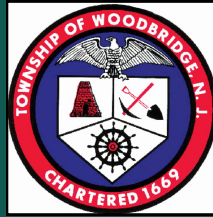


# Township of Woodbridge Environmental Resource Inventory

## 2019 Update



Mayor John E. McCormac

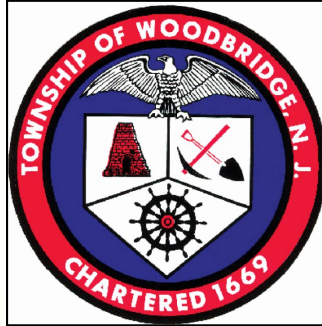
## **Township of Woodbridge Middlesex County Environmental Resource Inventory**

*2019 Update*

*Cover Photo: Ernest Oros Wildlife Preserve, Avenel*



# Acknowledgements



Mayor John E. McCormac

Caroline Ehrlich, Chief of Staff

## **Woodbridge Township Municipal Council**

Cory Spillar, Council President Councilman 3rd Ward

Lizbeth DeJesus, Council Vice- President Councilwoman-at-Large

Nancy Drumm, Councilwoman - First Ward

Howie Bauer, Councilman - Second Ward

Virbhadra N. Patel, Councilman-Fourth Ward

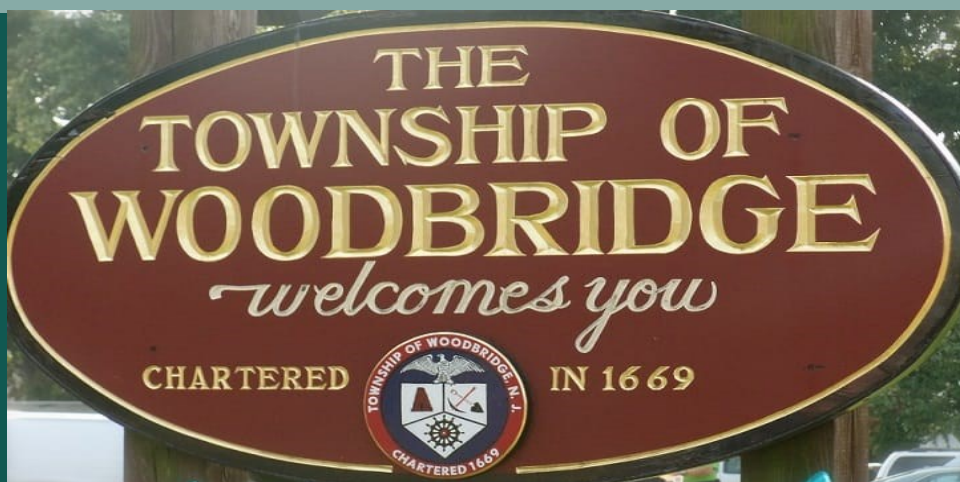
Debbie Meehan, Councilwoman - Fifth Ward

Kyle Anderson, Councilman-at-Large

Gregg M. Ficarra, Councilman-at-Large

Brian Small, Councilman-at-Large

*The 2019 ERI update seeks to address new conservation, preservation, carbon reduction alternatives, and sustainability initiatives undertaken Woodbridge Township since the 2008 Environmental Resource Inventory was initially drafted. Furthermore, this update outlines changes in land use paradigms and federal floodplain delineations.*



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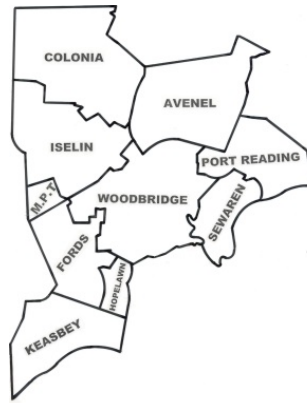
# Standard Operating Procedure for Evaluating ERI

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*"Ten Towns, One Community"*



TOWNSHIP OF WOODBRIDGE  
ENVIRONMENTAL RESOURCE INVENTORY UPDATE  
STANDARD OPERATING PROCEDURE (SOP)

May, 2019

The Township requires the annual review and maintenance (when applicable) to its Environmental Resource Inventory (ERI).

Said document was initially created in 2008, and encompasses a range of parameters detailing the municipality's critical natural infrastructure and aggregated information in relation to environmental conditions. As such, unvarying principles embedded within the initial description of the Township's ERI shall likely remain constant, such as, but not limited to, geology, soils, aquifers, topography, etc. Amendments noted within any update to the ERI shall not nullify said original document unless specifically stated, updates may include aspects of the Township's known resources which have changed as per federal, state, or local data, local innovative programs, and /or more detailed information. Updates to the Township's ERI provide a synopsis of actions and evidence to best ensure an accurate and well-documented account of locally pertinent information.

The goal of each update to the Environmental Resource Inventory is to inclusively examine and revise said ERI (if applicable) to discuss the holistic manner by which the Township manages, restores, and understands its relationship with its environmental resources. The Township will continue to update its Environmental Resource Inventory in relation to new information and methodologies used to produce better data. At said time all updates to the ERI shall be presented to the Township Municipal Council for review and voted on for approval. In addition, the Planning Board, Zoning Board, and Environmental Commission shall be made aware of any updates made to the inventory.

## Overview of 2019 ERI Updates

- Creating new cultural attractions through performing art
- Increase energy resilience
- Examine impervious cover reduction actions and associated negative heat effects
- Create safer and better managed floodplains
- Design and enhance places for people to connect with habitat
- Encourage biking to promote healthy active living and to enjoy the associated economic and environmental benefits
- Re-envision public places as public spaces for people to enjoy



# The Avenel Performing Arts Center

Woodbridge Township's Destination for the Performing Arts

### Profile

The Township of Woodbridge has one of the largest populations (99,585 according to the 2010 US Census; and estimated at 101,965 in relation to the 2017 Census) in New Jersey, and is as diverse in its people as it is in its geography. An “All-American City” through the National Civic League, Woodbridge has been recognized for its environmental policies and programs – including its Greenable Woodbridge initiatives, and was the first-ever recipient and multi-year winner of the Sustainable Jersey Champion Award. 2018 stood as the Ninth Year that Woodbridge garnered the Sustainable Jersey Champion title in the large municipality category. Furthermore, 2019 marked the grand opening of the Avenel Arts Center (see former brownfield update beginning on B-17). Situated 40 minutes from Manhattan and the Jersey Shore, Woodbridge features many of the amenities typically found in a thriving metropolis. The Township is home to Fortune 500 companies, a sophisticated road, rail, and shipping network, first-rate shopping, a full range of community programming, and quality neighborhoods for everyone.



## *Overview of 2019 ERI Update: Floodplains*

- FEMA - Special Flood Hazard Delineation Changes
- Super Storm Sandy and Relative Impacts
- NJ Blue Acres Program
- FEMA—CRS Program
- Floodplain Restoration

## *Woodbridge Township Floodplains*

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*\*Includes excerpts from the Township Floodplain Management Plan; adopted by Township Municipal Council August 21, 2018\**





## Updated Floodplains

Spread across 24.5 square miles with varying densities and land uses, Woodbridge is a mature suburb with over 2,000 acres of Special Flood Hazard Area's as delineated by FEMA's 2010 Effective Flood Insurance Rate Map (FIRM). Furthermore, FEMA's 2014 Preliminary FIRM (though not officially adopted by FEMA for flood insurance purposes, as of yet), includes over 3,000 acres of SFHA's. As a result of said increase in the Township's floodplains, and amendments to N.J.A.C. 7:13 (NJDEP Flood Hazard Area Control Act Rules), the Township contains over 1250 structures within SFHA's (over 980 of which are single family residential structures).



*Sewaren Boat Launch*

### ***Woodbridge Township Floodplains:***

The hydrology, hydraulics, and enormity of Woodbridge Township, contain portions of nine subwatersheds and encompasses ten towns: Avenel, Colonia, Fords, Hopelawn, Iselin, Keasbey, Port Reading, Menlo Park Terrace, Sewaren, and Woodbridge. Although these are separate unincorporated towns, the Township functions and prospers as one community. Each subwatershed is a distinct feature of the Township, and as such, floodplain vulnerability varies based on scale, scope, and weather patterns. The storm of record since 2008 is Super Storm Sandy (2012), which exceed FEMA 1% annual chance storm models by upwards of three feet within some of Township's tidal floodplains.

