJ Clean Communities Web site: www.njclean.org

NJ Department of Environmental l Protection Web site:
http://www.nj.gov/dep/dshw/recycling/economi

ERI
APPENDIX

Glen Rock Boro, New Jersey

Showing Growth in Developed Use Areas from 1986 to 1995/97



Legend

- Municipal Boundary
- Roads
- Streams
- Lakes
- Developed Areas in 1986
- Developed Area Growth from 1986 to 1995/1997

Note: Developed areas include residential, commercial and industrial land uses.

N
W
E
S

The yellow outlined areas delineate areas that were developed as of 1986. The solid yellow areas have been developed between 1986 and 1995/97. The total area of impervious surface (buildings, sidewalks, driveways, parking lots, etc.) is about 600 acres About 10 acres of this total were added since 1986. The total area of impervious surface constitutes 35% of the total (1735) acres in the municipality.

Ridgewood Water Department

Source Water Assessment Summary

A State Review of Potential Contamination Sources Near Your Drinking Water

The Department of Environmental Protection (DEP) has conducted an assessment of the water sources that supply each public water system in the state, including yours. The goal of this assessment was to measure each system's susceptibility to contamination, not actual (if any) contamination measured in a water supply system.

The assessment of your water system, the *Ridgewood Water Department*, involved:

- Identifying the area (known as the source water assessment area) that supplies water to your public drinking water system;
- Inventorying any significant potential sources of contamination in the area; and
- Analyzing how susceptible the drinking water source is to the potential sources of contamination.

DEP evaluated the susceptibility of all public water systems to eight categories of contaminants. These contaminant categories are explained, along with a summary of the results for your water system, on page 3. Page 4 contains a map of your water system's source water assessment area.

A public water system's susceptibility rating (L for low, M for medium or H for high) is a combination of two factors. H, M, and L ratings are based on the potential for a contaminant to be at or above 50% of the Drinking Water Standard or MCL (H), between 10 and 50% of the standard (M) and less than 10% of the standard (L).

- How "sensitive" the water supply is to contamination. For example, a shallow well or surface water source, like a reservoir, would be more exposed to contamination from the surface or above ground than a very deep well.
- How frequently a contaminant is used or exists near the source. This is known as "intensity of use." For example, the types of activities (such as industry or agriculture) surrounding the source.

The susceptibility rating does not tell you if the water source is actually contaminated. The Consumer Confidence Report annually issued by your water utility contains important information on the results of your drinking water quality tests, as required by the federal Safe Drinking Water Act.

Where does drinking water come from?

There are two basic sources of drinking water: ground water and surface water.

Ground water is water found beneath the Earth's surface. Ground water comes from rain and snow seeping into rock and soil. Ground water is stored in underground areas called aquifers. Aquifers supply wells and springs. Wells in New Jersey range from about 15 feet to 2,000 feet deep.

Surface water is the water naturally open to the atmosphere, such as rivers, lakes, streams and reservoirs. Precipitation that does not infiltrate the ground or evaporate into the sky runs off into surface water bodies.

Ground water can seep into a stream, river or other surface water body, recharging surface water bodies. Likewise, under some circumstances, surface water can seep into an adjacent aquifer.

A water system obtains its water from 1) wells drilled into the ground that pump out ground water; 2) devices called surface water intakes placed on a river, stream, reservoir; or 3) both.

What factors may affect the quality of your drinking water source?

A variety of conditions and activities may affect the quality of drinking water source. These include geology (rock and soil types); depth of a well or location of a surface water intake; how the land surrounding the source is used (for industry, agriculture or development); the use of pesticides and fertilizers; and the presence of contaminated sites, leaking underground storage tanks, and landfills.

What steps are being taken now to ensure my drinking water quality?

The DEP has numerous programs in place to maintain and protect the quality of our State's water resources. For example, the Safe Drinking Water Program is designed to ensure that water delivered for human consumption meets DEP's stringent health-based drinking water standards. Additionally, DEP has permitting, waste management, and clean up programs in place to avoid and control potential contamination. Key DEP drinking water protection initiatives will be phased-in over time in Source Water Assessment areas to advance existing program protections.

