

CITY OF LINWOOD
ATLANTIC COUNTY, NEW JERSEY



Municipal Stormwater Management Plan
July 2005

MAYOR

Richard L. DePamphilis, III

COUNCIL MEMBERS

Scott McKnight, President

John F. Amodeo

Edward Armbruster

Elliot Beinfest

Robert W. Boileau

Gene Maier

Donna Taylor

PLANNING BOARD

Lawrence Lhulier, Chairperson

Robert McAllister, Vice-Chairperson

Richard L. DePamphilis, III, Mayor

John F. Amodeo, Councilman

Hank Kolakowski

James Rutala

Gerald Slusher

Tim Tighe

Jeff Vasser

Phyllis Barbella

Kenneth Strang

Robert Bruce, P.E., Engineer

Willis F. Flower, Esq., Solicitor

Richard Hinman, Secretary

Prepared by:

Kevin J. Dixon, P.E., C.M.E.

Office of the City Engineer

Dixon Associates

335 E. Jimmie Leeds Road

Galloway, NJ 08205

Table of Contents

Introduction..... 1

Plan Procedure 1

Plan Requirements and Goals 2

Stormwater Discussion 4

Background 6

Watershed Characteristics and Existing Drainage Conditions 10

Problem Areas and Design Alternatives 13

Design and Performance Standards 16

Plan Consistency 16

Nonstructural Stormwater Management Strategies 17

Land Use 20

Mitigation Plans 24

List of Tables

Table 1: The City of Linwood Existing Land Use..... 21

List of Figures

Figure 1: Groundwater Recharge in the Hydrologic Cycle 5

Figure 2: The City of Linwood Flood Zones 7

Figure 3: The City of Linwood and Its Waterways 7

Figure 4: The City of Linwood Boundary on USGS Quadrangles 8

Figure 5: The City of Linwood Groundwater Recharge Areas..... 9

Figure 6: The City of Linwood Wellhead Protection Areas 10

Figure 7: The City of Linwood Watershed Areas..... 11

Figure 8: The City of Linwood Existing Land Uses..... 21

Figure 9: The City of Linwood Hydrologic Units (HUC14s)..... 22

Figure 10: The City of Linwood Zoning Districts 23

Figure 11: The City of Linwood Wetlands 24

Appendix A: The City of Linwood Regional Maps

Introduction

This Municipal Stormwater Management Plan (MSWMP) documents the strategy for the City of Linwood (“the City”) to address stormwater-related impacts. The creation of this plan is required by N.J.A.C. 7:14A-25 Municipal Stormwater Regulations. Under the Municipal Land Use Law (MLUL), a municipal stormwater management plan is an integral part of any master plan. The municipal planning board has the authority under the MLUL to prepare and adopt or amend all or part of the master plan. This plan documents the strategy for the City of Linwood to address the impacts of stormwater runoff from new development and redevelopment projects, and provides a structure and process for addressing such impacts.

The Linwood Municipal Stormwater Management Plan and subsequent to this, the Stormwater Control Ordinance shall conform to the applicable regional stormwater management plan. This plan is being undertaken by the Atlantic County Department of Regional Planning and Development. In accordance with N.J.A.C. 7:8-4.4 (d), the County Department of Regional Planning and Development must review and either approve, conditionally approve, or disapprove the Municipal Stormwater Management Plan within 60 days of receipt. Upon approval by the County Department of Regional Planning and Development, the City of Linwood Stormwater Management Plan will become effective.

This plan addresses groundwater recharge, stormwater quantity, and stormwater quality impacts by incorporating stormwater design and performance standards for new “Major Development”, defined as projects that disturb one or more acre of land or increases impervious surfaces by one-quarter of an acre or more. These standards are intended to minimize the adverse impact of stormwater runoff on water quality and water quantity and the loss of groundwater recharge that provides baseflow in receiving water bodies. The intent of the plan is to provide long-term operation and maintenance measures for existing and future stormwater facilities. The implementation of design and performance standards for new major development including the implementation of maintenance provisions and compliance with safety standards will be accomplished through the adoption of the new Stormwater Control Ordinance by City Council. This new Stormwater Control Ordinance will be forthcoming and is intended to comply with the provisions of State Stormwater Management Standards (N.J.A.C. 7:8).

The plan addresses the review and update of existing ordinances, the City Master Plan, and other planning documents to allow for project designs that include low impact development techniques. The final component of this plan is a mitigation strategy for when a variance or exemption of the design and performance standards is sought. As part of the mitigation section of the stormwater plan, specific stormwater management measures are identified to lessen the impact of existing development.

Plan Procedure

On March 22, 2004, the City of Linwood was issued a New Jersey Pollutant Discharge Elimination System (NJPDES) General Permit to discharge stormwater from the New Jersey Department of Environmental Protection (NJDEP). The City of Linwood was assigned a unique NJPDES permit number NJG0152439. The effective date of the permit is April 1, 2004. The permit expires February 28, 2009.

Tier A municipalities, of which the City of Linwood is one, are required to develop, implement, and enforce a stormwater program. This program shall be designed to reduce the discharge of pollutants from the City's small MS4's (Municipal Separate Storm Sewer Systems) to the maximum extent practicable, to protect water quality, and to satisfy the appropriate water quality requirements of the Federal Act and State Act by including the Statewide Basic Requirements (SBR's).

Tier A municipalities shall prepare and implement a written Stormwater Pollution Prevention Plan (SPPP) that describes the Tier A municipality's stormwater program and serves as the mechanism for the implementation of the Statewide Basic Requirements. A copy of the Linwood SPPP will be on file at the City Clerk's office.

Within twelve months of the effective date of permit authorization (April 1, 2005), Tier A municipalities shall adopt a municipal stormwater management plan pursuant to the Stormwater Rules N.J.A.C. 7:8-4, and control the passage of solids and floatable materials through the Tier A municipality's small MS4's. On April 11, 2005, NJDEP Commissioner Bradley M. Campbell issued correspondence stating that the NJDEP will not take any enforcement action regarding MSWMP adoption until August 1, 2005.

Within twelve months from the adoption of the municipal stormwater management plan, Tier A municipalities shall adopt a stormwater control ordinance to implement that plan, and shall submit the adopted municipal stormwater management plan and ordinance(s) to the appropriate county review agency for approval.

In accordance with NJAC 7:8-4.3, the City of Linwood must adopt a municipal stormwater management plan as an integral part of its master plan and official map. The deadline is as established in the Stormwater General Permit.

Plan Requirements and Goals

In accordance with N.J.A.C. 7:8-4.2(c), a municipal stormwater management plan shall, at a minimum:

1. Describe how the municipal stormwater management plan will achieve the goals of stormwater management planning set forth at N.J.A.C. 7:8-2.3;
2. Include maps showing water bodies based on Soil Surveys published by the U.S. Department of Agriculture; the U.S. Geological Survey Topographic Map, 7.5 minute quadrangle series; or other sources of information depicting water bodies in similar or greater detail;
3. Map groundwater recharge areas and well head protection areas based on maps prepared by the Department under N.J.S.A. 58:11A-13 or a municipal ordinance;
4. Describe how the municipal stormwater management plan incorporates design and performance standards in N.J.A.C. 7:8-5 or alternative design and performance standards adopted as a part of a regional stormwater management plan or water quality management plan;

5. Describe how adequate long-term operation as well as preventative and corrective maintenance (including replacement) of the selected stormwater management measures will be ensured;
6. Describe how the plan will ensure compliance with Safety Standards for Stormwater Management Basins under N.J.A.C. 7:8-6;
7. Describe how the municipal stormwater management plan is coordinated with the appropriate Soil Conservation District and any other stormwater management plans, including any adopted regional stormwater management plan, prepared by any stormwater management planning agency related to the river basins or drainage areas to which the plans and/or ordinances apply;
8. Evaluate the extent to which the municipality's entire master plan (including the land use plan element), official map and development regulations (including the zoning ordinance) implement the principles expressed in N.J.A.C. 7:8-5.3(b). This evaluation shall also be included (with updating as appropriate) in the reexamination report adopted under N.J.S.A. 40:55D-89;
9. Include a map of the City showing:
 - i. Projected land uses assuming full development under existing zoning, and
 - ii. The hydrologic unit code 14 (HUC14) drainage areas as defined by the United States Geological Survey; and an estimate, for each HUC14 drainage area, of the total acreage in the City of impervious surface and associated future nonpoint source pollutant load assuming full build out of the projected land uses.
10. At the option of the City, document that it has a combined total of less than one square mile of vacant or agricultural lands rather than provide the information required in (c) 8 and 9 above. Agricultural lands may be excluded if the development rights to these lands have been permanently purchased or restricted by covenant, easement or deed. Vacant or agricultural lands in environmentally constrained areas may be excluded if the documentation also includes an overlay map of these areas at the same scale as the map under (c) 10i below.
 - i. Documentation shall include an existing land use map at an appropriate scale to display the land uses of each parcel within the City. Such a map shall display the following land uses: residential (which may be divided into single family, two-to-four family, and other multi-family), commercial, industrial, agricultural, parkland, other public uses, semipublic uses, and vacant land;
11. In order to grant a variance or exemption from the design and performance standards in N.J.A.C. 7:8-5, include a mitigation plan that identifies what measures are necessary to offset the deficit created by granting the variance or exemption. The mitigation plan shall ensure that mitigation is completed within the drainage area and for the performance standard for which the variance or exemption was granted;
12. Include a copy of the recommended implementing stormwater control ordinance(s) requiring stormwater management measures, and

13. The municipal stormwater management plan may also include a stream corridor protection plan to address protection of areas adjacent to waterbodies. For waterbodies subject to N.J.A.C. 7:8-5.5(h), the plan shall provide, at a minimum, protections equivalent to those provided at N.J.A.C. 7:8-5.5(h) and be approved by the NJDEP.

The goals of this MSWMP are to:

1. reduce flood damage, including damage to life and property;
2. minimize, to the extent practical, any increase in stormwater runoff from any new development;
3. reduce soil erosion from any development or construction project;
4. assure the adequacy of existing and proposed culverts and bridges, and other in-stream structures;
5. maintain groundwater recharge;
6. prevent, to the greatest extent feasible, an increase in nonpoint pollution;
7. maintain the integrity of stream channels for their biological functions, as well as for drainage;
8. minimize pollutants in stormwater runoff from new and existing development to restore, enhance, and maintain the chemical, physical, and biological integrity of the waters of the state, to protect public health, to safeguard fish and aquatic life and scenic and ecological values, and to enhance the domestic, municipal, recreational, industrial, and other uses of water; and
9. protect public safety through the proper design and operation of stormwater management facilities.

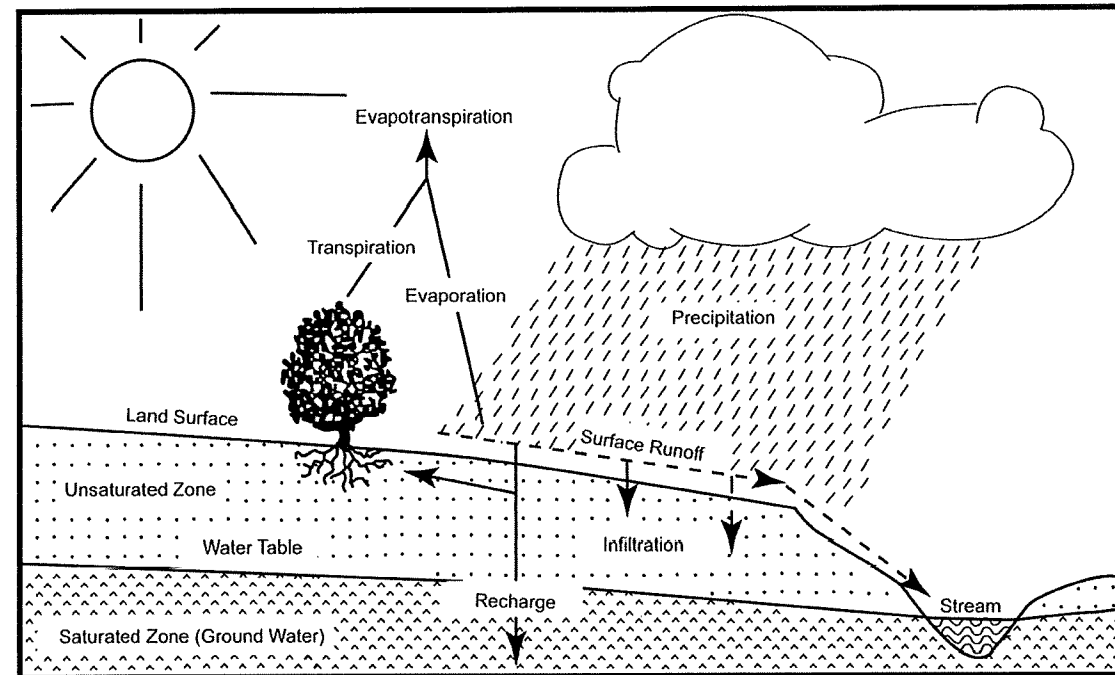
To achieve these goals, this plan outlines specific stormwater design and performance standards for new development. Additionally, the plan proposes stormwater management controls to address impacts from existing development. Preventative and corrective maintenance strategies are included in the plan to ensure long-term effectiveness of stormwater management facilities. The plan also outlines safety standards for stormwater infrastructure to be implemented to protect public safety.