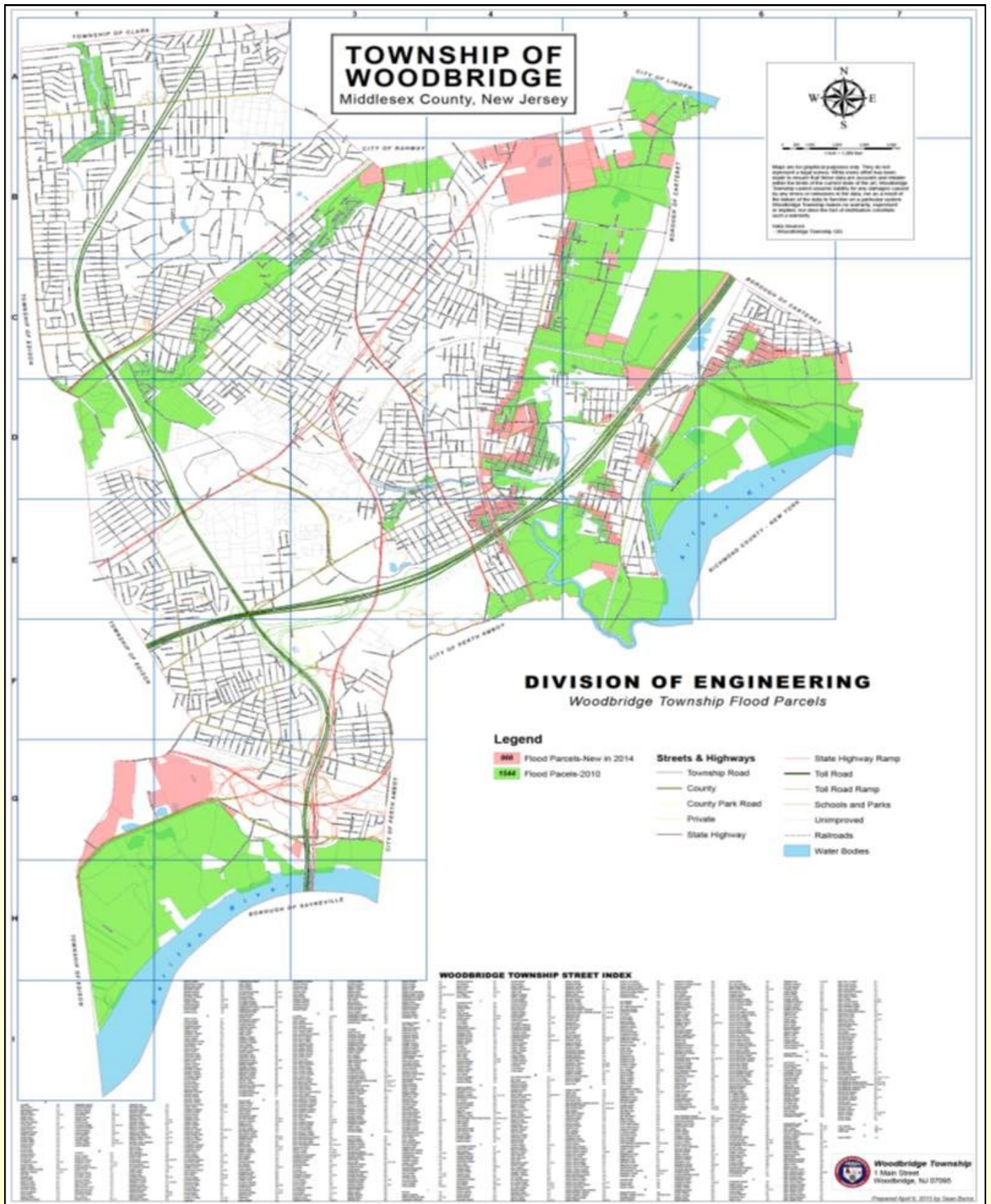
In the aftermath of Super Storm Sandy, Woodbridge Township has participated in various federal, state, county and local government and private sector programs aimed at reducing flooding impacts within the Township. The Township connected flood victims with the Federal Emergency Management Agency (FEMA) and other assistance agencies. Also, the Township participated in the New Jersey Department of Environmental Protection's Blue Acres Program which to date, has acquired over 140 residential properties from the Township's Special Flood Hazard Areas (SFHAs). Despite such ongoing programs, flooding problems persist at a number of low-lying properties within the Township.



*Sewaren Marina ~ Post-Super Storm Sandy*

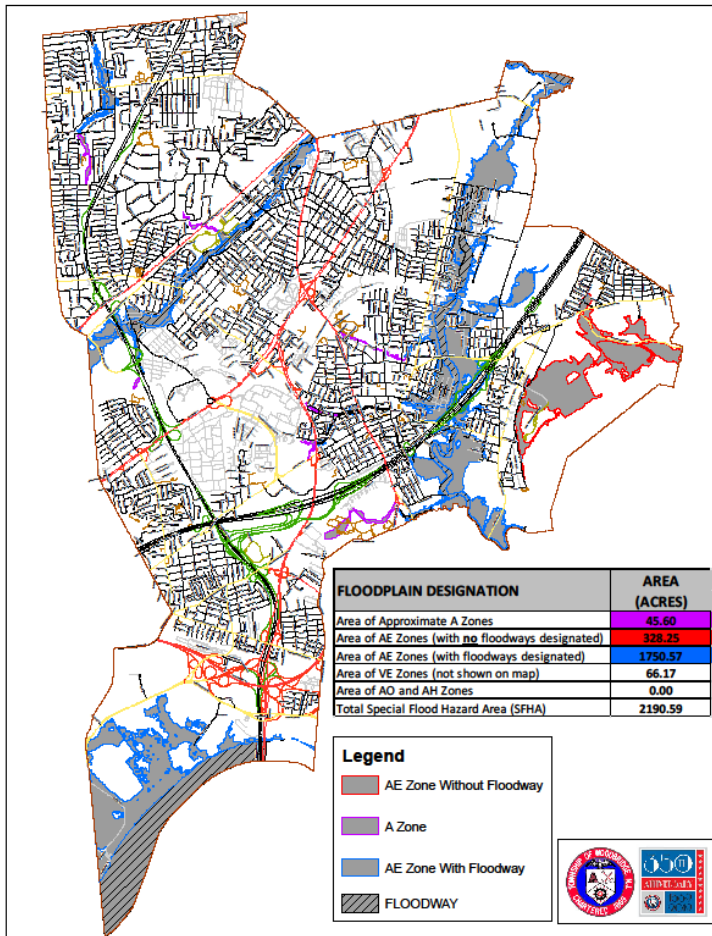
## ***Remembering Super-Storm Sandy***







## *Woodbridge Township Floodplains (History/Planning)*



Woodbridge Township is bordered to the east by the Arthur Kill tidal strait and to the south by the tidal Raritan River. The Woodbridge River extends from its headwaters (in the northeastern corner of the Township) to the Arthur Kill. The Township has a history of tidal flooding in low-lying areas adjacent to these waterways, including: (a) the Woodbridge Proper section, along the Woodbridge River and its tributaries, (b) the Sewaren and Port Reading sections, along the Arthur Kill; and (c) the Keasbey section, along the Raritan River. Also, fluvial flooding occurs along Pumpkin Path Brook which flows northerly from Colonia to the Township of Clark, and from the South Branch Rahway River, which crosses western sections of the Township, within the Colonia and Iselin sections. Approximately 19% (5.5 square miles) of Woodbridge Township lies within FEMA's Special Flood Hazard Area (SFHA), primarily areas adjacent to the Woodbridge River, Arthur Kill and South Branch Rahway River.

Woodbridge is an older community that was originally built to maximize wa-



terfront access for regional industry. Adjacent neighborhoods were built to support these industrial waterfront operations. Over 75 percent of the homes had been built before 1979, resulting in many vulnerable pre-FIRM (Flood Insurance Rate Map) structures. FEMA's statistics for Woodbridge Township indicate that there are presently 433 Pre-FIRM flood insurance policies in force (versus 119 Post-FIRM policies).

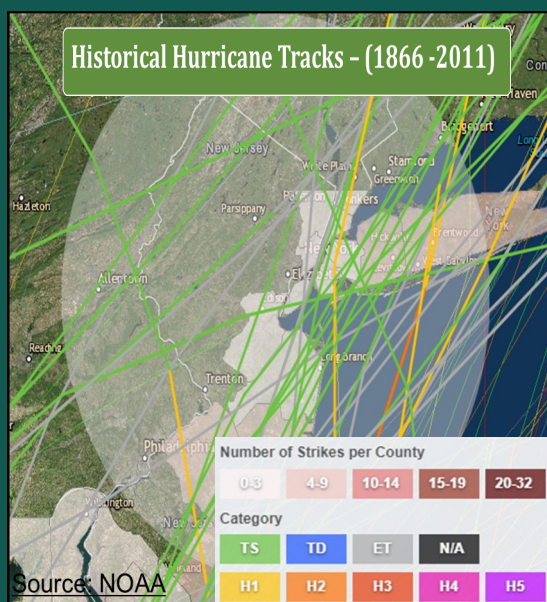


Before suburban expansion during the industrial revolution, much of tidal floodplain of Sewaren (adjacent to the Arthur Kill) functioned as a resort, hotel, and boat house known as Boynton Beach. Although the name “Boynton Beach” lives on even to this today, remnants of the Township’s tidal tourism have long been washed away by severe storm systems. In order to ensure that the Township adaptively manages to impending storms, a variety of efforts have been undertaken to help build resilience, safety, and recreation while managing floodplains more wisely.

## Overview of 2019 ERI Update: Floodplains



Approximate area of inundation in Woodbridge during Super Storm Sandy (Source: USGS Sandy Storm Sandy Tide Mapper)



### Woodbridge Township Floodplains (FEMA-CRS)



To reduce flood damages, and increasing flood-insurance costs, Woodbridge Township joined the Federal Emergency Management Agency's (FEMA's) Community Rating System (CRS) Program. This Program encourages and recognizes community floodplain management and planning activities that exceed the minimum re-

quirements of the National Flood Insurance Program (NFIP). CRS rewards such activities by discounting flood insurance premiums for policy holders within a participating community. Due to a concerted effort on the behalf of the Township, in 2019 the Township was awarded CRS Class Rating of Six out of Ten (6 out of 10). Said rating correlates to a 20% discount, on all flood insurance policies with the Township's special Flood Hazard Area. The goals of the CRS are summarized as follows:

- to reduce and avoid flood damage to insurable property;
- to strengthen and support the insurance aspects of the NFIP; and
- to foster comprehensive floodplain management.

By supporting these common goals, Woodbridge Township property owners will become more flood resilient, and less burdened by rising insurance costs. Accordingly, this program was prepared to:

1. Help minimize risks to human life within hazardous floodplains, and reduce the amount of flood damage sustained during future flood events.
2. Enhance Township resilience and increase hazard mitigation preparedness by improving readiness for climate related emergency situations.
4. Strengthen the Township's vulnerability to critical infrastructure and community assets in relation to special flood hazard area's (SFHA) and sea level rise (based on global estimates by the year 2050).
5. Protect and enhance natural floodplain functions in order to safeguard and promote biodiversity and ecological integrity.



# FEMA - CRS Approval Letter

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FEMA

April 1, 2019

The Honorable John E. McCormac  
Mayor of Woodbridge  
01 Main Street  
Woodbridge, NJ 07095

Dear Mayor McCormac:

I want to congratulate your community on its application to the National Flood Insurance Program (NFIP) Community Rating System (CRS). The Department of Homeland Security, Federal Emergency Management Agency (FEMA), has verified that the voluntary actions undertaken by your community exceed the minimum standards of the NFIP and meet the criteria for a CRS Class 6 rating. The floodplain management activities implemented by your community qualifies it for a 20 percent discount in the premium cost of flood insurance for NFIP policies issued or renewed in Special Flood Hazard Areas on or after May 1, 2019. This savings is a tangible result of the flood mitigation activities your community implements to protect lives and reduce property damage.