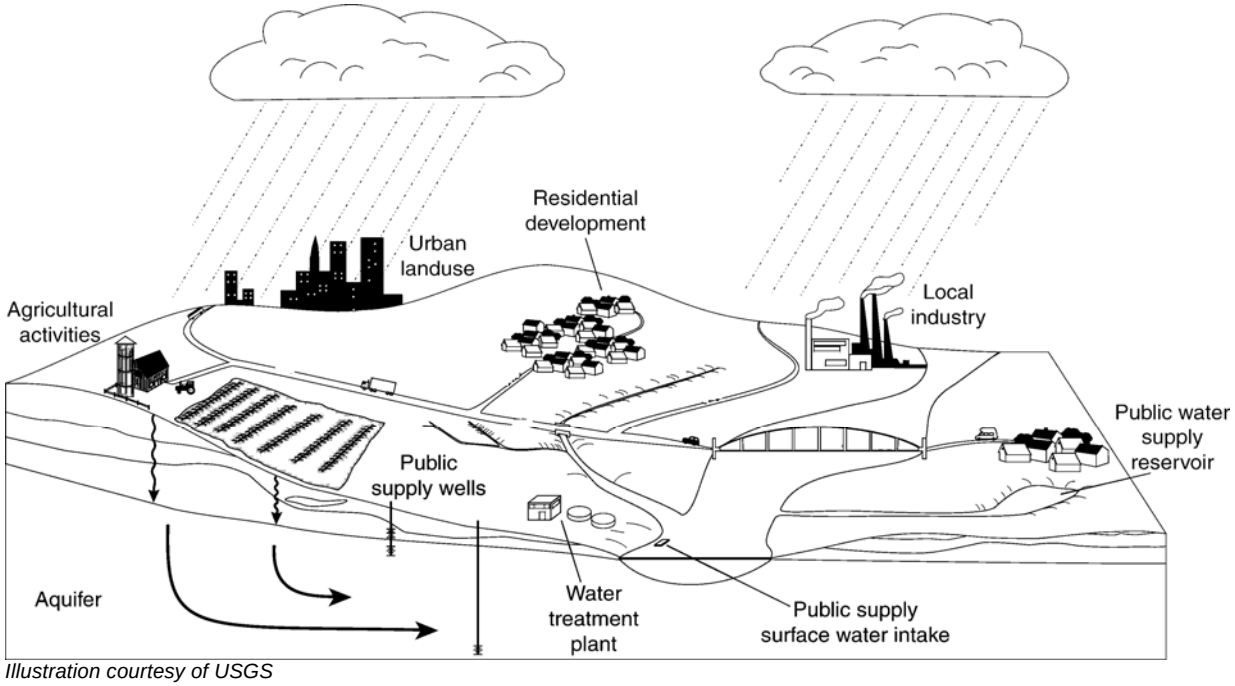


Illustration courtesy of USGS

Among the factors that may affect the quality of drinking water are the type of rock and soil and how the land is used. While some rain and snow evaporates into the sky, most of it runs off into nearby rivers and streams or seeps into the ground. Drinking water comes from underground aquifers or surface water bodies.

What can you and others do to help?

Federal law requires each state to establish and implement a Source Water Assessment Program. While government at the state and local levels can do their part, there are actions that you and your neighbors in homes and businesses can take now to help protect our precious and shared natural resource.

Here's just a few ways you and others can help ensure clean and plentiful water for New Jersey – now and in the future. Join us today for a clean water future.

In your home or business:

- Dispose of waste properly. Some materials such as motor oil, paint, flea collars, and household cleaners have the potential to contaminate source water. Contact your local Department of Public Works for proper household hazardous waste disposal.
- Limit your use of fertilizer, pesticides, and herbicides.

Here are some actions that municipal and county officials/local and county planners can take and you can help encourage and support.

- Manage and work with owners of existing potential contaminant sources to minimize potential contamination.
- Establish regulations prohibiting or restricting certain activities or land uses within the source water assessment area. Take appropriate enforcement action when necessary.
- Update municipal master plans to ensure greater protection.
- Purchase lands or create conservation easements within the source water assessment area.