Stormwater Discussion

Land development can alter the hydrologic cycle (Figure 1) of a site and, ultimately, an entire watershed. Prior to development, native vegetation can either directly intercept precipitation or draw that portion that has infiltrated into the ground and return it to the atmosphere through evapotranspiration. Development can remove this beneficial vegetation and replace it with lawn or impervious cover, reducing the site's evapotranspiration and infiltration rates. Clearing and grading a site can remove depressions that store rainfall. Construction activities may also compact the soil and diminish its infiltration ability, resulting in increased volumes and rates of stormwater runoff from the site. Impervious areas that are connected to each other through gutters, channels, and storm sewers can transport runoff more quickly than natural areas. This shortening of the transport or travel time quickens the rainfall-runoff response of the drainage area, causing flow in downstream waterways to peak faster and higher than natural conditions. These increases can create new and aggravate existing downstream flooding and erosion problems and increase the quantity of sediment in the channel. Filtration of runoff and removal of pollutants by surface and channel vegetation is eliminated by storm sewers that discharge runoff directly into a stream. Increases in impervious area can also

decrease opportunities for infiltration that, in turn, reduces stream base flow and groundwater recharge. Reduced base flows and increased peak flows produce greater fluctuations between normal and storm flow rates, which can increase channel erosion. Reduced base flows can also negatively impact the hydrology of adjacent wetlands and the health of biological communities that depend on base flows. Finally, erosion and sedimentation can destroy habitat from which some species cannot adapt.

Figure 1: Groundwater Recharge in the Hydrologic Cycle



Source: New Jersey Geological Survey Report GSR-32.

In addition to increases in runoff peaks, volumes, and loss of groundwater recharge, land development often results in the accumulation of pollutants on the land surface that runoff can mobilize and transport to streams. New impervious surfaces and cleared areas created by development can accumulate a variety of pollutants from the atmosphere, fertilizers, animal wastes, and leakage and wear from vehicles. Pollutants can include metals, suspended solids, hydrocarbons, pathogens, and nutrients.

In addition to increased pollutant loading, land development can adversely affect water quality and stream biota in more subtle ways. For example, stormwater falling on impervious surfaces or stored in detention or retention basins can become heated and raise the temperature of the downstream waterway, adversely affecting cold water fish species such as trout. Development can remove trees along stream banks that normally provide shading, stabilization, and leaf litter that falls into streams and becomes food for the aquatic community.

Background

The City encompasses a 4.2 square mile area located along the southeast mainland portion of Atlantic County, New Jersey. The area consists of 3.8 square miles of land and 0.4 square miles of water. The land area is broken up into 1.6 square miles of wetlands, 2 square miles of urban and developed area and 0.2 square miles of developable land (including barren land, forests and agriculture). The City is bordered on the west by Egg Harbor Township; to the south by the City of Somers Point; to the north by the City of Northfield; and to the east by Scull Bay.

The entire city is under the jurisdiction of the Coastal Atlantic Facilities Review Act (CAFRA) as regulated by the New Jersey Department of Environmental Protection Bureau of Land Use Regulation.

The City is fairly flat and sits at an elevation of 28 feet above sea level. Portions of the city, mainly along Patcong Creek and Scull Bay, are prone to flooding due to their proximity to the back bay areas of the County. Figure 2 illustrates the floodplains within the City. The population of the City has increased from 6,144 in 1980, to 6,866 in 1990, and 7,152 in 2000. It is estimated that the population has been growing at an annual rate less than one percent in recent years.

Figure 3 illustrates the waterways in the City. Figure 4 depicts the City boundary on the USGS quadrangle maps.

The New Jersey Department of Environmental Protection (NJDEP) has established an Ambient Biomonitoring Network (AMNET) to document the health of the state's waterways. There are over 800 AMNET sites throughout the state of New Jersey. These sites are sampled for benthic macroinvertebrates by NJDEP on a five-year cycle. Streams are classified as non-impaired, moderately impaired, or severely impaired based on the AMNET data. The data is used to generate a New Jersey Impairment Score (NJIS), which is based on a number of biometrics related to benthic macroinvertebrate community dynamics. Patcong Creek, which serves as the western border of Linwood, has been identified as being moderately impaired based on AMNET data.

Figure 2: The City of Linwood Flood Zones

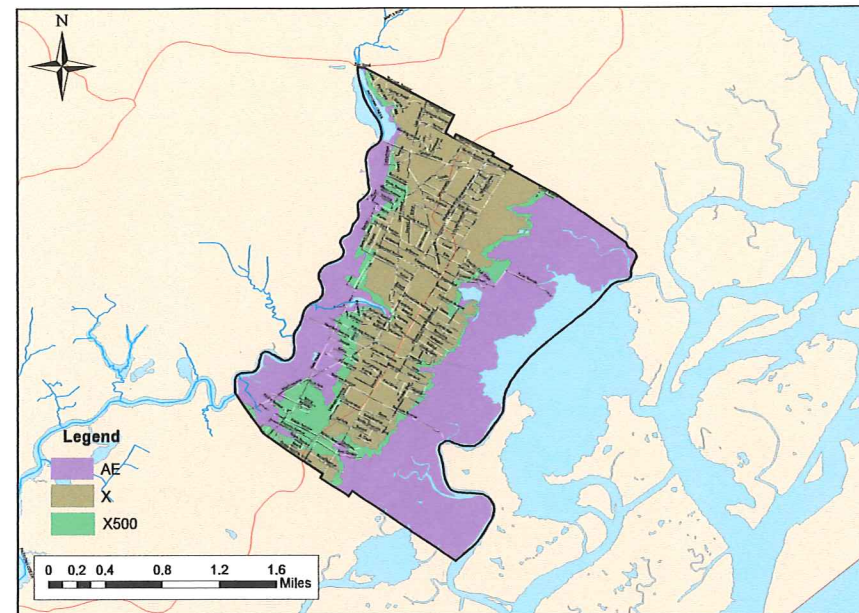


Figure 3: The City of Linwood and Its Waterways

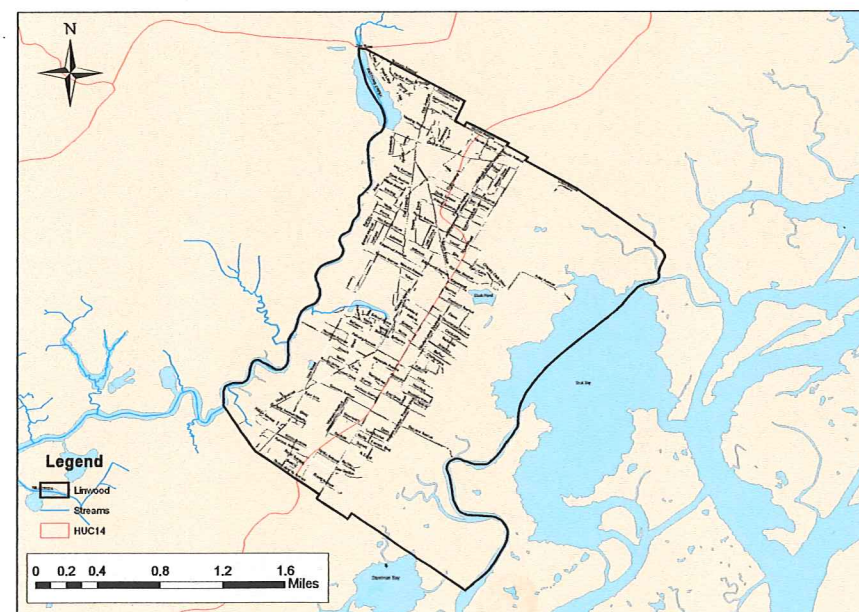
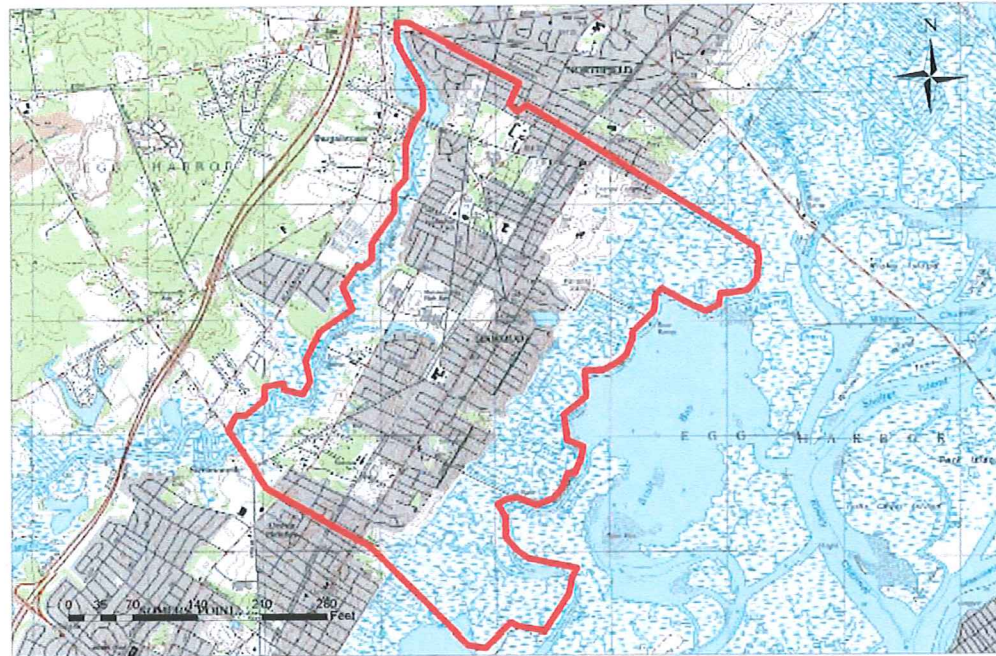


Figure 4: The City of Linwood Boundary on USGS Quadrangles



A Total Maximum Daily Loading (TMDL) is the amount of a pollutant that can be accepted by a waterbody without causing an exceedance of water quality standards or interfering with the ability to use a waterbody for one or more of its designated uses. The allowable load is allocated to the various sources of the pollutant, such as stormwater and wastewater discharges, which require a NJPDES permit to discharge, and nonpoint source, which includes stormwater runoff from agricultural areas and residential areas, along with a margin of safety. Provisions may also be made for future sources in the form of reserve capacity. An implementation plan may be developed to identify how the various sources will be reduced to the designated allocations. Implementation strategies may include improved stormwater treatment plants, adoption of ordinances, reforestation of stream corridors, retrofitting stormwater systems, and other Best Management Practices (BMPs). Implementation plans to address TMDL requirements would be initiated as part of a Regional Stormwater Management Plan that will be prepared by the County Planning Agency.

The New Jersey Integrated Water Quality Monitoring and Assessment Report (305(b) and 303(d)) (Integrated List) is required by the Federal Clean Water Act to be prepared biennially and is a valuable source of water quality information. This combined report presents the extent to which New Jersey waters are attaining water quality standards, and identifies waters that are impaired. Sublist 5 of the Integrated List constitutes the list of waters impaired or threatened by pollutants, for which one or more TMDLs are needed.

Figures 5 and 6 show the groundwater protection areas and wellhead protection areas located in the City, as required as part of the MSWMP.

Figure 5: The City of Linwood Groundwater Recharge Areas

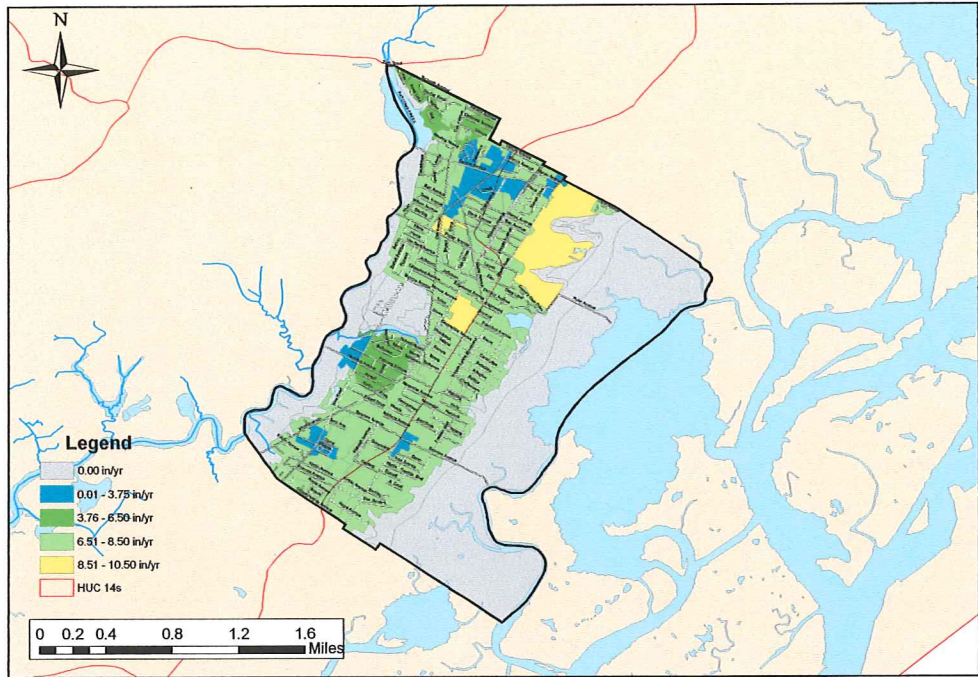
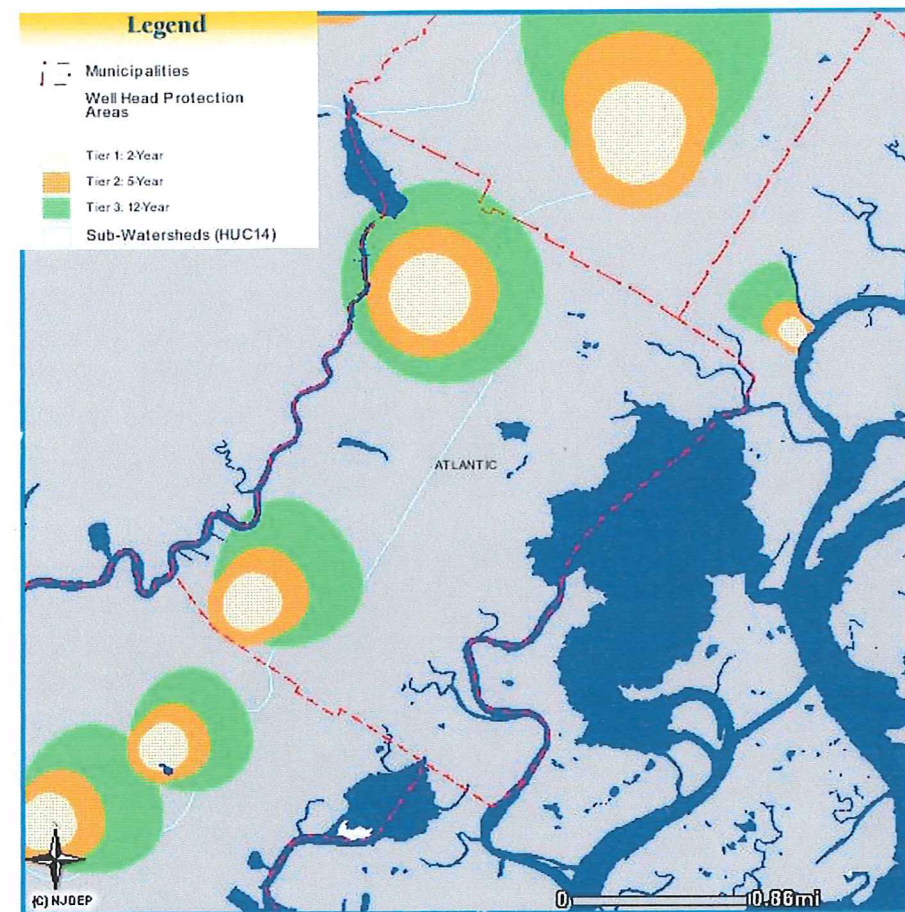