Please note Preferred Risk Policies, applicable in Zones B, C, and X, on your community's NFIP Flood Insurance Rate Map, are not eligible for the CRS discount. Standard rated flood insurance policies in Zones B, C, X, D, AR, and A99 are limited to a CRS discount of ten percent in Class 1-6 communities and five percent in Class 7-9 communities. The rates for these zones already reflect significant premium reductions.

If there are no NFIP noncompliance actions, the CRS rating for your community will automatically be renewed annually and a notification letter will not be sent to your community. This renewal will occur as long as your community continues to implement the CRS activities you certify annually. If no additional modifications or new CRS activities are added, the next verification visit for your community will be in accordance with its established five-year cycle. In the interim, FEMA will periodically send the *NFIP/CRS Update* Newsletter and other notices to your CRS Coordinator to keep your community informed.

I commend you on your community actions and your determination to lead your community to be more disaster resistant. This commitment enhances public safety, property protection, and protects the natural functions of floodplains, and reduces flood insurance premiums.

If you have any questions or need additional information, please contact the FEMA Region II Office, CRS Coordinator, Marianne Luhrs, by telephone at (347) 515-4874.

Sincerely,

A handwritten signature in black ink that reads "William H. Lesser".

William H. Lesser, CRS Coordinator  
Federal Insurance and Mitigation Administration

Enclosure

cc: Mr. Thomas C. Flynn, CRS Coordinator



COMMUNITY  
RATING  
SYSTEM

VERIFICATION  
REPORT

---

**Township of Woodbridge, NJ**

**Verified Class 6**

NFIP Number: 345331

New Application

Date of Verification Visit: August 28, 2018

This Verification Report is provided to explain the recommendations of Insurance Services Office, Inc. (ISO) to DHS/FEMA concerning credits under the Community Rating System (CRS) for the above named community.

A total of 2256 credit points are verified which results in a recommendation that the community improve from a CRS Class 10 to a CRS Class 6. The community has met the Class 6 prerequisite with a Building Code Effectiveness Grading Schedule (BCEGS) Classification of 3/3. The following is a summary of our findings with the total CRS credit points for each activity listed in parenthesis:

**Activity 310 – Elevation Certificates:** The Construction Department maintains elevation certificates for new and substantially improved buildings. Copies of elevation certificates are made available upon request. (38 points)

**Activity 320 – Map Information Service:** Credit is provided for furnishing inquirers with basic flood zone information from the community's latest Flood Insurance Rate Map (FIRM). Credit is also provided for the community furnishing additional FIRM information, information about problems not shown on the FIRM, flood depth data, historical flood information, and natural floodplain functions. The service is publicized annually and records are maintained. (90 points)

**Activity 330 – Outreach Projects:** Credit is provided for informational outreach projects that include flood handouts, general outreach projects that include posters, flood videos, and mailings, and a targeted outreach project to the repetitive loss area properties. These projects are disseminated annually. Credit is also provided for having a pre-flood plan for public information. (122 points)

**Activity 340 – Hazard Disclosure:** Credit is provided for state regulations requiring disclosure of flood hazards. (15 points)

**Activity 350 – Flood Protection Information:** Documents relating to floodplain management are available in the reference section of the Woodbridge Public Library. Credit is also provided for floodplain information displayed on the community's website. (86 points)

**Activity 360 – Flood Protection Assistance:** Credit is provided for offering one-on-one advice regarding property protection. (25 points)

**Activity 410 – Floodplain Mapping:** Credit is provided for adopting flood studies for areas on the FIRMs that exceed minimum mapping standards. (109 points)

**Activity 420 – Open Space Preservation:** Credit is provided for preserving approximately 37 percent of the Special Flood Hazard Area (SFHA) as open space, protecting open space land with deed restrictions, and preserving open space land in a natural state. (631 points)

**Activity 430 – Higher Regulatory Standards:** Credit is provided for enforcing regulations that require freeboard for new and substantial improvement construction, enclosure limits, local drainage protection, and coastal A Zone structures to meet building and enclosure criteria. Credit is also provided for the enforcement of building codes, a BCEGS Classification of 3/3, state mandated regulatory standards, and regulations administration. (474 points)

**Activity 440 – Flood Data Maintenance:** Credit is provided for maintaining and using digitized maps in the day to day management of the floodplain. Credit is also provided for establishing and maintaining a system of benchmarks. (154 points)

**Activity 450 – Stormwater Management:** The community enforces regulations for stormwater management, low impact development, soil and erosion control, and water quality. (272 points)

**Section 502 – Repetitive Loss Category:** Based on the updates made to the NFIP Report of Repetitive Losses as of July 31, 2018, the Township of Woodbridge, NJ has 37 repetitive loss properties and is a Category B community for CRS purposes. All requirements for a Category B community have been met. (No credit points are applicable to this section)

**Activity 510 – Floodplain Management Planning:** Credit is provided for the adoption and implementation of the Woodbridge Township Floodplain Management Plan on August 21, 2018. A progress report must be submitted on an annual basis. An update to the credited plan will be due by October 1, 2023. (50 points)

**Activity 520 – Acquisition and Relocation:** Credit is provided for acquiring and relocating 52 buildings from the community's regulatory floodplain. (190 points)

**Activity 710 – County Growth Adjustment:** All credit in the 400 series is multiplied by the growth rate of the county to account for growth pressures. The growth rate for Middlesex County, NJ is 1.05.

Attached is the Community Calculations Worksheet that lists the verified credit points for the Community Rating System.

**CEO Name / Address:**

The Honorable John E. McCormac  
Mayor of Woodbridge  
01 Main Street  
Woodbridge, New Jersey 07095

**CRS Coordinator Name / Address:**

Thomas C. Flynn  
Floodplain Manager  
01 Main Street  
Woodbridge, New Jersey 07095  
(732) 602-6057

Date Report Prepared: December 12, 2018

**Community :** Township of Woodbridge, NJ

**NFIP Number :** 345331

**720 COMMUNITY CREDIT CALCULATIONS (New Application):**

**CALCULATION SECTION :**

Verified Activity Calculations:

Credit

c310	38					38
c320	90					90
c330	122					122
c340	15					15
c350	86					86
c360	25					25
c370						
c410	104	x CGA	1.05	=		109
c420	601	x CGA	1.05	=		631
c430	451	x CGA	1.05	=		474
c440	147	x CGA	1.05	=		154
c450	259	x CGA	1.05	=		272
c510	50					50
c520	190					190
c530						
c540						
c610						
c620						
c630						

**Community Classification Calculation:**

cT = total of above

cT = 2256

Community Classification (from Table 110-1):

Class = 6

**CEO Name/Address:**

The Honorable John E. McCormac  
Mayor of Woodbridge  
01 Main Street  
Woodbridge, New Jersey 07095

**CRS Coordinator Name/Address:**

Thomas C. Flynn  
Floodplain Manager  
01 Main Street  
Woodbridge, New Jersey 07095  
(732) 602-6057

Date Report Prepared: December 12, 2018

AW-720

## ***Woodbridge Township Floodplains (Known Causes / Intro to Blue Acres)***

Flood damages in Woodbridge Township are caused by tidal and fluvial flooding. Tidal flooding is caused by coastal storms, which consist of two general types: (1) tropical storms and hurricanes; and (2) extra-tropical storms or nor'easters. The former consist of warm-core, cyclonic systems generated in the tropics. These systems derive their energy from oceanic heat and evaporation. Nor'easters are cold core, cyclonic systems that usually form in areas where strong surface temperature gradients coincide with a strong jet stream. Intense winds generated by both of these storms tend to pile water against the coastline, and raise tide levels above normal to create a "storm surge." Other factors contributing to storm surge include falling atmospheric pressure levels, mildly sloping coasts and "setup" due to breaking waves.

As noted above, Woodbridge Township has a history of tidal flooding. The most extreme flooding occurred in 2012 during Super Storm Sandy, when the U.S. Geological Survey measured a High Water Mark (HWM) elevation of 12.5 feet NAVD88 at Station #NJMID07292, adjacent to the lower Woodbridge River. All low-lying areas adjacent to the Woodbridge River and Arthur Kill were inundated during this Storm.

Besides Sandy, Woodbridge Township has experienced several other major coastal storm events, including Hurricane Donna (1960); the Great Nor'easter of December 1992, and Tropical Storm Irene (2011). While storm tide data are unavailable for Woodbridge River during such events, data are available at NOAA's primary gaging station at Sandy Hook, NJ. Here, measured peak storm tides are *typically about 10% lower* than in Woodbridge Creek. The second tier of peak storm tides ranged from approximately 6-8 feet NAVD88 at Sandy Hook, or about 3-5 feet lower than Super Storm Sandy's peak tide.

Thus, these second-tier coastal storm events – which occur at decadal intervals, on-average -- also caused flooding in low-lying areas of the Township (i.e., where ground elevations are less than about 7-9 feet, NAVD88). As the lowest ground elevations at the outer edges of developed areas of the Township are approximately 5-6 feet NAVD88, these decadal storm events have the potential to cause up to 4 feet of inundation. Note that some of these events (e.g., Tropical Storm Irene and Floyd) were accompanied by intense rainfall, which exacerbated flooding impacts.





TOWNSHIP OF WOODBRIDGE, MIDDLESEX COUNTY, NEW JERSEY

## STRATEGIC RECOVERY PLANNING REPORT

POST SANDY PLANNING ASSISTANCE GRANT

NEW JERSEY DEPARTMENT OF COMMUNITY AFFAIRS, OFFICE OF LOCAL PLANNING SERVICES

MAY 2014

Through the Post Sandy Planning Assistance Grant Program administered by the New Jersey Department of Community Affairs, Office of Local Planning Services, the Township was awarded a means by which to plan for policies and methods to best ensure a more resilient future

As a result of said planning, The Township established an Open Space Conservation/Resiliency Zone (OSC/R) to help minimize the risk to residences within floodplains, and to reduce the amount of flood damage sustained during future flood events. The areas designated as within the Open Space Conservation/Resiliency Zone are located within the Watson Avenue, Crampton Avenue, South Roberts Street, and Saints Field neighborhoods of the Township.