Ridgewood Water Department- PWSID # 0251001

Ridgewood Water Department is a public community water system consisting of 58 well(s), 0 wells under the influence of surface water, 0 surface water intake(s), 3 purchased ground water source(s), and 4 purchased surface water source(s).

This system's source water comes from the following aquifer(s) and/or surface water body(s) (if applicable): Brunswick aquifer

This system purchases water from the following water system(s) (if applicable): WALDWICK WATER DEPARTMENT,ALLENDALE WATER DEPARTMENT,CARR WELL #8,HACKENSACK WATER COMPANY,HAWTHORNE WATER DEPT.,MAHWAH WATER DEPARTMENT

Susceptibility Ratings for Ridgewood Water Department Sources

The table below illustrates the susceptibility ratings for the seven contaminant categories (and radon) for each source in the system. The table provides the number of wells and intakes that rated high (H), medium (M), or low (L) for each contaminant category. For susceptibility ratings of purchased water, refer to the specific water system's source water assessment report.

The seven contaminant categories are defined at the bottom of this page. DEP considered all surface water highly susceptible to pathogens, therefore all intakes received a high rating for the pathogen category. For the purpose of Source Water Assessment Program, radionuclides are more of a concern for ground water than surface water. As a result, surface water intakes' susceptibility to radionuclides was not determined and they all received a low rating.

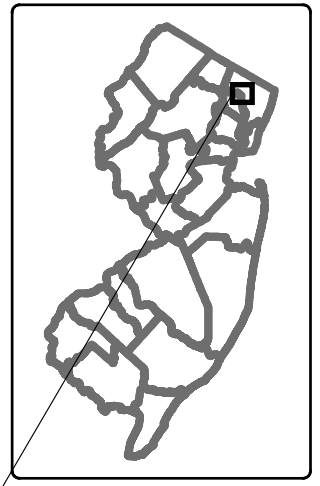
If a system is rated highly susceptible for a contaminant category, it does not mean a customer is or will be consuming contaminated drinking water. The rating reflects the potential for contamination of source water, not the existence of contamination. Public water systems are required to monitor for regulated contaminants and to install treatment if any contaminants are detected at frequencies and concentrations above allowable levels. As a result of the assessments, DEP may customize (change existing) monitoring schedules based on the susceptibility ratings.