Figure 6: The City of Linwood Wellhead Protection Areas



Watershed Characteristics and Existing Drainage Conditions

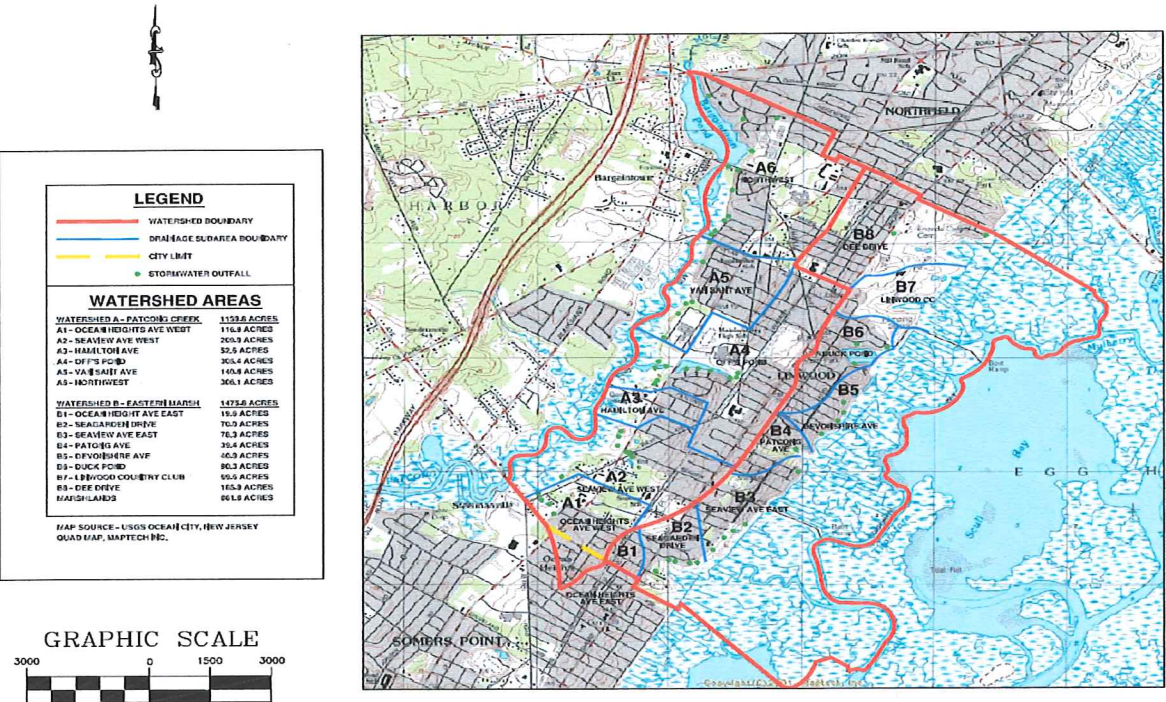
Watershed Boundaries Defined

The City of Linwood consists of approximately four square miles. It is bordered to the north by the City of Northfield, to the south by the City of Somers Point, to the west by Patcong Creek and to the east by the marshlands discharging into Scull and Isaac's Creek and Scull Bay, all of which ultimately discharge into the Atlantic Ocean. As these water bodies are tidally influenced, much of the City's stormwater discharge is tidally impacted, either directly or through tailwater build-up in municipal storm sewer systems.

Review of the City's United States Geologic Survey (USGS) mapping indicates that the existing topography causes water within the City to drain in three directions. A natural ridgeline to the west of Wabash Avenue directs stormwater runoff to the west into Patcong Creek. A second ridgeline in the area of Shore Road discharges runoff to the east. The remaining area between Shore Road and Wabash Avenue is a natural low area. The historical construction of municipal storm sewer systems has directed this flow either to Patcong Creek or the eastern marsh. The watershed areas in the City

are shown in Figure 7. This figure shows the division of the city into two primary watersheds. Also shown are the MS4 outfall locations.

Figure 7: The City of Linwood Watershed Areas



Patcong Creek Watershed

The Patcong Creek watershed consists of 1,130.7 acres and drains to the west into Patcong Creek. This watershed can be further separated into the following six general subareas:

A1 – Ocean Heights Avenue West	76.8 acres
A2 – Seaview Avenue West	246.3 acres
A3 – Hamilton Avenue	51.9 acres
A4 – Off’s Pond	308.8 acres
A5 – Van Sant Avenue	132.2 acres
A6 – Northwest	314.7 acres
Total	1,130.7 acres

The majority of the Ocean Heights Avenue West subarea discharges through the 24” diameter Brighton Drive Outfall and ultimately passes through the existing drainage culvert at West Avenue between Ocean Heights Avenue and Kirkland Avenue. The A5 flood zone (100-year flood plain - elevation 9) for this drainage subarea extends from the creek to Grammercy Avenue on the south side of Frances Avenue. The remainder of this subarea is almost entirely in the 500-year flood plain.

A large portion of the Seaview Avenue West subarea drains through the Seaview Avenue School property towards Mary Jane Pond and ultimately discharges across New Road (U.S. Route 9) adjacent to the Bloom Property redevelopment tract via a 24” diameter outfall pipe. The 100-year flood plain

in this subarea extends from south of Sara Ann Court north to Joseph Avenue, from Patcong Creek to mid-block between New Road and Wabash Avenue.

The City of Linwood Public Works Facility and Hamilton Avenue boat ramp are both part of the Hamilton Avenue drainage subarea as well as the Joseph, Hamilton and a portion of Patcong Avenue to the east of New Road. These areas are served by a series of recharge pipes that have no positive discharge.

Off's Pond is bordered to the south by the Schoolhouse Drive residential housing development and to the north by Mainland Regional High School. This open channel permanent pool conveyance system is bordered to the north by the Falling Water residential development on the west side of New Road. This area receives substantial stormwater discharge from the drainage systems of the Wabash Avenue corridor from Georgetown Court to Poplar Avenue, including the Belhaven School. The 100-year flood plain extends to the eastern limits of Off's Pond to Wabash Avenue.

The Van Sant Avenue subarea receives discharge from the residential houses south of Poplar Avenue and from the Cornerstone redevelopment property through a series of outfalls. Bartlett Avenue from Monroe to Van Sant Avenues is within the 100-year flood plain.

The Northwest drainage subarea receives flow from Poplar Avenue north to the Linwood/Northfield border and east from Grammercy Avenue. Discharge for this subarea occurs through a series of street end outfalls into Bargaintown Pond and Patcong Creek. This subarea includes the Fischer Woods residential development. River Drive and half of Davis Avenue is mapped within the 100-year flood plain.

Eastern Marsh Watershed

The Eastern Marsh Watershed consists of 1475.8 acres within the municipal boundary. Sixty percent (881.8 acres) of this area consists of wetland marsh area. The remaining 594 acres can be characterized into eight subareas:

B1 – Ocean Heights Avenue East	19.6 acres
B2 – Seagarden Drive	70.0 acres
B3 – Seview Avenue East	78.3 acres
B4 – Patcong Avenue	39.4 acres
B5 – Devonshire Avenue	40.9 acres
B6 – Duck Pond	90.3 acres
B7 – Linwood Country Club	69.6 acres
B8 – Dee Drive	185.9 acres
Total	594.0 acres

Ocean Heights Avenue East is a relatively small self contained drainage area with designated outfall. Drainage in this area is provided through a series of recharge pipe systems.

The Seagarden Drive subarea discharges stormwater through a series of outfalls located along the south side of Seagarden Drive and an outfall at the end of Royal Avenue. The 100-year flood plain extends along Seagarden Drive to Kirklan Avenue, mid-block between Shore Road and Wabash Avenue.

The Seaview Avenue East subarea is characterized by a series of street end outfalls receiving stormwater runoff from residences on the east side of Shore Road. The outfalls vary from stormsewer end sections to stone lined channels.

The Patcong Avenue drainage area receives flow from East Drive to Cheltenham Boulevard.

The Devonshire Avenue drainage area discharges stormwater flow through street end outfalls at Balfour, Berkshire, Cambridge and Devonshire Avenues. This area receives its flow primarily from the east side of Franklin Boulevard.

The Duck Pond is located at the north and east termination points of Franklin Boulevard and Edgewood Avenue. It also receives flow from a stormwater outfall on the south side of Delmar Avenue.

The Linwood Country Club subarea is a natural discharge point located at the juncture of Wood-Lynne Boulevard and Poplar Avenue.

The Dee Drive subarea receives runoff from Sterling, Wilson, Davis, Barr, Haines, Central and Vernon Avenues and Dee Drive. This area's westernmost limit is located approximately along Grammercy Avenue. The 36" diameter outfall pipe located at the end of Dee Drive is the sole storm sewer outfall for these streets. This subarea located in the northeast of the City also includes an 18" outfall at Carol Road near Gail Avenue.

Problem Areas and Design Alternatives

General

Drainage concerns within the City of Linwood can be separated into flood control, maintenance of surface water quality and reduction of sediment accumulation within the stormwater systems.

Flooding problems can generally be separated into two categories. The predominance of the City is serviced by some means of storm sewer system. However, lack of sufficient elevation changes from the top of the watershed to the discharge point, insufficient pipe capacity, insufficient outfall capacity and tidally influenced outfalls generally lead to substandard drainage capacity, resulting in residential flooding. Other areas of the City either have no stormwater discharge system or have a piping network with no positive discharge and are also subject to flooding. The nature of drainage improvements in these areas consists of seepage pits, trenches or other underground drainage systems that have no outfalls and consequently routinely subject their immediately surrounding areas to flooding during storm events substantially under the design (100-year) storm event. The combination of either of these problems with existing development within the 100-year flood plain has and will continue to lead to residential flooding and adverse impacts to the health, safety and welfare of the citizens of Linwood.

Retrofit and reconstruction of existing storm sewer systems can be costly. However, long-term construction of increased capacity storm sewer systems and outfalls should be considered on a watershed basis. Larger diameter outfall pipes such as the one constructed on the west side of Barr Avenue may be utilized as trunk lines to help reduce localized flooding problems. Additionally, an on-going maintenance program needs to be developed and implemented to clean and/or reduce debris entering the storm sewer systems and to ensure maximum pipe capacity is maintained.

A second issue that needs to be considered is the maintenance of the vitality and capacity of the surface water ponds utilized for stormwater control. Structural measures such as storm sewer inlet retrofit for the removal of sediments from the water bodies of Off's Pond, Duck Pond, Mary Jane Pond and Bargaintown Pond should be implemented. Additionally, these water bodies should be reviewed for capacity to reduce the risks of flooding and maintain stormwater flow continuity.

The third consistently occurring problem in the City is the sedimentation of existing stormsewer systems. Areas such as Franklin Boulevard generate large volumes of runoff and erosive velocities. Structural measures such as additional in-line systems, sump inlets and sediment hoods combined with a cohesive maintenance program would be effective in reducing sediment accumulation.

Specific Problem Areas

The following specific problem areas have been identified within the City. These areas do not represent the only problem areas within the City but have been identified as raising the most immediate concern.

1. Frances Avenue Drainage System/Brighton Drive Outfall

The Frances Avenue drainage system consists of an 18" to 24" drainage pipe which is located on the south side of Frances Avenue from Grammercy Avenue to its outfall on the west side of Brighton Drive. This pipe has a zero and even a negative slope in some areas and services a watershed of 72.5 acres. This system receives flow from the residential development of Somers Point on the south side of Ocean Heights Avenue and is the ultimate discharge point for the County stormwater pumping station that serves an existing low point on Ocean Heights Avenue. The outfall pipe is usually partially submerged and is tidally influenced by Patcong Creek.