The OSC/R codifies permitted uses of structures to a higher standard than that of the NFIP and N.J.A.C.7:13. the zone also defines street arrangement, landscaping restrictions, buffer requirements, and required registration for all property owners within said zone. A change in tenancy of a structure within the OSC/R Zone triggers building design standards, and new construction is not permitted. In addition, all landscaping vegetation shall be planted in accordance with the recommendations made in the Flood Plain Restoration Plan prepared by the Rutgers Cooperative Extension, dated January 29, 2016. As determined in that Plan, vegetation shall be planted based on its habitat: Edge, Floodplain Forest, Meadow, Saline Marsh, and Scrub/Shrub.

A minimum 12-foot wide buffer is required where the OSC/R Zone abuts the adjacent residential zone. The buffer is to be designed to provide a visual buffer to the residential zone and shall be planted with soil-appropriate plants.

Development of Codes, Ordinance, Regulations,  
and Design Standards  
&  
Permit and Application Process Quality Improvements

For the Township of Woodbridge  
Middlesex County  
New Jersey

POST SANDY PLANNING ASSISTANCE PROGRAM

New Jersey Department of Community Affairs  
Office of Local Planning Services

August 12, 2016

Prepared by:



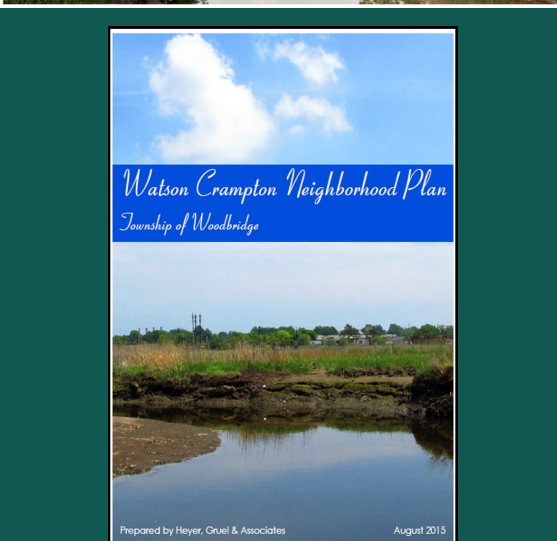
Heyer, Gruel & Associates  
Community Planning Consultants  
236 Broad Street, Red Bank, NJ 07701  
(732) 741-2900



*Saints Field Neighborhood Plan*  
Township of Woodbridge



*South Roberts Neighborhood Plan*  
Township of Woodbridge



*Watson Crampton Neighborhood Plan*  
Township of Woodbridge



Heidelberg Ave. in Watson Crampton neighborhood

## NJDEP Blue Acres Program

As per the State of New Jersey Department of Environmental Protection: “The Green Acres, Farmland, Blue Acres, and Historic Preservation Bond Act of 2007 authorized \$12 million for acquisition of lands in the floodways of the Delaware River, Passaic River or Raritan River, and their respective tributaries, for recreation and conservation purposes. An additional \$24 million was approved by the voters in the Green Acres, Water Supply and Floodplain Protection, and Farmland and Historic Preservation Bond Act of 2009.

Properties (including structures) that have been damaged by, or may be prone to incurring damage caused by, storms or storm-related flooding, or that may buffer or protect other lands from such damage, are eligible for acquisition. All Blue Acres acquisitions must be from willing sellers.



While policy and zoning standards were being developed in 2015, simultaneously through the NJ Blue Acres Program, Woodbridge Township acquired over 140 floodprone properties throughout the municipality. The majority of these properties are concentrated within the Watson Crampton neighborhood, an ~100-acre area bounded on three sides by the Woodbridge River, Heards Brook, and Wedgewood Brook. As such the Township began concerted efforts towards framing and implementing floodplain ecological restoration in 2015 with Rutgers Cooperative Extension (RCE). RCE developed floodplain restoration plans focusing on two primary objectives: 1) protect safety and health of Township residents by encouraging homeowners to relocate permanently to higher elevation areas; and 2) restore the natural function of the floodplain to promote storage and infiltration of stormwater in appropriate areas, particularly during significant storm events.

The RCE approach was to maximize the use of native vegetation to increase the ecosystem services provided by the open space within the project area, particularly to maximize stormwater infiltration and flood storage. Recommendations for buffer zones between residential areas and open space focus on maximizing aesthetic value while decreasing maintenance requirements. Public access will highlight scenic vistas and habitat features, while working to physically connect the Watson-Crampton neighborhood to surrounding Township neighborhoods and open space resources. The restoration plan calls for a mosaic of habitat types, including saline marsh, floodplain forest, scrub/shrub habitat and meadow, within the project area and capitalizes on tying in existing stormwater infrastructure to vegetated swales and other green infrastructure to mitigate flooding. In 2016, Woodbridge Township and RCE began implementation of Phase 1 of the restoration plan, removing ~2 acres of impervious surface, planting 50 native trees, and installing 3 acres of native warm-season meadow. In 2017, the team removed ~5 acres of *Phragmites australis* and restored 8 acres of native woodland through invasive species management and the planting of 1,000 native trees and shrubs. The Township's continued work with Rutgers has been recognized by the New Jersey Association for Floodplain Management (NJAFM), who awarded Woodbridge with the 2017 Outstanding Floodplain Management Award.





## *Overview of 2019 ERI Update: Biking and Pedestrian Mobility*

- Increase bicycle ridership
- Create safe biking routes
- Where applicable design intersections that are clearly marked allowing for safe crossing of all modes of transportation and that allow enough time for pedestrians to cross safely
- Encourage biking and walking to promote healthy active living and to enjoy the associated economic and environmental benefits
- Re-envision public places as public spaces for people to enjoy



## *Woodbridge Township Biking and Pedestrian Mobility*

*(This page has been left intentionally blank)*

## Goals & Objectives

- Implement and maintain a Township wide connected and safe bicycle network which will also promote regional connectivity.
- Provide bike parking and support facilities.
- Transit system connectivity
- Multi –modal transportation network
- Model for other municipalities
- Connect with Greenway and trails.
- Implement mileage markers where appropriate.
- Connect to mass transit, downtowns, schools, libraries, community center, and parks.



## Bike and Pedestrian Mobility

Walking and bicycling are important facets of a mobility, economic development, public health, and environmental sustainability. While walking and cycling have long been recognized as important activities, mobility and access as measured in traditional planning practices focused on motor vehicle travel. Furthermore, there is increasing recognition that balanced transportation choices are important to individual travelers and society overall.



*Proposed bike lanes on existing Main St. in Woodbridge*

Bikable travel will benefit Woodbridge Township in many ways. Inter-connected bikeable travel removes barriers to mobility and increases the safety and comfort of pedestrians and cyclists, broaden travel options for non-drivers, reduce conflicts between motorists and other road users, reduce automobile traffic and the problems it creates, increase recreational activity and exercise, encourage nonmotorized tourism, better accommodate people with disabilities, and help create more livable communities. Improved cycling conditions can benefit everyone in Woodbridge Township regardless of how much they use nonmotorized travel modes.

Walking and biking are affordable ways of incorporating physical activity into people's daily routine helping to fight obesity, chronic illness and to improve a community sense of wellbeing.

Walkable and bikeable communities make it more convenient for people to know their neighbors. When people walk or bike instead of driving, less air pollution is the result and everyone can breathe more easily. Improving the connectivity of bike and walking networks will provide more direct, convenient and safe travel routes and reduce the dependency on the car.



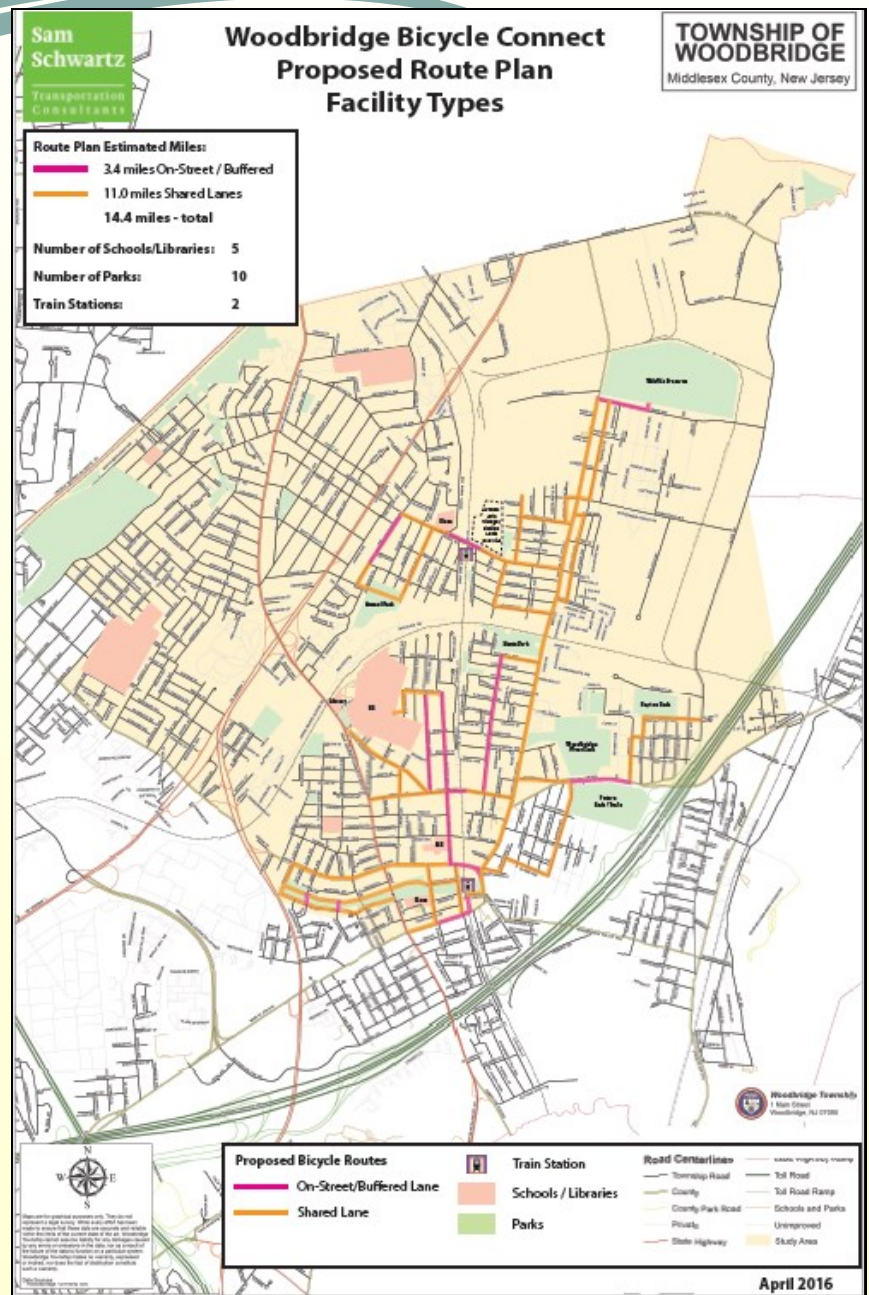


# BIKEABLE WOODBIDGE PLAN 2019

The rendering (right) denotes the preapproved NJDOT plans whereby Woodbridge Township has already begun to make the necessary connections of it's vibrant business districts and local open spaces. These crucial connections help to relieve stress on the roads, and have been well-received by the community.