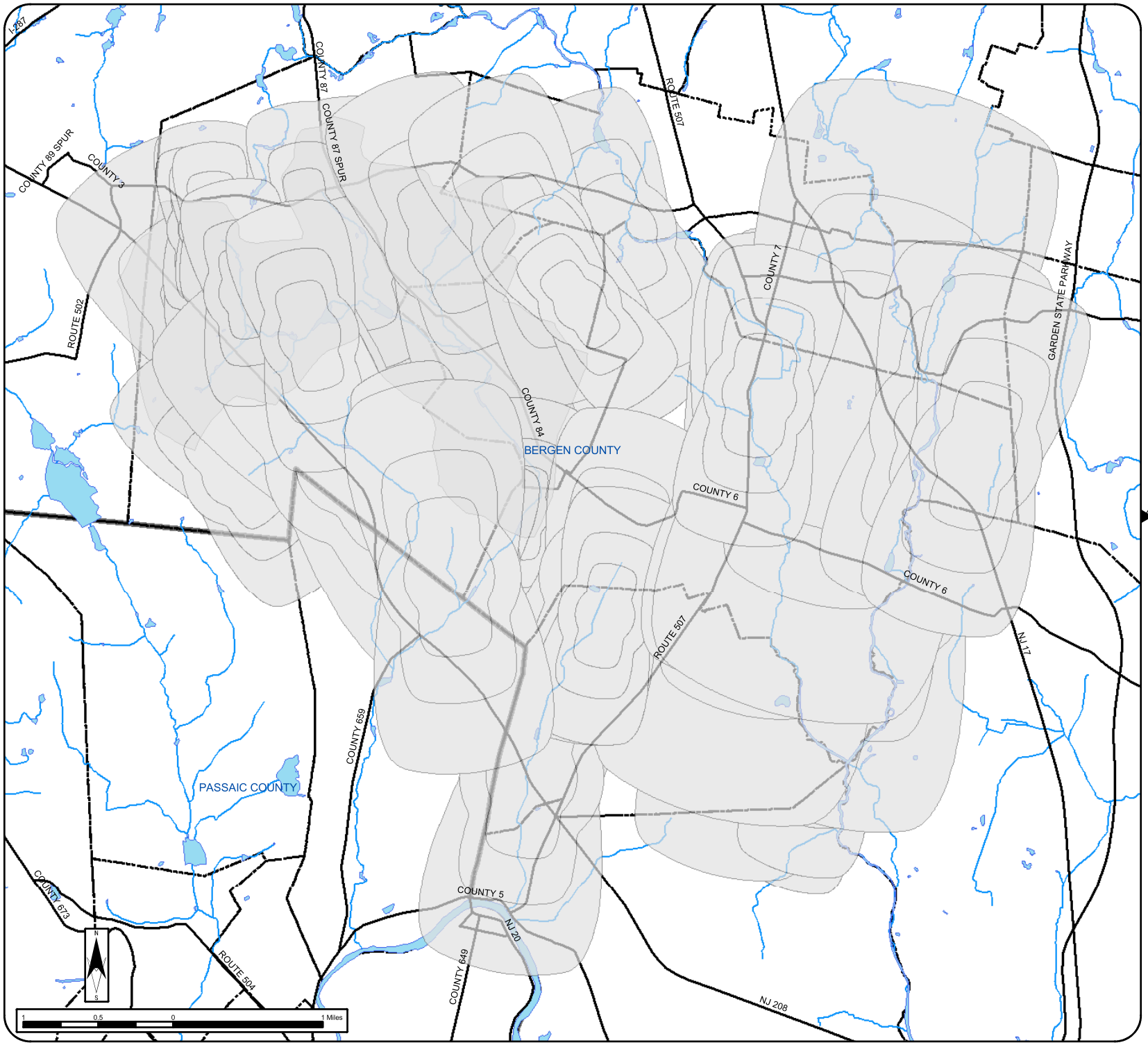
	Pathogens			Nutrients			Pesticides			Volatile Organic Compounds			Inorganics			Radio-nuclides			Radon			Disinfection Byproduct Precursors		
Sources	H	M	L	H	M	L	H	M	L	H	M	L	H	M	L	H	M	L	H	M	L	H	M	L
Wells - 58	**1**	**53**	**4**	**33**	**25**			**27**	**31**	**55**		**3**	**37**	**21**		**32**	**26**		**58**			**4**	**54**	
GUDI - 0																								
Surface water intakes - 0																								

- Pathogens: Disease-causing organisms such as bacteria and viruses. Common sources are animal and human fecal wastes.
- Nutrients: Compounds, minerals and elements that aid growth, that are both naturally occurring and man-made. Examples include nitrogen and phosphorus.
- Volatile Organic Compounds: Man-made chemicals used as solvents, degreasers, and gasoline components. Examples include benzene, methyl tertiary butyl ether (MTBE), and vinyl chloride.
- Pesticides: Man-made chemicals used to control pests, weeds and fungus. Common sources include land application and manufacturing centers of pesticides. Examples include herbicides such as atrazine, and insecticides such as chlordane.
- Inorganics: Mineral-based compounds that are both naturally occurring and man-made. Examples include arsenic, asbestos, copper, lead, and nitrate.
- Radionuclides: Radioactive substances that are both naturally occurring and man-made. Examples include radium and uranium.
- Radon: Colorless, odorless, cancer-causing gas that occurs naturally in the environment. For more information go to http://www.nj.gov/dep/rpp/radon/index.htm or call (800) 648-0394.
- Disinfection Byproduct Precursors: A common source is naturally occurring organic matter in surface water. Disinfection byproducts are formed when the disinfectants (usually chlorine) used to kill pathogens react with dissolved organic material (for example leaves) present in surface water.

Ridgewood Water Department

Source Water Assessment Areas





Legend

- Source Water Areas
- Water Bodies
- Streams
- NJDOT Major Roads
- Municipalities
- Counties

To obtain your water system Source Water Assessment Report, Potential Contaminant Source Inventory, and additional information please go to www.state.nj.us/dep/swap or call (609) 292-5550.
August, 2004