Development along Frances Avenue is within the 100-year flood plain. A common occurrence during larger rainfall events is flooding on Ocean Heights Avenue between New Road and Grammercy Avenue, flooding on Grammercy Avenue at its intersection with Frances Avenue and flooding at Brighton Drive.

The Brighton Drive discharge occurs at the southwest corner of Lot 15, Block 2, a residential dwelling. A discharge channel meanders behind Lots 15, 16 and 17 of Brighton Drive and ultimately flows west to the West Avenue culvert before entering Patcong Creek. Of significant concern is the standing water within the meandering swale during no flow periods. This channel has depths from 2' to 3' in some areas. Additionally, this standing water also presents a health risk due to its stagnation that could lead to water borne viruses and potential infection from the West Nile Virus that has become more prominent in the region.

A potential long-term solution to addressing the issues of the Frances/Brighton area may involve the reconstruction of some or all of the existing drainage system. The potential for reconstruction of the outfall to provide a positive draining system and remove the existing standing water should be explored.

2. Meadow View Avenue Ponding at Street End

The west end of Meadow View Avenue at Lot 3.02 of Block 38 is an existing low area prone to flooding at regular intervals. This area has no positive drainage. Design alternatives are presently being evaluated to provide relief from this condition.

3. Hemlock Avenue Storm Sewer System

The existing storm sewer system at Hemlock Avenue is undersized for its contributing drainage area. A low point at Lot 11 of Block 40 is prone to flooding during larger storm events. Reconstruction of the stormsewer to increase its capacity is a possible solution, however it would be costly due to the substantial change in elevation from the low point at this property to the high point on Franklin Boulevard. Expansion of the outfall capacity and an active maintenance program to ensure no sediment build-up in the pipes may help this situation.

4. Dee Drive Watershed

Insufficient pipe capacity in this watershed has led to substantial flooding during larger storm events. The potential for the construction of additional or increased capacity outfalls should be explored.

5. Joseph, Hamilton and Patcong Avenues at New Road

Lack of positive drainage combined with the elevation changes created with the New Road overlay has resulted in localized ponding at the entrances of each of these roadways. The potential for providing a positive discharge drainage alternative should be explored.

6. Wabash Avenue Drainage System

The existing storm sewer in Wabash Avenue adjacent to the Belhaven School presently discharges via a bubble-up inlet. Flooding has been experienced at Georgetown Court, the upstream end of this drainage system. Analysis of this system should be performed to assess potential design alternatives.

7. Seaview Avenue Street End

A large contributing drainage area along Franklin Boulevard and an extended flow path have contributed to erosive flows at the end of pavement at the east end of Seaview Avenue. The street continues as a gravel road to an existing boat ramp. In-line flow reducers and a constructed stabilized channel would reduce flow turbulence prior to discharge.

8. Kirklin Avenue at Grammercy Avenue

Drainage for this intersection is presently provided by low capacity inlets with no positive discharge. This intersection frequently floods. Alternatives could be evaluated to provide positive discharge in this area.

Design and Performance Standards

Upon the effective date of permit authorization, the Tier A Permit requires Tier A municipalities to ensure that any residential development and redevelopment project (including projects operated by the municipality itself) that are subject to the Residential Site Improvement Standards (RSIS) for stormwater management at N.J.A.C. 5:21-7 and that disturb one acre or more comply with those standards, when conflict exists between the NJDEP stormwater requirements and the RSIS, the NJDEP's standards control.

The City will adopt the design and performance standards for stormwater management measures as presented in N.J.A.C. 7:8-5 to minimize the adverse impact of stormwater runoff on water quality and water quantity and loss of groundwater recharge in receiving water bodies. The design and performance standards include the language for maintenance of stormwater management measures consistent with the stormwater management rules in N.J.A.C. 7:8-5.8 Maintenance Requirements, and language for safety standards consistent with N.J.A.C. 7:8-6 Safety Standards for Stormwater Management Basins. The Stormwater Control Ordinances shall be adopted within one year of adoption of the MSWMP. These standards will apply to all major development.

The maintenance requirements in N.J.A.C. 7:8-5.8 is among the most important design and performance standards. The maintenance plan shall contain: specific preventative maintenance tasks and schedules; cost estimates, including estimated cost of sediment, debris, or trash removal; and the name, address, and telephone number of the person or persons responsible for preventative and corrective maintenance (including replacement). Stormwater management facilities shall be regularly maintained to insure they function at a design capacity, and to prevent health hazards associated with debris build up and stagnant water.

Maintenance and upkeep responsibilities depend on the ownership of the facilities and should be clearly defined in the Stormwater Maintenance Plan.

During construction, inspectors on behalf of the city will observe the construction of approved projects to ensure that the stormwater management measures are constructed and function as designed.

Plan Consistency

The City is not within a Regional Stormwater Management Planning Area and no TMDLs have been developed for waters within the City; therefore this plan does not require consistency with any regional stormwater management plan (RSWMP) nor have any TMDLs been established. As RSWMPs or TMDLs are developed in the future, this Municipal Stormwater Management Plan will be updated for consistency.

The City's Stormwater Management Ordinance requires all new development and redevelopment plans to comply with New Jersey's Soil Erosion and Sediment Control Standards. During construction, inspectors on behalf of the city will observe on-site soil erosion and sediment control measures and report any inconsistencies to the local Soil Conservation District.

The Stormwater Management Plan and implementation ordinance shall include protection of the natural stormwater management areas that the Linwood Master Plan and Environmental Resource Inventory have identified, including floodplains and wetlands.

Likewise, the Stormwater Ordinance shall reflect and be consistent with the City's site clearing ordinance. Retention of natural vegetation promotes filtration and infiltration. Trees with their evapotranspiration functions are especially important to maintain the hydrologic cycle.

These goals are reflected in the recently adopted Site Clearing Ordinance. In 2004 the City of Linwood adopted a site clearing ordinance that was prepared in consultation with the Planning Board and Environmental Commission. The preamble states that the City of Linwood finds that the development of unimproved or the redevelopment of improved land may result in clear cutting of trees which can create increased surface water runoff and soil erosion. It further finds that such excessive removal of trees can produce serious negative visual, economic and environmental effects not only on the individual properties but also upon the neighboring properties and the community at large. This ordinance is intended to protect the quality of life and the character of the natural and built environment. Site clearance is limited to 65% for non-residential uses and 55% for residential uses on 20,000 ft² lots or smaller.

Nonstructural Stormwater Management Strategies

The City of Linwood's master plan has been reviewed and the recommended modifications to the land use and zoning ordinances to incorporate nonstructural stormwater management strategies have been provided. Once the revised ordinances are completed, they will be submitted to the county review agency for review and approval. A copy will be sent to the Department of Environmental Protection at the time of submission.

Chapters 155, 238, 241 and 277 of the City Code were reviewed with regard to incorporating nonstructural stormwater strategies. Several changes are recommended to this chapter to incorporate these strategies.

Chapter 155 – FLOOD HAZARD AREAS

Section 155-17, "Specific Standards" should be revised to include the following statement: "Development within a flood plain shall be in compliance with the special water resource protection area standards in accordance with N.J.A.C. 7:8-5.5(h)".

Section 155-18, "Floodways" should be amended to add a section D which states, "Pursuant to N.J.A.C. 7:8, Applications for stream encroachment shall preserve and maintain a special water resource protection area in accordance with N.J.A.C. 7:8-5.5(h)".

Chapter 238 – STORMWATER MANAGEMENT

The Stormwater Management chapter will undergo substantial revisions as part of the adoption of the revisions to the municipal stormwater control ordinance in accordance with the NJDEP Model Stormwater Ordinance.

Chapter 241 – STREETS AND SIDEWALKS

Section 241-4, “Curbs and Gutters” requires that concrete curbs and/or gutters are required for major subdivisions and planned developments, but may be waived by the Planning Board if the applicant proposes an acceptable drainage system not requiring curbs and gutters. This section should be amended to allow for curb cuts or flush curbs with curb stops in commercial development to allow vegetated swales to be used for stormwater conveyance and to allow the disconnection of impervious areas. Flush curb should be defined as having a negative reveal to prohibit stormwater ponding at the curb face.

Section 241-4, “Bikeways” should be added to provide an alternative to concrete sidewalks as required in Section 241-4, “Sidewalks”. Bike paths are permitted in lieu of sidewalks depending on the development’s location in relation to schools, recreation areas, shopping facilities and other populated areas. This section should be amended to include a provision that allows the use of porous pavement in lieu of the specified bituminous pavement standard. The use of porous pavement shall be at the discretion of the Board Engineer subject to the provisions of Chapter 238, “Stormwater Management” for both design and maintenance

Chapter 277 - ZONING

Article II – Zoning Districts

The City of Linwood is currently divided into the following ten zoning districts: Dwelling A (single-family detached houses); Dwelling B (estate housing); Dwelling C (multifamily residential); Limited Business (retail and offices); Planned Commercial Development (which can be broken down into three sub-zones; Planned Development Zone, Planned Commercial Zone and Planned Residential Zone); Conservation; Recreation and Institutional.

Although each zone has a maximum allowable percent impervious surface, the City Code will be amended to remind developers that satisfying the percent impervious requirements does not relieve them of responsibility for complying with the design and performance standards for stormwater management measures contained in Chapter 238, “Stormwater Management”. The City is evaluating the maximum allowable impervious cover for each zone to determine whether a reduction in impervious cover is appropriate. Also, if a developer is given a variance to exceed the maximum allowable percent imperviousness, the developer must mitigate the impact of the additional impervious surfaces. This mitigation effort must address water quality, flooding, and groundwater recharge as described in Chapter 238. A detailed description of how to develop a mitigation plan is included in this Municipal Stormwater Management Plan.

Article V – Regulations Applicable to All Zones

Section 277-8, “Fences” requires buffer areas along all lot lines separating nonresidential uses from residential uses. The ordinance states that natural vegetation shall be retained within the buffer. Additional language should be added to this section promoting the use of native vegetation for landscape enhancement of the buffers. Native vegetation requires less fertilization and watering than non-native species. Additionally, language should be included

to allow buffer areas to be used for stormwater management by disconnecting impervious surfaces and treating runoff from these impervious surfaces.

Article VI – Definitions

Section 277-18, “Definitions” should be amended to include the following definitions:

MAJOR DEVELOPMENT - Pursuant to N.J.A.C. 7:8 – 1.2, “Major development” means any “development” that provides for and ultimately disturbs one or more acres of land or increases impervious surface by one-quarter acre or more. Disturbance is the placement of impervious surface or exposure and/or movement of soil or bedrock or clearing, cutting, or removing of vegetation.

IMPERVIOUS SURFACE - Pursuant to N.J.A.C. 7:8 – 1.2, “Impervious surface” means a surface that has been covered with a layer of material so that it is highly resistant to infiltration by water.

WETLANDS - Pursuant to N.J.A.C. 7:8 – 1.2, “Wetlands” or “Wetland” means an area that is inundated or saturated by surface water or groundwater at a frequency and duration sufficient to support, and that under normal circumstances does support, a prevalence of vegetation typically adapted for life in saturated soil conditions, commonly known as hydrophytic vegetation.

A new section titled, “Lot Grading” should be added which identifies standards for lot grading for residential subdivisions. This section will establish minimum and maximum slopes for lot grading to secure proper drainage and prevent the collection of stormwater. The following language addresses lot grading:

Lot Grading

- A. All lots, open spaces and planting areas shall be graded to secure proper drainage and to prevent the collection of stormwater. Grading shall be performed in such a manner that will minimize the damage to or destruction of trees growing on the land. Topsoil shall be provided and/or redistributed on the surface as cover and shall be stabilized by seeding or planting. Grading plans shall have been submitted with the preliminary and final plats, and any departure from these plans must be approved in accordance with the requirements of this chapter for the modification of improvements.
- B. Wherever possible, the land shall be graded so that the stormwater from each lot shall drain directly to the street via sheet flow through disconnected pervious surfaces. If impossible to drain directly to the street, it shall be directed to a system of interior yard drainage designed in accordance with this chapter.
- C. Unless otherwise required by this chapter, all tree stumps, masonry and other obstructions shall be removed to a depth of two feet below existing or finished grade, whichever is lower.

- D. The minimum slope for lawns and disturbed areas shall be one and one-half percent (1 ½ %) and, for smooth, hard-finished surfaces other than roadways and parking lots, four tenths of one-percent (4/10 of 1%).
- E. The maximum grade for lawns and disturbed areas within five feet of a building shall be ten percent (10%) and, for lawns more than five feet from a building, twenty-five percent (25%); except that, for the driveway, the maximum grade shall be fifteen percent (15%).
- F. Lots shall be graded to provide positive drainage from the rear, side and front yard areas towards a downstream stormwater management system. In no case shall lots discharge directly towards building units of adjoining residential properties. In areas where conveyance swales are required, the design shall be in accordance with the Standards for Soil Erosion and Sediment Control in New Jersey and the stormwater management provisions of this chapter.
- G. Retaining walls installed in slope-control areas shall be constructed of heavy timber or logs properly treated in accordance with environmental regulations, reinforced concrete, reinforced masonry or of other construction acceptable to the Board Engineer and shall be adequately designed and detailed on the final plat to carry all earth pressures, including any surcharges. The heights of retaining walls shall not exceed 1/3 of the horizontal distance from the foundation wall of any building to the face of the retaining wall.