## Smart Growth and Interconnectivity





In 2019, Woodbridge Township will be implementing a bicycle share project that will move the Township towards a more mobile future.

By partnering with P3GM to bring bike share to Woodbridge Township, this transportation alternative project will work in conjunction with the Township's Complete Street Policy to expand travel choices and reduce traffic congestion, strengthen our local economy, protect our environment, promote healthy lifestyles, and improve resident's quality of life.

P3GM will have strategically located bicycle share stations within Woodbridge Township. Bicycles will be equipped with secure bike locks and appropriate safety elements such as lights, reflective strips, bells, etc. Bicycles will have baskets or compartments for carrying typical items, such as laptop bags or groceries, and be equipped with kickstands and easily adjustable saddles to accommodate users with a range of heights. The bike share system will provide a smartphone app (iOS, Android) to guide users to nearby stations or nearby vacant docks and to notify users of their time limitations.



### ***Bike and Pedestrian Mobility (continued)***

Working towards achieving the goals of increased walkability and bikeability, Woodbridge Township's Municipal Council passed a resolution to adopt, support, and promote a Complete Street policy within the Township in July 2011.

Additionally in 2017, Woodbridge Township began accepting Requests for Proposals for a bike share program. Woodbridge Bike Share has been designed to continue to encourage cycling as a mode of transportation and to connect different sections of the Township via bike compatible roadways. This will increase visibility, tourism, and economic opportunities.

Bikable Woodbridge is consistent with the goals and objectives of the North Jersey Transportation Planning Authority, Together North Jersey's regional planning process, and Keep Middlesex Moving, Inc., Middlesex County's non-profit transportation management association. Transit system connectivity is an integral tool to link opportunities in economic growth, environmental protection, education, cultural and recreational opportunities, and quality of life goals. This program will compliment and add value to the goals of North Jersey Transportation Planning Authority, Together North Jersey's regional planning process, and Keep Middlesex Moving, Inc.





### ***Bike and Pedestrian Mobility (Health Benefits)***

The bicycle is one of the most environmentally efficient modes of transportation. By using a renewable energy source, the human body, the bicycle, in contrast to the automobile, is non-polluting. The bicycle also uses much less space than the automobile, and is considerably quieter than other modes of transportation. These benefits are especially attractive in Woodbridge Township, as we struggle with noise and congestion issues.

The bicycle also has tremendous health benefits. Cycling is ranked among the top three exercises for improving cardiovascular fitness. According to the U.S. Center for Disease Control, the most effective activity regimens are moderate in intensity, individualized and incorporated into daily activity. Cycling to work, school or shopping as part of one's regular daily routine can be both a sustainable and time-efficient exercise regimen for maintaining acceptable levels of fitness.



*New visions for Pearl Street and the west entrance to the Train Station and Parker Press Park are among the principle ideas for the future of downtown Woodbridge*

- Mobility, particularly important for non-drivers (including children and the elderly).
- Financial savings.
- Exercise, leading to increased health and well-being (reduced heart disease, stroke, hypertension, obesity, diabetes, colon cancer, osteoporosis, stress, and depression).
- Increased social interaction, opportunities to meet neighbors.
- Reduced traffic congestion.
- Road and parking facility savings.
- Reduced motor vehicle air, water, and noise pollution.
- More livable communities.
- Increased appeal and access for tourists.



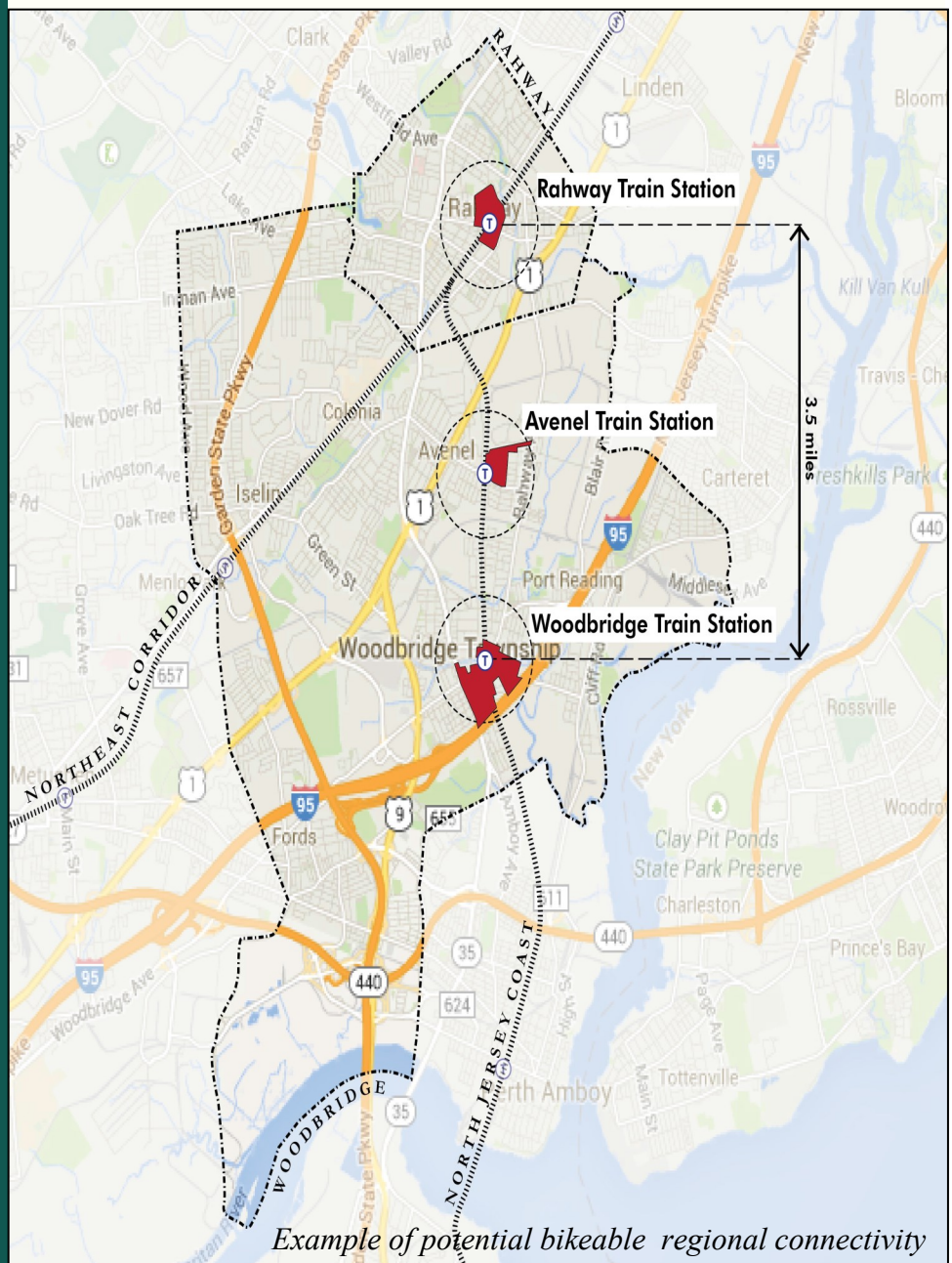


## Regional Objectives

- Increase biking by way of regional corridors
- Lower pedestrian and bicycle accidents
- Improved critical roadway connectivity
- Reduce carbon footprint by enhancing infrastructure for non-traditional methods of transportation
- Enhanced Bikeable miles of roadways added
- Enhanced Bikeable miles of off road trails added
- Bikeable Activity Programs
- Reduce non-point source pollution by enhancing infrastructure for non-traditional methods of transportation
- Increase regional promotion of healthy lifestyles
- Enhance buy local initiatives
- Encourage private sector initiatives like bike share programs
- Reduce regional traffic congestion

### *Bike and Pedestrian Mobility (Regional Significance)*

Community members of Woodbridge Township will be provided with a unique opportunity to discover regional corridors that connect the Township with other areas of the state. The design of non-traditional ways to connect towns and cities would be fortified through biking connectivity. This proposed transportation alternative project will work in conjunction with the Township Complete Street Policy to expand travel choice, connect to regional corridors, reduce traffic congestion, strengthen our local economy, protect our environment and improve our resident's quality of life.



## *Bike and Pedestrian Mobility (Visioning)*

There are many reasons to plan for nonmotorized transportation. Walking, cycling, jogging and skating are increasingly popular for transport and recreation. Safe and convenient nonmotorized travel provides many benefits, including reduced traffic congestion, user savings, road and parking facility savings, economic development and a better environment. This section presents a brief overview of the importance of considering nonmotorized transport in transport plans.

The ultimate goal of transportation is to provide access to goods, services and activities. In general, the more transportation options available, the better the access. Nonmotorized modes are important transport choices,

for trips made entirely by walking or cycling, and to support public transport. In urban areas, walking and cycling are often the fastest and most efficient way to perform short trips. A built environment that is hostile to non-motorized transport reduces everybody's travel choices. The result of this "automobile dependency" is increased traffic congestion, higher road and parking facility costs, increased consumer costs, and greater environmental degradation. Adequate pedestrian and cycling conditions are essential to guarantee everybody a minimal level of mobility.

Biking should be a part of many roadway environments, and attention must be paid to it's presence in rural as well as urban areas. Because of the demands of vehicular traffic in congested urban areas, it is often extremely difficult to make adequate provisions for pedestrians. Yet this must be done, because bikeability and walkability are the lifeline of our urban areas, especially in the downtown and other retail areas. In general, the most successful shopping sections are those that provide the most comfort and pleasure for pedestrians.

Walking, cycling and skating are enjoyable and healthy activities. They are among the most popular forms of recreation. Public health officials increasingly recognize the importance of frequent aerobic exercise.

Many sections of Woodbridge are traditionally walkable, and the existing network of bike lanes, trails, and other facilities has improved the safety and comfort of bike travel. Nevertheless, there are still gaps in the pedestrian and



*Proposed rendering of Bikeable downtown Woodbridge*

bicycle networks. Improving the connectivity of these networks will provide more direct, convenient and safe travel routes for walking and bicycling; provide more travel choices and reduce dependency on automobiles; and strengthen the community by increasing opportunities for neighbors to interact.



*Example of potential bike lane*

## *Overview of 2019 ERI Update: Former Brownfields*

- The Township of Woodbridge prioritized potential brownfield sites to be redeveloped or recreated as restored conservation areas. These sites were utilized for industrial purposes for a number of years and much of their value was degraded. The redevelopment and restoration of these subject brownfields are critical for revitalization.
- The Township prioritized sites by focusing on properties from the Township's designated Brownfield Development Area's and Redevelopment Areas. The sites were ranked in the following four categories: • Ownership • Proximity to Residential Properties • Redevelopment Potential • Potential to Reduce Blight. The Woodbridge Township Brownfield Inventory will be updated annually at the end of each calendar year (when applicable). The Planning Department will update the Inventory with input from other municipal departments, including the Township Department of Health, Department of Public Works and the Township Administration. The redevelopment and cleanup of these sites will be a great benefit to the residents of Woodbridge.



## *Woodbridge Township Former Brownfields*

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# BCONE

## BROWNFIELD COALITION OF THE NORTHEAST

### Woodbridge Former Brownfield Summaries

The Township of Woodbridge has partnered with NJDEP/Office of Brownfield Reuse in an effort to remediate/redevelop brownfield sites in the Keasbey Redevelopment Zone/Brownfield Development Area. In varying stages of remediation and redevelopment, these sites either currently are or will provide passive open-space/recreation, expand/relocate existing businesses, attract new businesses, create an eco-park, and house a power plant.

#### 1. CPV Woodbridge Energy Complex

One of the projects in the construction phase is the 27.28 acre parcel of the Former 185 acre Nuodex Corporation Site. This parcel will be developed into the Woodbridge Energy Center. This \$845 million 700-megawatt natural gas-fueled facility generates enough electricity to power 700,000 homes, reduce the State's reliance on imported energy, reduce energy costs for residences and businesses, create over 500 construction jobs, generate \$3.5 million in ratables, create 25 permanent jobs with a payroll of \$50 million, and remediate/redevelop a former chemical contaminated site that has sat vacant and contaminated for decades.



A rendering of the \$845 million CPV Woodbridge Energy Center project.

# BDA ➡ CPV Woodbridge Energy Center

Situated on 27.5 acres at the Keasbey Redevelopment Zone - BDA

700 mega-watt natural gas-fueled electric generating facility to Produce electricity to power 700,000 homes

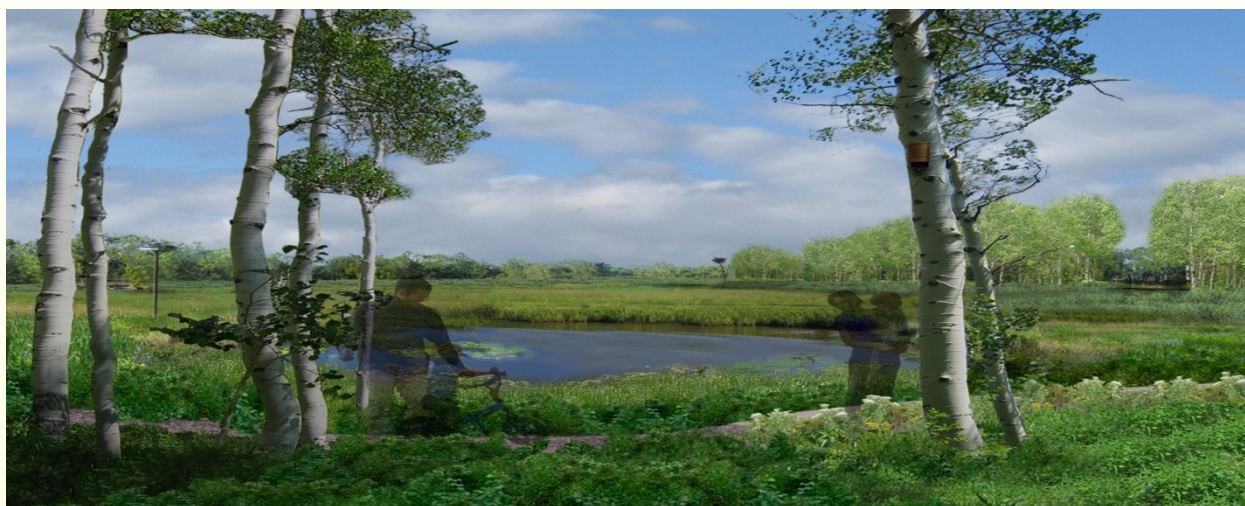
Over \$100 million in tax revenues over 30 years





## 2. Nuodex Site/Project

The remainder of the Former 185 acre Nuodex Corporation Site is also in the remedial/construction phase. This site has a long history of mining, industrial activities, and chemical manufacturing dating back to the 19<sup>th</sup> and early 20<sup>th</sup> centuries. All environmental media (soil, groundwater, surface water, sediments, air, storm water, wetlands, etc.) in-and-around this site have been impacted severely by the industrial activities from the past. The site was primarily contaminated with chlorotoluene, toxaphene, lead, base neutrals acid extractable, pesticides, metals, and low levels of uranium. Once remediated, this site will be restored into the Woodbridge Wetland Park which will include approximately 90 acres of open water habitats, freshwater wetlands, coastal wetlands and riparian areas, as well as a public access system that includes a network of walking trails, boardwalks, landscape viewing areas, public gathering space, wildlife breeding and nesting structures and educational signage describing the local ecology.





Renderings of the Woodbridge Wetland Park

### 3. Morris Property

This site is approximately 26 acres and until recently was owned by numerous chemical companies but always remained vacant. It's currently owned by the Township and will be restored and incorporated into the Woodbridge Wetland Park. The site is densely vegetated with wetlands and two large ponds. The site is contaminated with historic fill and an adjacent off-site source has impacted the site's ponds and sediments with PCBs and Bis(2-ethylhexyl) phthalate. The impact from the off-site source is currently being investigated by the discharger and all that is left to close-out the groundwater is two-rounds of groundwater sampling.

### 4. Gentempo Site

This site is approximately 17.6 acres, was owned by numerous commercial and industrial entities from 1931 to 1963, operated as a private landfill in the 1960s and 1970s, and ceased its landfill operation in 1974. The site is densely vegetated, the landfill has not been properly closed, current soil and groundwater quality is unknown, and a PA/SI is required to assess the nature and extent of its contamination. The site owner is currently in the process of negotiating sale with several developers. The end use will remain commercial/industrial.

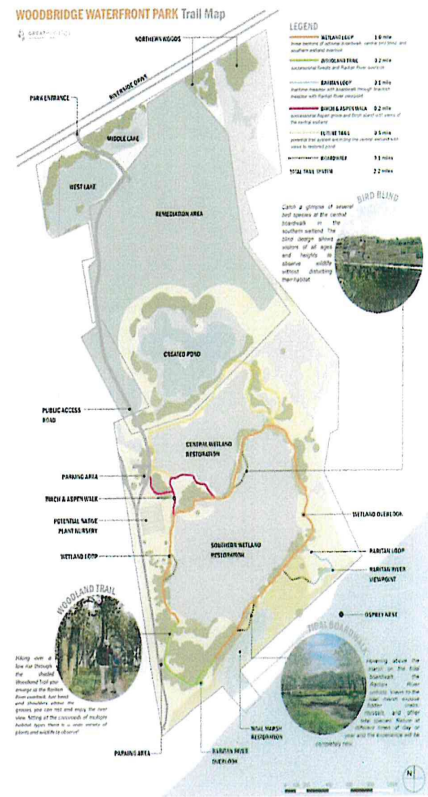
### 5. Ashland/Veridian Site

This site is 18.4 acres and produced phenolic resins and antioxidant food additives, among other products. The site was heavily contaminated with historic fill, LNAPL, VOC and SVOC. The remedial action required extensive removal and offsite disposal of impacted soils, de-watering and treatment of excavated groundwater, characterization and reuse of concrete and building structures, and engineering and institutional controls. Site groundwater remediation is ongoing and may include some form of treatment, monitoring, and natural attenuation. In May 2013, the site was paved to provide parking for semi-trucks and trailers from the nearby Federal Express terminal.



# Woodbridge Waterfront Park

Two miles of hiking trails, boardwalks along the river and upland areas, bird blinds, boating areas, ecological signage and other passive recreation areas.



## 6. Wakefern Site

Prior to its redevelopment as a distribution center, the Wakefern site had been part of a long-abandoned and vacant site previously owned by Center Realty. The site's history includes designation as a "U.S. Military Reservation" as part of the U.S. Army's Raritan Arsenal, formerly located on the Raritan River in Edison and Woodbridge Townships. The area was designated in need of redevelopment in 1996. In 2001, Wakefern Food Corporation, the largest retailer-owned cooperative in the United States, constructed a distribution center at the site, including a 487,209 square foot warehouse. In 2010, the warehouse underwent a 90,000 square foot expansion, which added 25 new loading dock doors, for a total of 100, increasing the warehouse's pallet capacity by 28 percent. The expansion further increased Wakefern's ability to service its 47 member companies, which individually own and operate more than 228 supermarkets under the ShopRite banner in New Jersey, New York, Connecticut, Pennsylvania, Maryland, and Delaware. The facility ships more than 1.5 million cases of product each week and handles all incoming and outgoing meat, dairy/deli, fresh bake, and appy deliveries for all ShopRite and PriceRite stores. The Wakefern facility is a PILOT project that has made significant contributions to Woodbridge Township projects and stands as a significant example of a productive development project that has benefited the economy of the entire Central Jersey region.