A new section titled, “Special Water Resource Protection Area” should be added to this section that identifies standards for water quality along Category One waters. The following language addresses these standards:

Pursuant to N.J.A.C. 7:8 – 5.5(h), “Special Water Resource Protection Areas” shall be established along all waters designated Category One at N.J.A.C. 7:9B and perennial or intermittent streams that drain into or upstream of the Category One waters as shown on the USGS Quadrangle areas shall be established for the protection of water quality, aesthetic value, exceptional ecological significance, exceptional recreational significance, and exceptional fisheries significance of those established Category One waters.

Land Use

A detailed land use analysis for the City was conducted. Figure 8 illustrates the existing land use in the City based on 1995/97 GIS information from NJDEP. Figure 9 illustrates the HUC14s within the City. The City zoning map is shown in Figure 10. Figure 11 illustrates the constrained lands within the City.

Since the amount of land available for development (barren land, agriculture and forest) is less than 1 square mile a build-out analysis is not required and has not been performed as part of this MSWMP. Table 1 shows a complete breakdown of current land uses in the City of Linwood.

Table 1: The City of Linwood Existing Land Use

Land Use	Total Area	Vacant Area	Constrained Area
	mile ²		
Developable			
Urban	2.0		
Forest	0.133		
Barren Land	0.0133	0.17	
Agriculture	0.0233		
Constrained			
Water	0.30		1.63
Wetlands	1.33		

Figure 8: The City of Linwood Existing Land Uses

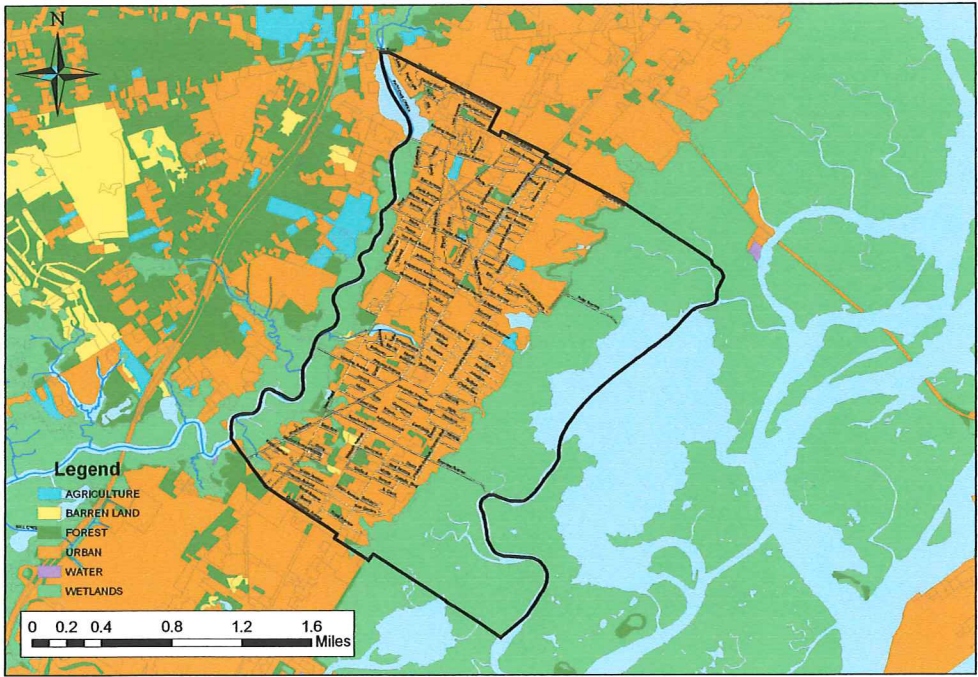


Figure 9: The City of Linwood Hydrologic Units (HUC14s)

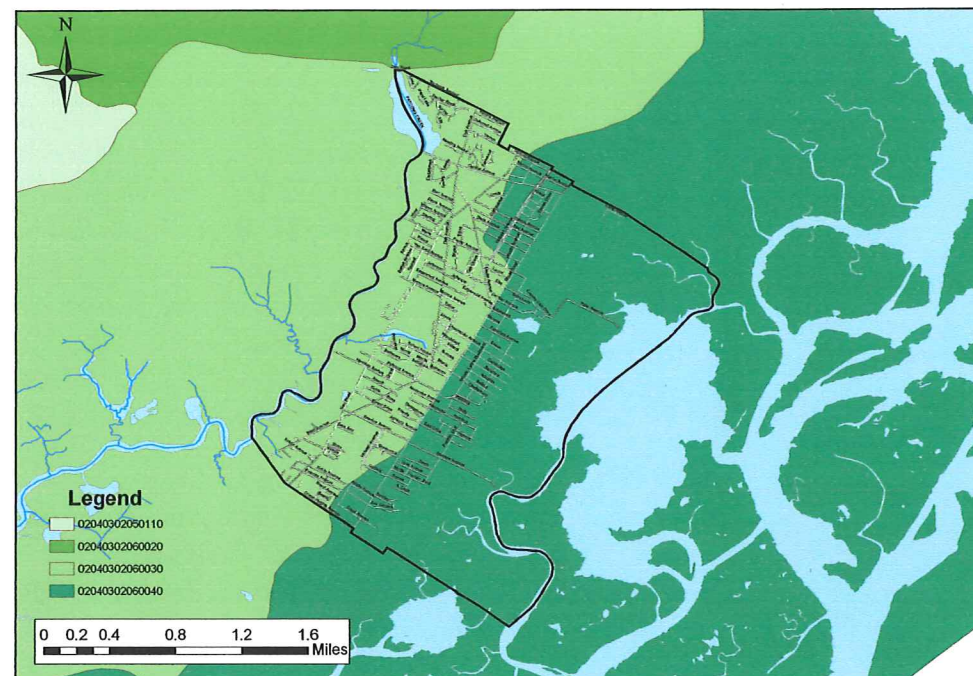


Figure 10: The City of Linwood Zoning Districts

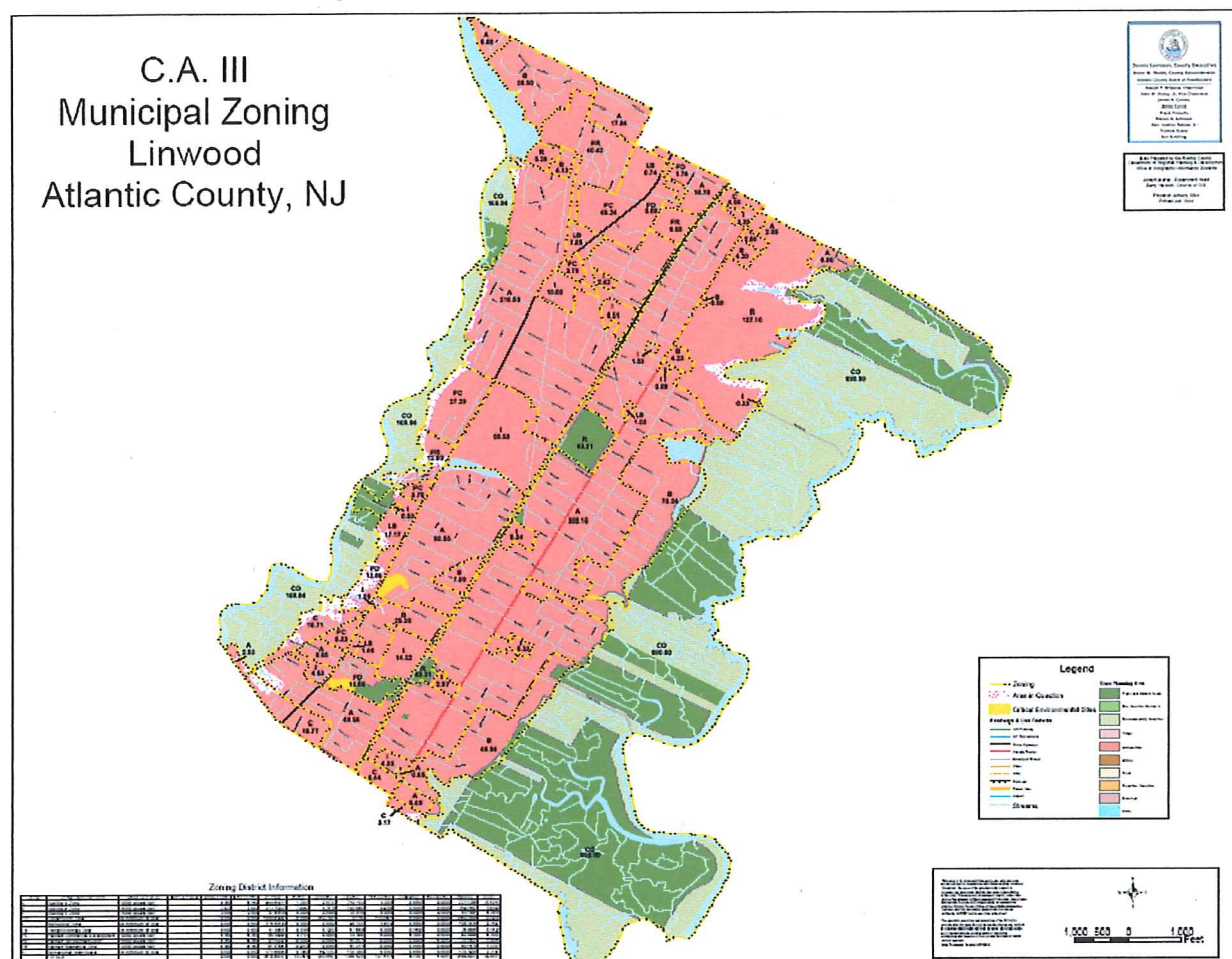
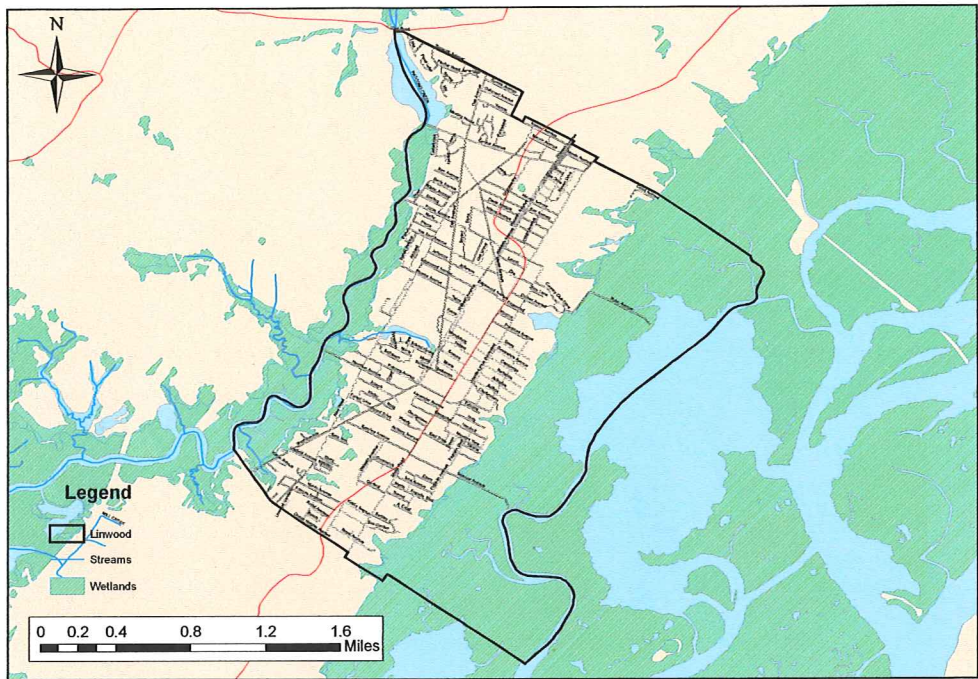


Figure 11: The City of Linwood Wetlands



Mitigation Plans

This mitigation plan is provided for a proposed development that is granted a variance or exemption from the stormwater management design and performance standards stated in this document along with the future changes to Chapter 238 of the City Code. Presented is a hierarchy of options.

Mitigation Project Criteria

- 1. The mitigation project must be implemented in the same drainage area as the proposed development. The project must provide additional groundwater recharge benefits, or protection from stormwater runoff quality and quantity from previously developed property that does not currently meet the design and performance standards outlined in the Municipal Stormwater Management Plan. The developer must ensure the long-term maintenance of the project, including the maintenance requirements under Chapters 8 and 9 of the NJDEP Stormwater BMP Manual.
 - a. The Planning or Zoning Board may direct an applicant seeking variance or waiver relief to perform all or a portion of the work identified in the following projects listed to compensate for a deficit from the performance standards resulting from the proposed project. Listed below are some of the projects that the City would consider to address the mitigation requirement. These projects identify current problem areas or stormwater improvements that the City has targeted. The City may adjust this list to

include additional projects as the needs of the City evolve. The attached list does not indicate order of priority. More detailed information on the listed projects can be obtained from the City Engineer.

Groundwater Recharge

- Provide recharge facilities along Wabash Avenue;
- Provide recharge facilities at All Wars Memorial Park.