Photograph of the Wakefern Foods Distribution Center

## 7. FedEx Ground

The FedEx Ground facility is another distribution center located on the same formerly-vacant property as the Wakefern Foods Distribution Center. FedEx Ground is 555,000 square feet, which includes over 1,000 parking spaces and 400 loading spaces. Parking spaces have been restriped around the southern end of the building to accommodate the loading dock expansion, and minor rehabilitation and striping improvements are happening throughout the site. FedEx Ground is also a PILOT, and, through initial construction and expansion, continues to provide funding for Township projects, programs, and events.





Photograph of the FedEx Ground Distribution Center

#### 8. Arizona Iced Tea

The Arizona Iced Tea Company is committed to constructing a brand new manufacturing and distribution facility just outside Raritan Center on the long-vacant site of a closed landfill in the Fords section of Woodbridge Township. On site, Arizona will manufacture bottles and cans, brew and package tea, as well as ship product directly from the facility. The project is likely to produce over \$20 million in revenue to Woodbridge Township over 30 years.



Site photograph of Arizona Iced Tea's future Manufacturing and Distribution Center

***It's the start of a new era for Avenel, as the formerly vacant General Dynamics site has been transformed into a vibrant new community.***

- Promote appropriate mixed-use development along Avenel Street corridors.
- Provide streetscape improvements including street trees, lighting, benches and improved sidewalks to enhance the pedestrian environment and to create a sense of place
- Encourage a variety of housing types that cater to current Avenel residents as well as any future residents of the neighborhood
- Strengthen the image of Avenel as a residential neighborhood with supporting retail and commercial service arts and uses.

Station Village at Avenel – along with the Avenel Arts Center complex – stand on the long-abandoned 27-acre General Dynamics industrial complex in the Avenel section of Woodbridge Township. Station Village at Avenel and the Avenel Arts Center, in concert with the NJT North Jersey Coastline commuter train station serving Avenel, represents a \$50 million transit-related development project that will create 500 luxury apartments and town homes, 25,000 square feet of arts-themed retail space, and a 10,000 square-foot performing arts center with artist studios, galleries, rehearsal and performance space, and themed restaurants and hospitality facilities. The Avenel Arts Village and Station Loft at Avenel include streetscape improvements, lighting, sidewalks, parks and green space.

The Avenel Performing Arts Center (APAC) is a multi-disciplinary performing arts center located in Avenel, New Jersey. Funded by the Woodbridge Arts Alliance, The APAC promises to energize Avenel and surrounding communities by programming exceptional, professional theatre, music, comedy, dance and more.

Woodbridge Arts Alliance (WAA) is a 501(c)(3) organization dedicated to advocating, activating and animating Downtown Woodbridge and Avenel as hubs for the arts in the Township of Woodbridge. Starting with The Avenel Performing Arts Center, the WAA will play a leadership role in helping to advance the Township's art-driven economic plan—a plan that includes further development of enhanced arts programming and education representative of the diverse population in the area. Woodbridge Arts Alliance will build and expand on these existing arts activities to further activate the Township of Woodbridge as a regional hub for the arts. The goal is to inform and help build capacities needed to organize and distinguish Woodbridge as an arts destination to help advance the economic position of artists, creative entrepreneurs and associated entities.

# THE AVENEL PERFORMING ARTS CENTER





# General Dynamics



## Avenel Station Lofts & Arts Village



## *Overview of 2019 ERI Update: Critical Habitat*

- Enhancing opportunities for preservation, conservation, and educational environmental stewardship contributes to healthy eco-system services and bio-diversity. Exploring and better understanding the species which thrive within the Township's natural areas will provide recreational opportunities, and better support the ability to manage diverse wildlife habitat.

## *Woodbridge Township Critical Habitat*

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# Rutgers University - 2017 Bioblitz Transmittal

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June 21, 2017

Ms. Caroline Ehrlich  
Greenable Woodbridge  
1 Main Street  
Woodbridge, NJ 07095

**Re: Ernest L. Oros Wildlife Preserve BioBlitz  
2017 Report**

Dear Caroline,

This letter report summarizes the Ernest L. Oros Wildlife Preserve BioBlitz that occurred on June 2-3, 2017, in collaboration with Woodbridge Township and the Rutgers Cooperative Extension's Wildlife Conservation and Management Program. The objectives of the BioBlitz were to: 1) perform a biological inventory of the Preserve in a 24-hour period; and 2) provide nature-based educational opportunities for members of the Woodbridge Township community.

In summary, 21 scientists from Rutgers University including faculty, staff, graduate students, and undergraduates identified 388 species of birds, mammals, fish, amphibians, reptiles, insects, fungi, plants, and other organisms. Species were identified in the field, or at a large tented area (Base Camp) containing computers, field guides, microscopes, hand lenses, sorting jars, and plant presses. Some of the scientists camped in the Preserve as well, to perform night surveys and continue processing specimens.

On Saturday, June 3<sup>rd</sup>, BioBlitz staff conducted 11 nature-based walks and talks, as well as all-day events such as bird house painting and a nature themed scavenger hunt. In addition, a variety of organizations provided table displays, including the Rutgers Wildlife Conservation and Management Program, New Jersey Mycological Association, Sustainable Jersey, Woodbridge River Watch, Woodbridge Township Environmental Commission, and The Forest Fire Service administered by the NJ Division of Parks and Forestry.

## **Survey Results**

### *Bird Survey*

We identified 51 avian species within the Preserve during the 24-hour period. Formal bird surveys occurred in the late afternoon on Friday and early morning Saturday. In addition, our staff recorded all other species observed opportunistically throughout the event. Species of interest included the black-crowned night heron (*Nycticorax nycticorax*) and osprey (*Pandion haliaetus*), which are both listed as threatened species under the New Jersey Division of Fish and Wildlife's Endangered and Nongame Species Program. Five avian species observed are



classified as species of special concern in New Jersey, including the great blue heron (*Ardea herodias*), northern parula (*Parula americana*), snowy egret (*Egretta thula*), spotted sandpiper (*Actitis macularius*), and wood thrush (*Hylocichla mustelina*).

## *Bat Survey*

On the evening of June 2<sup>nd</sup> from 7:30pm to 6:00am, we conducted a passive bat acoustical survey using two Pettersson D500X bat detectors and one Wildlife Acoustics Song Meter SM2BAT+ bat detector. Bats use echolocation to navigate and catch flying insects at night. We recorded these high frequency echolocation calls using the above-referenced specialized acoustic monitors, then analyzed them with bat call analysis software (Sonobat 3.1.4 NNE) to determine which species were present.

Over the entire monitoring period, we recorded a total of 199 bat calls (series of ultrasonic pulses with a minimum of 5 seconds in duration) and confirmed the identify of three species: big brown bat (*Eptesicus fuscus*), eastern red bat (*Lasiurus borealis*) and hoary bat (*Lasiurus cinereus*). Big brown bats are common across North America and are well adapted for occupying man-made structures. Eastern red bats and hoary bats are tree dwelling bats that spend their summers in New Jersey and migrate south during the colder months. Our acoustic monitors also detected that evening bats (*Nycticeius humeralis*) were present. This species is not common to New Jersey, although it has been confirmed occasionally in the state. The echolocation call structure of evening bats overlaps heavily with other high-frequency bat species, so it is difficult to say with certainty if this bat actually occurs in the Preserve without physically catching a voucher specimen through mist-netting operations. We did not observe any bats utilizing the bat roost boxes within the Preserve.

## *Mammal Survey*

We identified eight mammal species (excluding bats) using three survey methods: Sherman live traps, camera traps, and a track pad. We deployed 18 Sherman live traps at dusk throughout the meadow and forest of the Preserve and baited them with a mixture of peanut butter and oats. We checked the traps at 5:00am, but unfortunately did not catch any species using this method. We also deployed three camera traps from dusk until 5:00am, with two in the forest and one near the small ponds. The cameras were calibrated to take a picture when triggered by movement in front of the lens. Using this method, we documented red fox (*Vulpes vulpes*), white-tailed deer (*Odocoileus virginianus*), raccoon (*Procyon lotor*), and domestic cat (*Felis catus*). Last, we set one track pad by spreading out a layer of fine white play sand within a 2 x 2 foot area, near a trail that had evidence of wildlife traffic. At 6:00am, we identified red fox and domestic cat tracks in the sand. Other mammals were incidentally seen throughout the BioBlitz, including ground hog (*Marmota monax*), eastern cottontail (*Sylvilagus floridanus*), eastern gray squirrel (*Sciurus carolinensis*), and an unidentified mouse species (*Mus* sp.).

## *Fish Survey*

We identified nine species of fish in the Preserve using a seine net, which is a vertical net attached to a pole on either end, with buoys on the top to keep it afloat, and weights on the

bottom. Two scientists wearing rubber chest waders dragged or ‘swept’ the 6-foot long 3/18<sup>th</sup> inch mesh seine through the two small ponds west of Woodpecker Trail. Anything caught in the net was brought to the surface for identification. The ponds were swept multiple times until no new species were observed in several consecutive sweeps. The larger Fresh Meadows Pond was too deep and turbid to perform this method, so it was not surveyed. One species of interest was the American eel (*Anguilla rostrata*), which has a complex life cycle. This species is found in a variety of fresh water habitats along the east coast of the United States, where it spends up to 25 years maturing. Individuals then migrate to the Sargasso Sea in the North Atlantic to spawn. This connection between inland fresh water to the Atlantic Ocean is crucial for the American eel’s life cycle. Water bodies within the Preserve are not considered to be connected to rivers; therefore, it is unclear how the eels came to be present at the Preserve.