Water Quality

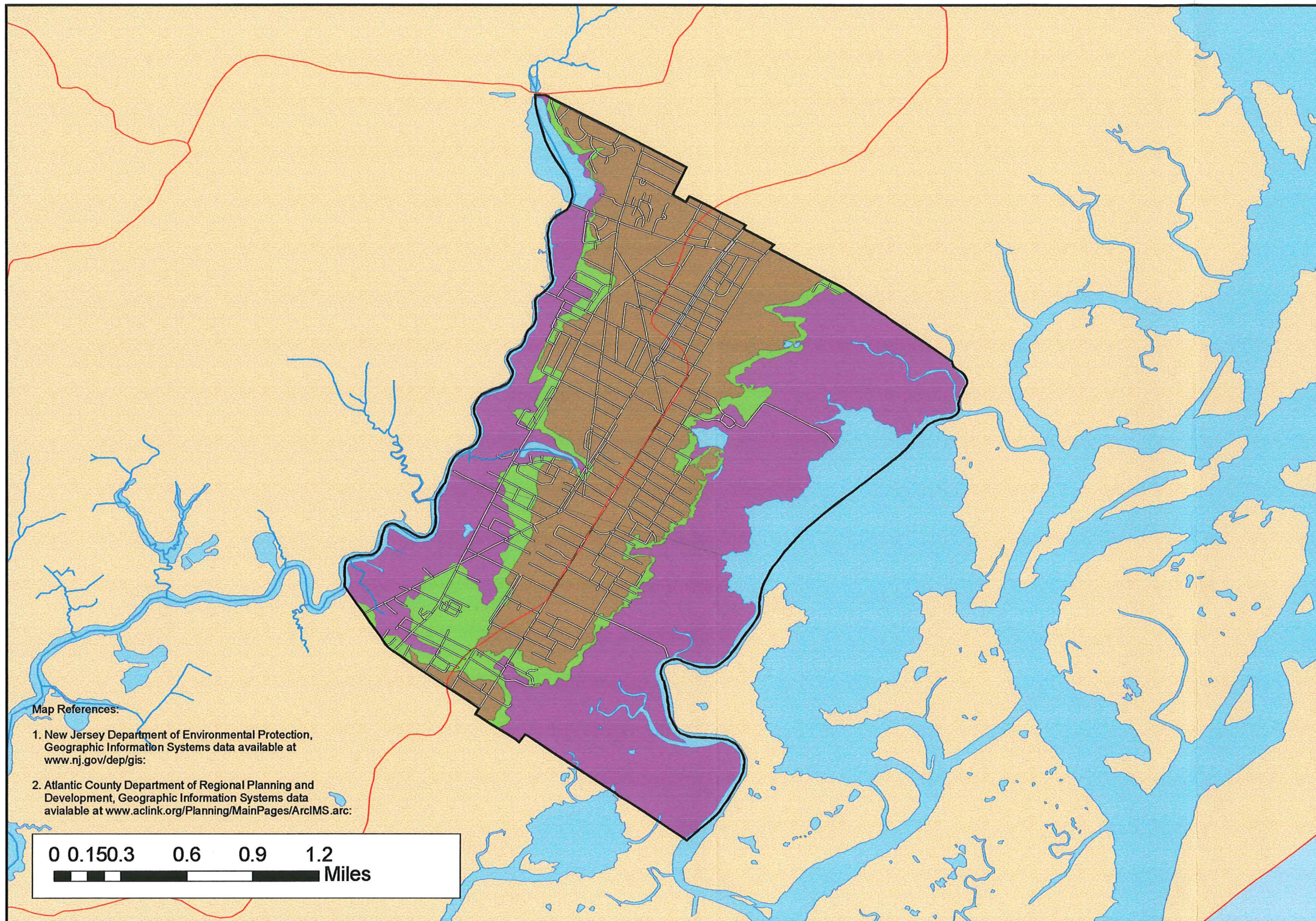
- Remediation of Duck Pond;
- Silt removal from Off's Pond;
- Road scour improvements at Seaview Avenue.

Water Quantity

- Hemlock Avenue Drainage: Replace and/or repair existing insufficient storm sewer structures;
- Meadow View Avenue: Install stormsewer improvements to promote positive drainage at street end;
- Burroughs Drive Drainage;
- Frances Avenue Drainage System/Brighton Drive Outfall: Reconstruct outfall channel and contributing drainage area stormsewer piping;
- Joseph, Hamilton and Patcong Avenues at New Road: Storm sewer improvements to provided positive drainage at street ends;
- Wabash Avenue: Stormsewer improvements to bubble-up system.
- Kirklin Avenue at Grammercy Avenue: Installation of stormsewer improvements;
- Provide stormsewer improvements at All Wars Memorial Park.

2. If a suitable site cannot be located in the same drainage area as the proposed development, as discussed in Option 1, the mitigation project may provide mitigation that is not equivalent to the impacts for which the variance or exemption is sought, but that addresses the same issue. For example, if a variance is given because the 80 percent TSS requirement is not met, the selected project may address water quality impacts due to a fecal impairment.

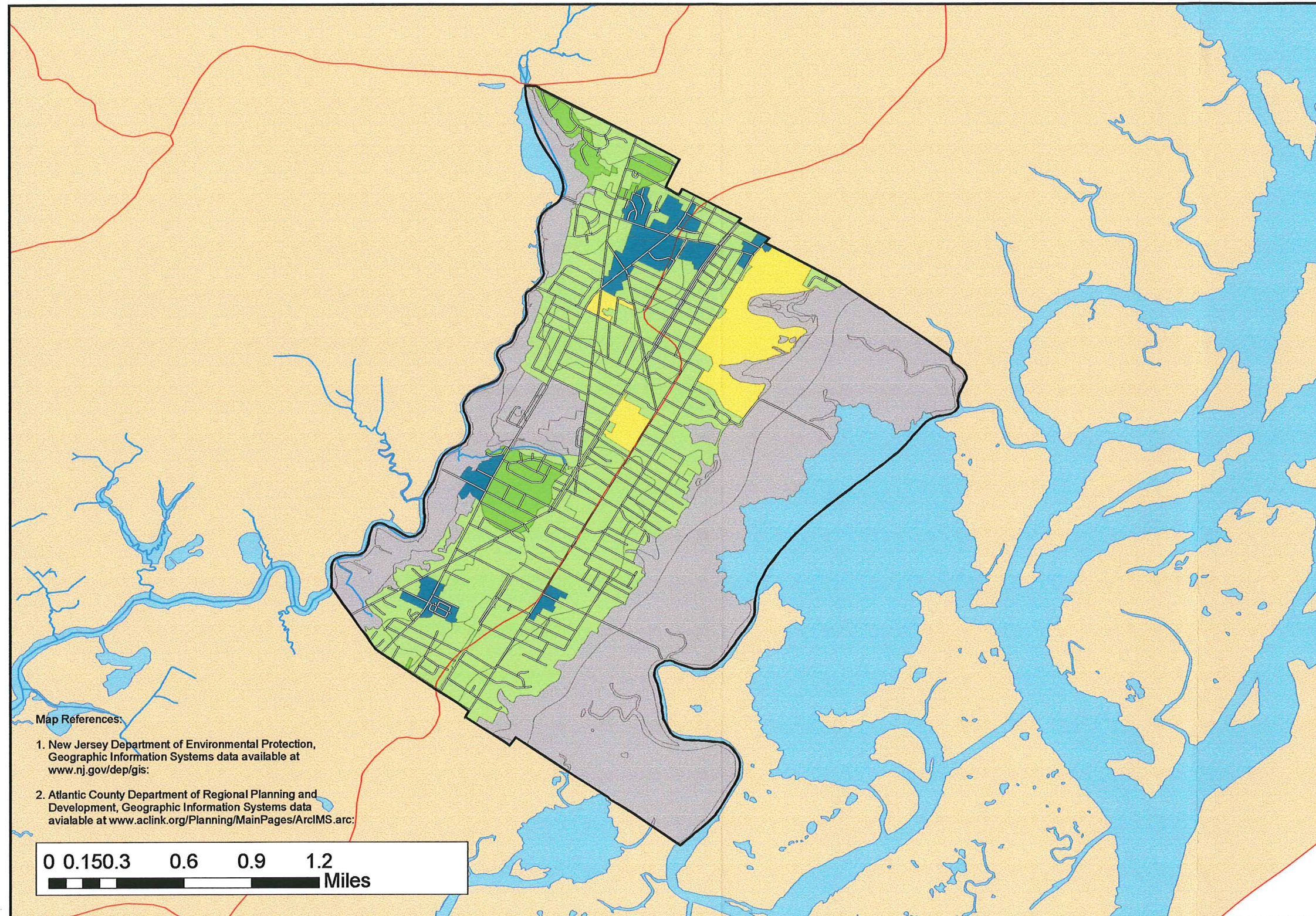
The municipality may allow a developer to provide funding or partial funding to the municipality for an environmental enhancement project that has been identified in a Municipal Stormwater Management Plan, or towards the development of a Regional Stormwater Management Plan. The funding must be equal to or greater than the cost to implement the mitigation outlined above, including costs associated with purchasing the property or easement for mitigation, and the cost associated with the long-term maintenance requirements of the mitigation measure.



The City of Linwood Flood Zones

Legend

- AE
- X
- X500



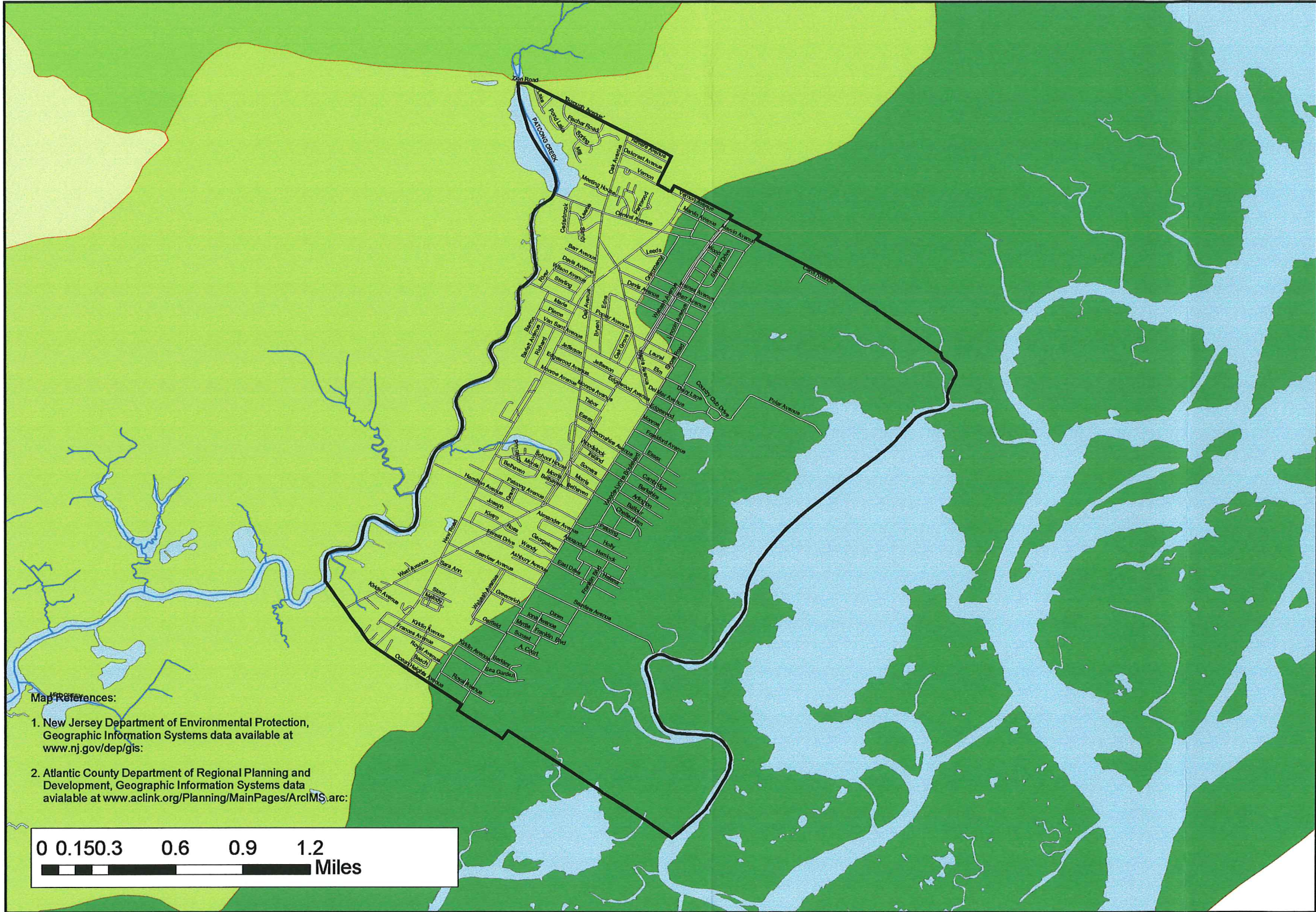


Curwood Atlantic Engineers, Inc.
Dixor Associates
ASSOCIATED ENGINEERS

The City of Linwood Groundwater Recharge Areas

Legend

	0.00 in/yr
	0.01 - 3.75 in/yr
	3.76 - 6.50 in/yr
	6.51 - 8.50 in/yr
	8.51 - 10.50 in/yr
	HUC 14s



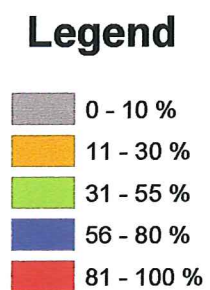
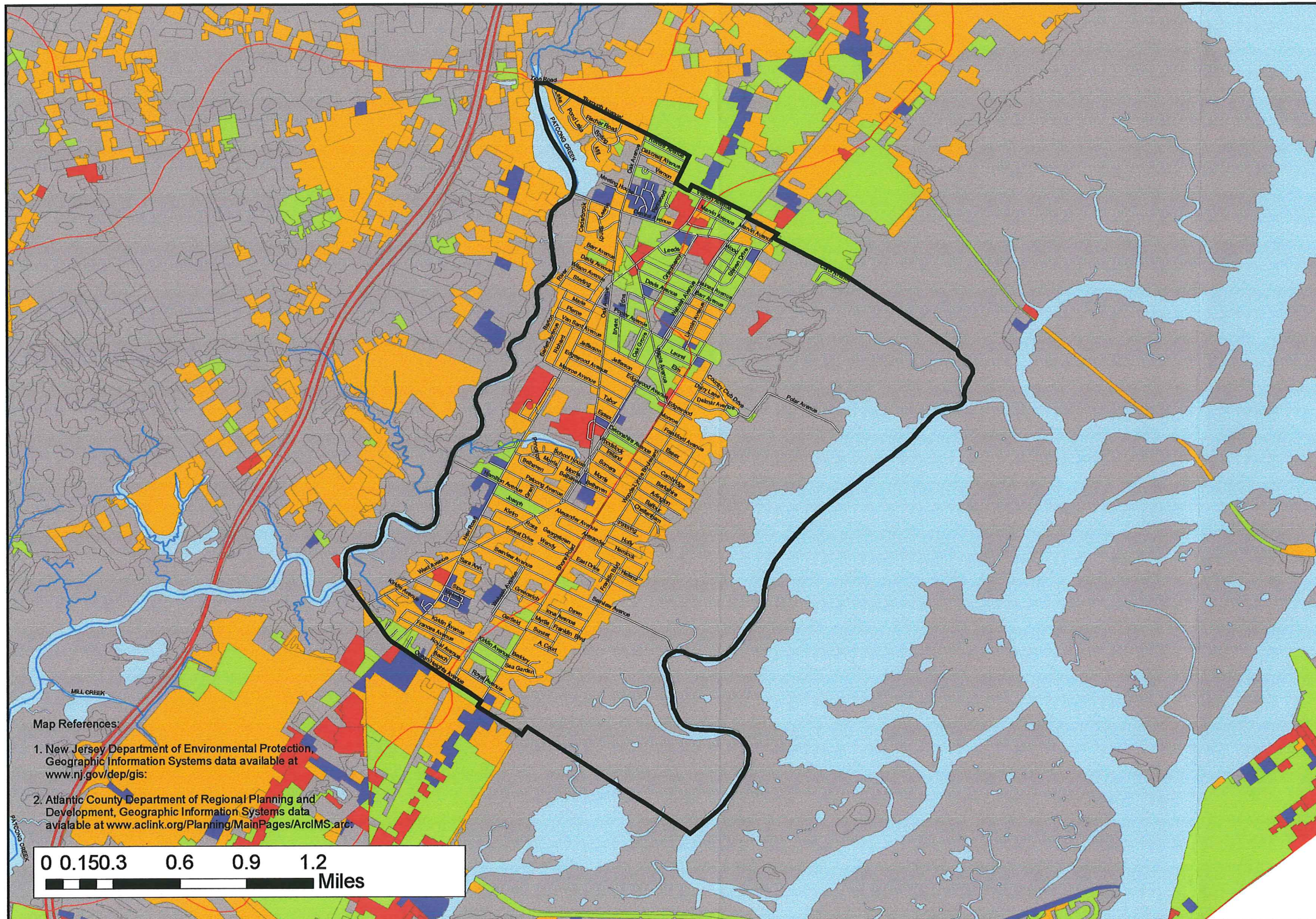


Concord Atlantic Engineers, Inc.
Dixon Associates, Inc.
ASSOCIATED ENGINEERS

The City of Linwood Hydrologic Units (HUC 14s)

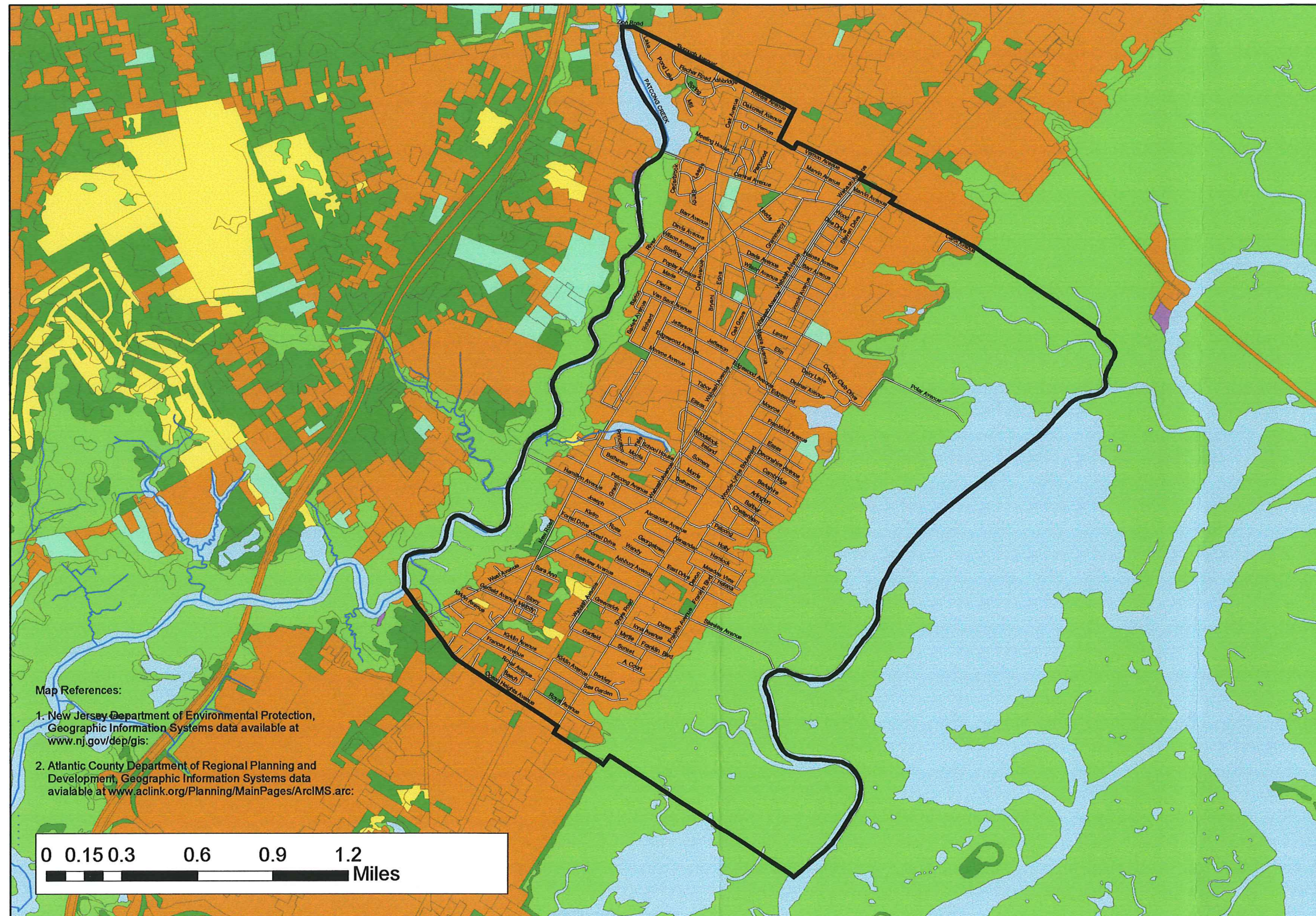
Legend

	02040302050110
	02040302060020
	02040302060030
	02040302060040



The City of Linwood Impervious Cover

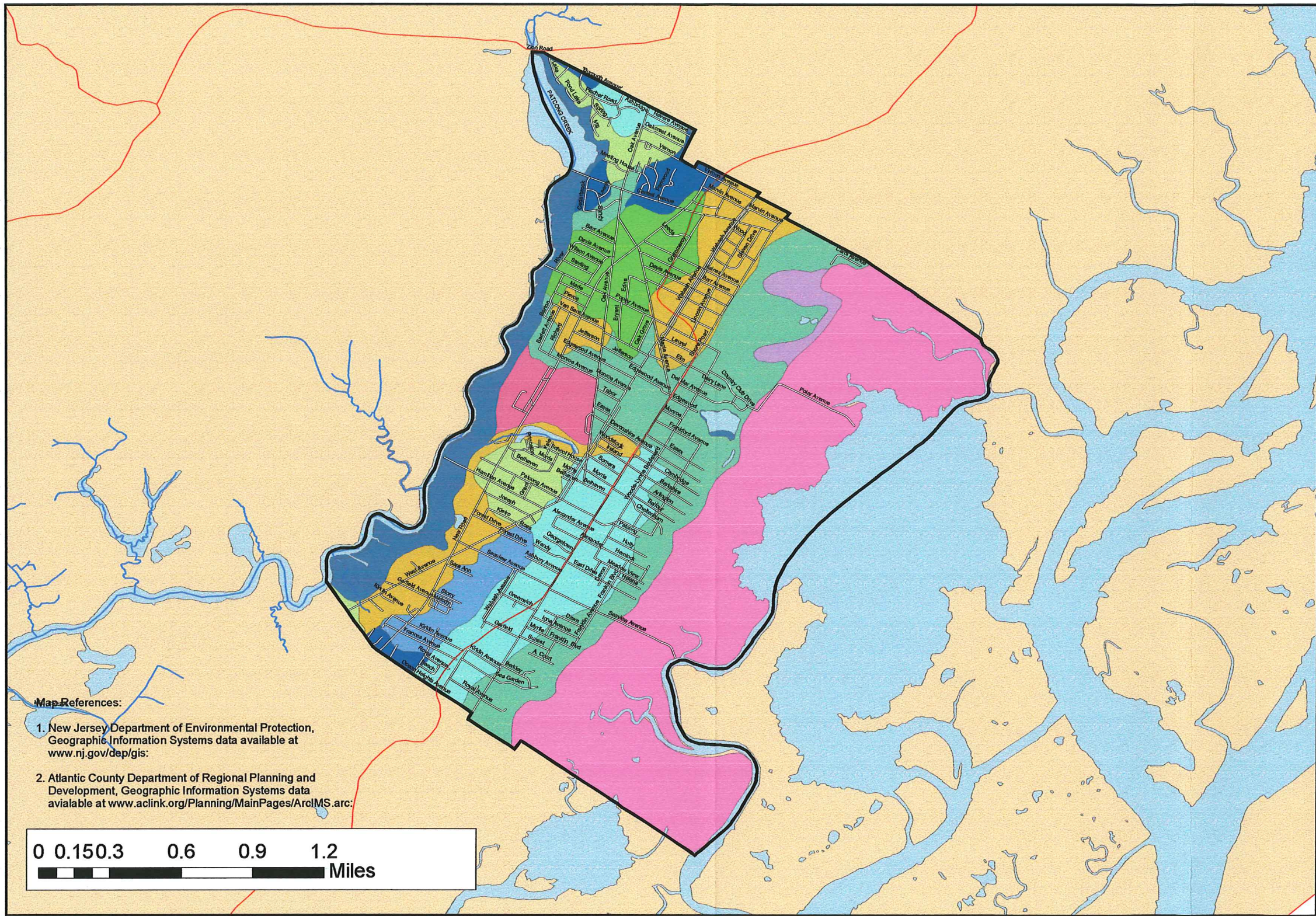




The City of Linwood Land Use

Legend

- AGRICULTURE
- BARREN LAND
- WOODED
- URBAN
- WATER
- WETLANDS



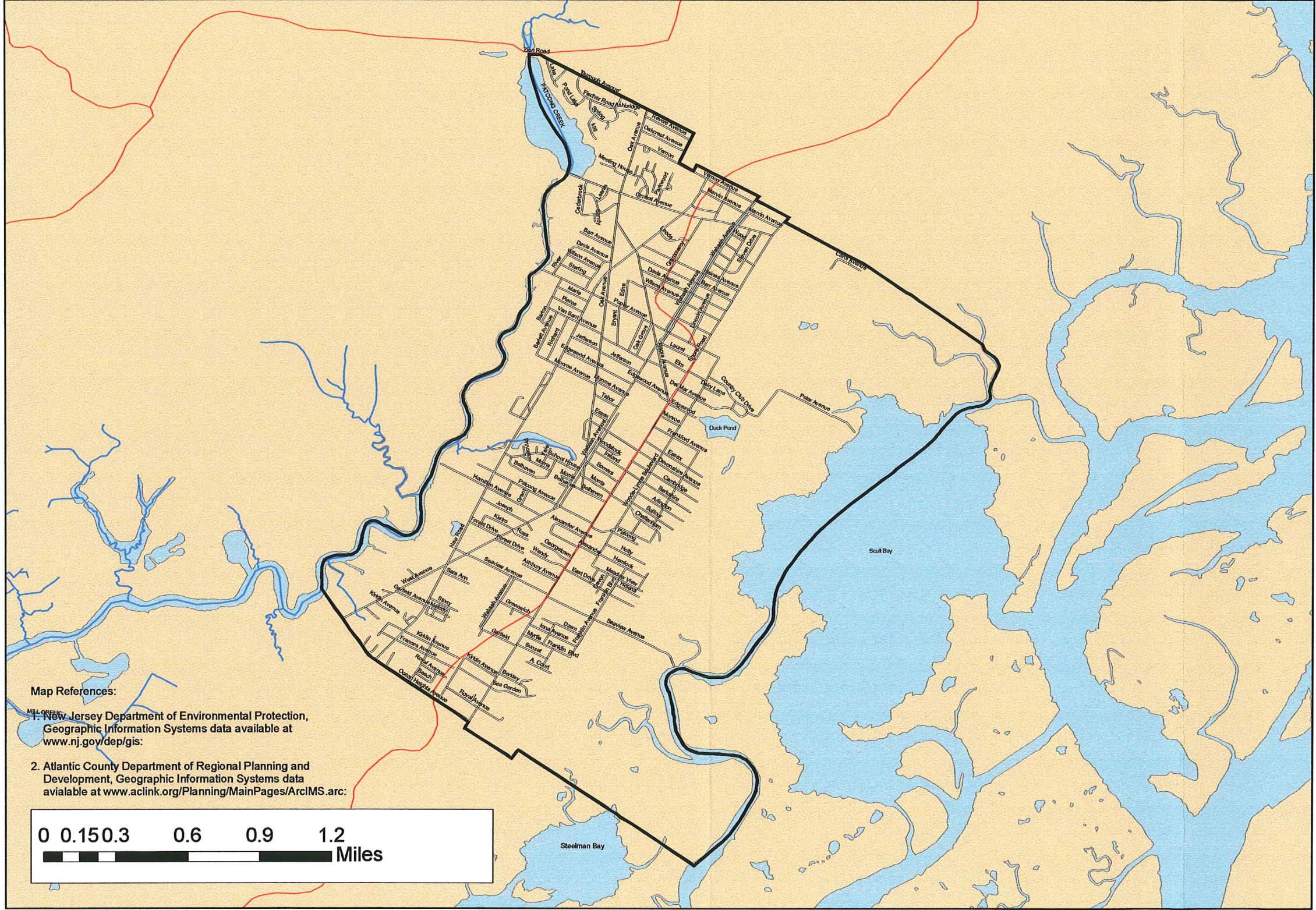
Carlisle, Atlantic Engineers, Inc.
Dixon Associates
ASSOCIATED ENGINEERS



The City of Linwood Soil Types

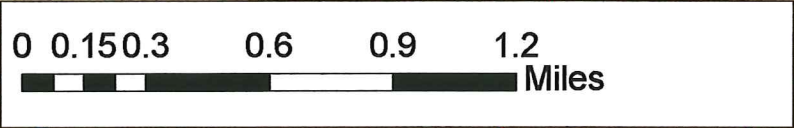
Legend

DoA	KnA
EvB	Po
EwB	SaA
FL	TD
FrA	TM
KmA	
HUC 14s	



Map References:

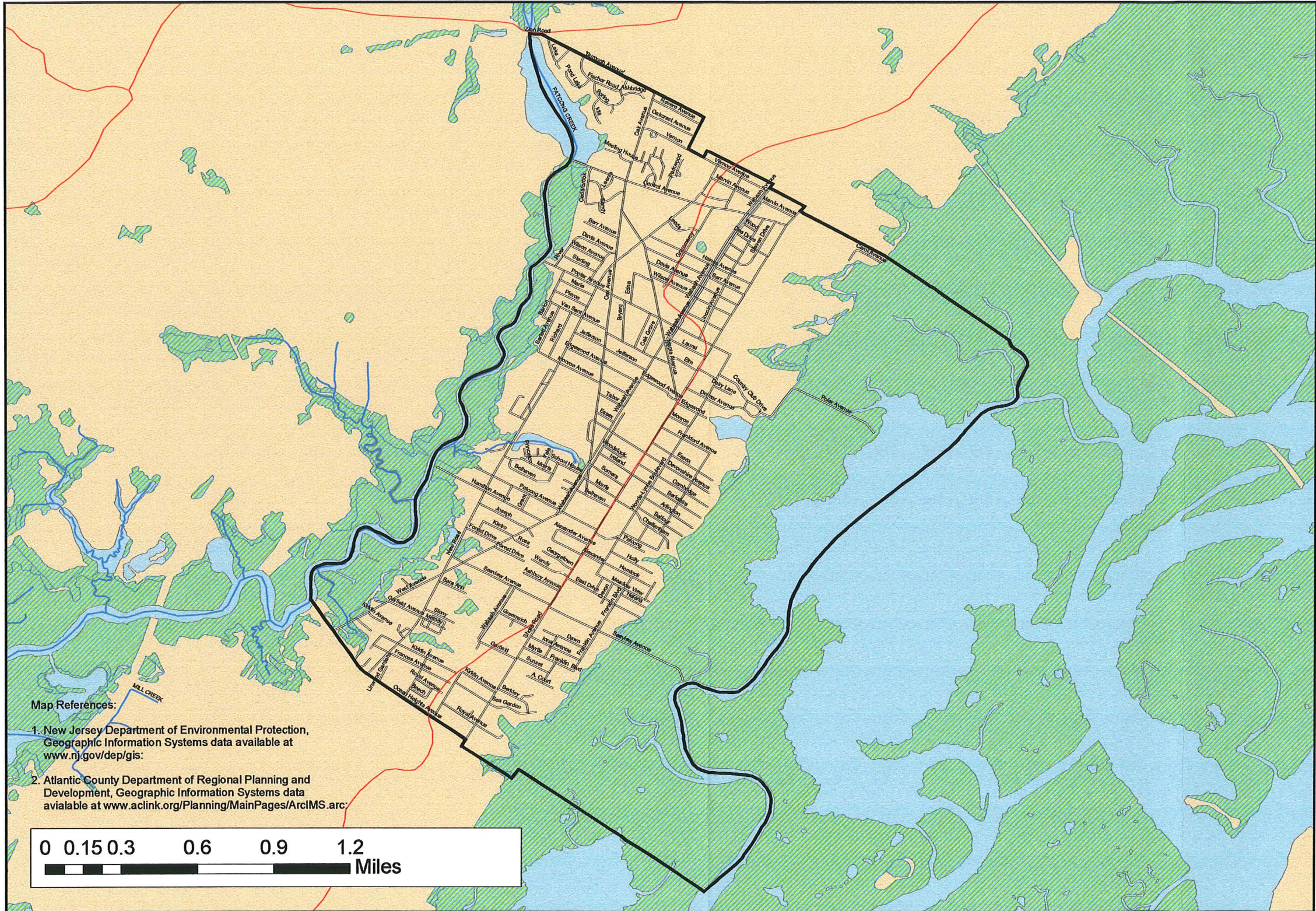
1. New Jersey Department of Environmental Protection, Geographic Information Systems data available at www.nj.gov/dep/gis:
2. Atlantic County Department of Regional Planning and Development, Geographic Information Systems data available at www.aclink.org/Planning/MainPages/ArcIMS.arc:



The City of Linwood Waterways




Legend

- Linwood
- Streams
- HUC14




The City of Linwood Wetlands

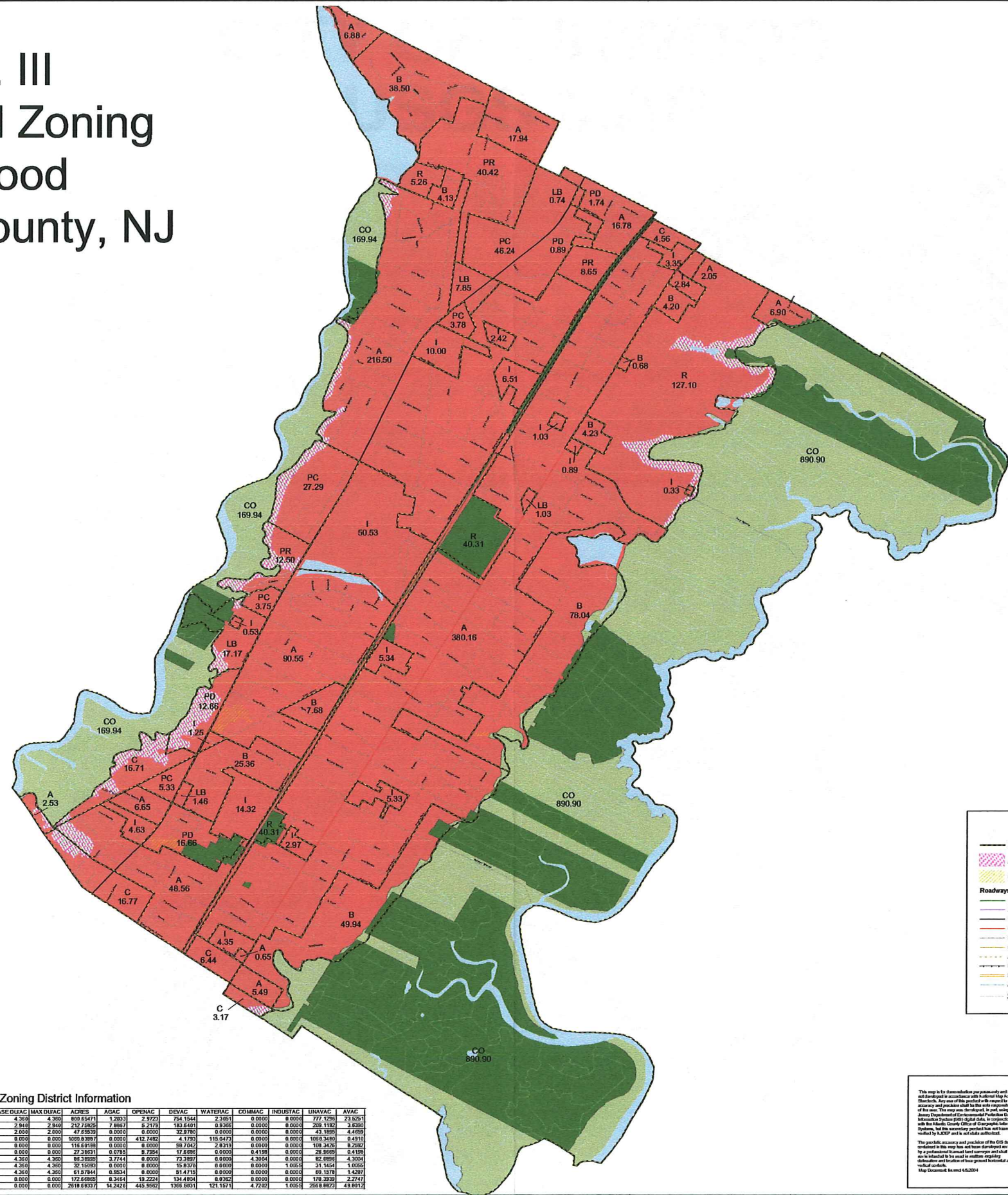
Legend

-  Linwood
-  Streams
-  Wetlands

C.A. III
Municipal Zoning
Linwood
Atlantic County, NJ


Dennis Levinson, County Executive
Eden W. Walsh, County Administrator
Atlantic County Board of Freeholders
Joseph F. Silipotes, Chairman
John W. Eklund, Jr., Vice Chairman
James A. Conway
James Corio
Frank Flannery
Armen K. Johnson
Ken. Landon Wilson, Jr.
I. Nishikubo
Ron Schilling

Map Prepared by the Atlantic County
Department of Regional Planning & Development
Office of Geographic Information Systems
Joseph Maher - Department Head
Barry Hackett - Director of GIS
Prepared January 2004
Printed July 2004



Legend

Zoning

- Area in Question
- Critical Environmental Sites

Roadways & Line Features

- GIS Parkway
- AG Expressway
- State Highways
- County Routes
- Municipal Streets
- Other
- Atty
- Railroad
- Power Line
- Airport
- Streams


State Planning Area

- Parks and Natural Areas
- Env. Sensitive Berterils
- Environmental Sensitive
- Fringe
- Metropolitan
- Military
- Rural
- Rural Env. Sensitive
- Suburban
- Water

Zoning District Information

ZONE	ZONE DESCRIPTION	BASIS LOT SIZE	MIN LOT SIZE	BASIS DUAC	MAX DUAC	ADRES	AGAC	OPENAC	DEVAC	WATERAC	COMMAC	INDUSTAC	UNIVAC	AVAC	
A	Dwelling A Zone	10000 square feet	4,368	4,368	800,85471	1,2033	2,9723	754,1544	2,3591	0.0000	0.0000	777,1290	23,5261		
B	Dwelling B Zone	15000 square feet	2,948	2,948	212,72825	7,8867	5,2178	183,6491	8,8305	0.0000	0.0000	208,1182	3,8260		
C	Dwelling C Zone	15000 square feet	2,008	2,008	47,45535	0.0000	0.0000	32,9780	0.0000	0.0000	0.0000	41,1885	4,4059		
CO	Conservation Zone	no minimum lot size			0.0000	1000,83817	0.0000	412,7482	4,1793	115,0472	0.0000	0.0000	106,83480	0,4910	
I	Institutional Zone	no minimum lot size			0.0000	0.0000	0.0000	89,7042	2,8719	0.0000	0.0000	108,3426	8,2592		
LB	Limited Business Zone	no minimum lot size			0.0000	0.0000	0.0000	17,6860	0.0000	0.4198	0.0000	26,3660	0,4198		
PC	Planned Commercial Development	10000 square feet	4,368	4,368	86,33950	3,7744	0.0000	73,2897	0.0000	4,3044	0.0000	62,6891	4,3044		
PD	Planned Development Zone	10000 square feet	4,368	4,368	32,16380	0.0000	0.0000	16,8378	0.0000	1,0000	0.0000	31,1444	1,0000		
PR	Planned Residential Zone	10000 square feet	4,368	4,368	61,87844	0.0000	0.0000	51,4715	0.0000	0.0000	0.0000	60,1578	1,4267		
R	Residential Open Space	no minimum lot size			0.0000	0.0000	172,68888	8,3464	19,2224	134,4804	8,8782	0.0000	170,2839	2,2747	
TOTALS					0.0000	0.0000	2618.84337	14.2425	445.3652	136.8801	121.1571	4.7205	1.0055	258.88625	48.8912

This map is for informational purposes only and is not intended to be used for legal or financial purposes. The map is prepared by the Atlantic County Department of Regional Planning & Development, Office of Geographic Information Systems. The map is prepared by Joseph Maher, Department Head, and Barry Hackett, Director of GIS. The map is prepared in January 2004 and printed in July 2004.


1,000 500 0 1,000 Feet