### *Reptile and Amphibian Survey*

From 11:30pm – 1:00am Friday evening, we performed a survey of the streams, wetlands, and water bodies in the Preserve to see or hear frog species. We documented green frog (*Lithobates clamitans*) and American bullfrog (*Lithobates catesbeianus*), both of which are common species in New Jersey. We incidentally saw eastern box turtle (*Terrapene carolina carolina*), snapping turtle (*Chelydra serpentina*) and painted turtle (*Chrysemys picta*) during the BioBlitz as well. We found no salamanders.

### *Arthropods*

With the help of seven scientists, we identified 142 arthropod species during the BioBlitz. Intensive surveys were performed specifically to identify spiders, bees, butterflies, and night flying moths using beat sheets, nets, and visual observations. On Friday evening, we performed a moth survey using a mercury vapor lamp and white drop cloth and identified 65 species. Highlights included the 4-spotted palpita (*Palpita quadristigmalis*), a species that appears to be expanding its range northward in response to climate change; and the crowned Phlyctaenia (*Anania coronata*), an uncommon species whose population may be under threat by invasive parasites and predators.

In summary, we identified 10 spiders (Order Araneae), 12 beetles (Order Coleoptera), 11 true flies (Order Diptera), eight true bugs (Order Hemiptera), 11 bees (Order Hymenoptera), 71 moths and butterflies (Order Lepidoptera), nine damselflies and dragonflies (Order Odonata), 1 stone centipede (Order Chilopoda), 1 scud (Order Amphipoda), 1 crayfish (Order Decapoda), and 1 sow bug (Order Isopoda).

### *Plants and Fungi Survey*

The Preserve was traversed by plant and fungus experts who either identified specimens in the field or brought specimens in question back to Base Camp for a more thorough examination. Scientists worked up until the final minutes of the BioBlitz at 3:00pm Saturday, and resulted in a total of 143 plant species and 13 fungus species.

## Other

In order to survey earthworms (Order Annelida) in the Preserve, we mixed 1/3 cup of mustard powder into 1 gallon of warm water, and poured this solution in 4 separate two-foot diameter circular plots on the forest floor. The mustard irritates the sensitive skin of earthworms, causing them to crawl to the surface. The earthworms were then collected, cleaned, and identified under a microscope at Base Camp, resulting in 6 total species, all which are native to Europe or Asia.

Other species identified were leopard slug (*Limax maximus*), snail (*Physa sp.*), a trematode parasite (*Clinostomum sp.*) attached to a fish, and 3 slime molds in the taxonomic class Myxogastria.

## Overall Assessment of Ecosystem Health

Overall, the species present within the Preserve are typical of a large open space within an urban/suburban land mosaic. The site does contain species not commonly found in an urban framework, including 2 threatened and 5 avian species of special concern, two forest-dwelling bats, the American eel, and a diverse array of insects and plants. Our observations underscore the importance of the Oros Preserve as an urban biodiversity refuge. Within a 24-hour period, we found that the Preserve's mixture of forests, wetlands, fields, and ponds support at least 388 unique species across a variety of taxa.

Although the Preserve acts like a haven for many wildlife, the site is not immune to the anthropogenic influences of the surrounding landscape. For example, we did not identify as many dragonfly and amphibian species as expected, which is notable because these organisms are sensitive to water quality and environmental toxins, making them known as 'indicator species.' When there is a large diversity of these species in an area, it often means the ecosystem is healthy. However, our scheduled dragonfly expert unexpectedly could not attend, and her expertise may have helped us detect more species. We also did not observe a wide diversity of amphibians. The American bullfrog and green frog were very abundant in the Preserve, but both have a high tolerance for disturbed and degraded habitats. Common frog species in New Jersey include spring peepers (*Pseudacris crucifer*) and wood frogs (*Lithobates sylvaticus*). As they breed in early spring and are cryptic, it is possible that they are present in Preserve. A survey of calling male frogs in early spring is warranted.

In addition to possible water quality issues, the Preserve demonstrates tell-tail signs of an overpopulation of white-tailed deer, which is negatively affecting the site's biodiversity. Due to chronic over-grazing by deer, the shrub and herbaceous layers of the forest lack plant abundance and diversity. Overgrazing not only hurts native plant survival, but allows invasive plants to flourish, which consequently affects the diversity of native birds, small mammals, and invertebrates.

Despite facing the common issues of New Jersey's open spaces, the Ernest L. Oros Wildlife Preserve remains an important biodiversity hot spot in an otherwise highly-developed area. A



large section within the Preserve is secured with a deer exclusion fence and has recently been planted with a variety of native trees, shrubs, grasses, sedges, and other herbaceous plants. Once these plants establish and the habitat matures in the absence of deer, it will be interesting to see how species diversity changes. With continued restoration projects like these and volunteer efforts by the Woodbridge River Watch and others, habitat quality will continue to improve and secure the Preserve as a biodiversity hotspot for generations to come.

We were honored to be a part of this initiative. Please do not hesitate to contact us with any questions or comments.

Sincerely,



Kathleen Kerwin  
Program Associate  
Wildlife Conservation and Management Program



Brooke Maslo, Ph.D.  
Assistant Professor/Extension Specialist  
Wildlife Conservation and Management Program

## *Critical Habitat (Ernest Oros Wildlife Preserve Bioblitz)*



In 2017, at the Ernest Oros Wildlife Preserve in Avenel, 21 scientists from Rutgers University including faculty, staff, graduate students, and undergraduates identified 388 species of birds, mammals, fish, amphibians, reptiles, insects, fungi, plants, and other organisms. Species were identified in the field, or at a large tented area (Base Camp) containing computers, field guides, microscopes, hand lenses, sorting jars, and plant presses. Some of the scientists camped in the Preserve as well, to perform night surveys and continue processing specimens.

BioBlitz staff conducted 11 nature-based walks and talks, as well as all day events such as bird house painting and a nature themed scavenger hunt. In addition, a variety of organizations provided table displays, including the Rutgers Wildlife Conservation and Management Program, New Jersey Mycological Association, Sustainable Jersey, Woodbridge River Watch, Woodbridge Township Environmental Commission, and The Forest Fire Service administered by the NJ Division of Parks and Forestry.

**Critical Habitat (Ernest Oros Wildlife Preserve Bioblitz)**



**Critical Habitat (Ernest Oros Wildlife Preserve Bioblitz) ~ Mammals**

Kingdom	Phylum	Class	Order	Family	Genus	Species	Common Name	Total Species:	12
Animalia	Chordata	Mammalia	Artiodactyla	Cervidae	<i>Odocoileus</i>	<i>virginianus</i>	white-tailed deer	1	
Animalia	Chordata	Mammalia	Carnivora	Canidae	<i>Vulpes</i>	<i>vulpes</i>	red fox	1	
Animalia	Chordata	Mammalia	Carnivora	Felidae	<i>Felis</i>	<i>cattus</i>	domestic cat	1	
Animalia	Chordata	Mammalia	Carnivora	Procyonidae	<i>Procyon</i>	<i>lotor</i>	raccoon	1	
Animalia	Chordata	Mammalia	Chiroptera	Vespertilionidae	<i>Eptesicus</i>	<i>fuscus</i>	big brown bat	1	
Animalia	Chordata	Mammalia	Chiroptera	Vespertilionidae	<i>Lasiurus</i>	<i>borealis</i>	eastern red bat	1	
Animalia	Chordata	Mammalia	Chiroptera	Vespertilionidae	<i>Lasiurus</i>	<i>cinerus</i>	hoary bat	1	
Animalia	Chordata	Mammalia	Chiroptera	Vespertilionidae	<i>Nycticeius</i>	<i>humeralis</i>	evening bat	1 *	
Animalia	Chordata	Mammalia	Rodentia	Leporidae	<i>Sylvilagus</i>	<i>floridanus</i>	Eastern cottontail	1	
Animalia	Chordata	Mammalia	Rodentia	Muridae	<i>Mus</i>		mouse 1	1	
Animalia	Chordata	Mammalia	Rodentia	Sciuridae	<i>Marmota</i>	<i>monax</i>	groundhog	1	
Animalia	Chordata	Mammalia	Rodentia	Sciuridae	<i>Sciurus</i>	<i>carolinensis</i>	eastern gray squirrel	1	



***Critical Habitat (Ernest Oros Wildlife Preserve Bioblitz)***



***Critical Habitat (Ernest Oros Wildlife Preserve Bioblitz) ~ Fish***

Kingdom	Phylum	Class	Order	Family	Genus	Species	Common Name	Total Species:
Animalia	Chordata	Actinopterygii	Anguilliformes	Anguillidae	<i>Anguilla</i>	<i>rostrata</i>	American eel	1
Animalia	Chordata	Actinopterygii	Cypriniformes	Cyprinidae	<i>Cyprinus</i>	<i>carpio</i>	common carp	1
Animalia	Chordata	Actinopterygii	Cyprinodonti- formes	Fundulidae	<i>Fundulus</i>	<i>diaphanus</i>	banded killifish	1
Animalia	Chordata	Actinopterygii	Cyprinodonti- formes	Poeciliidae	<i>Gambusia</i>		mosquito fish	1
Animalia	Chordata	Actinopterygii	Perciformes	Centrarchi- dae	<i>Lepomis</i>	<i>auritus</i>	red-breasted sunfish	1
Animalia	Chordata	Actinopterygii	Perciformes	Centrarchi- dae	<i>Lepomis</i>	<i>gibbosus</i>	pumpkinseed	1
Animalia	Chordata	Actinopterygii	Perciformes	Centrarchi- dae	<i>Lepomis</i>	<i>macrochirus</i>	bluegill sunfish	1
Animalia	Chordata	Actinopterygii	Perciformes	Centrarchi- dae	<i>Pomoxis</i>	<i>annularis</i>	white crappie	1
Animalia	Chordata	Actinopterygii	Perciformes	Centrarchi- dae	<i>Pomoxis</i>	<i>nigromaculatus</i>	black crappie	1
Animalia	Chordata	Actinopterygii	Siluriformes	Ictaluridae	<i>Ameiurus</i>	<i>natalis</i>	yellow bullhead catfish	1

Critical Habitat (Ernest Oros Wildlife Preserve Bioblitz)



Critical Habitat (Ernest Oros Wildlife Preserve Bioblitz) ~ Amphibians

Kingdom	Phylum	Class	Order	Family	Genus	Species	Common Name	Total Species:	
Animalia	Chordata	Amphibia	Anura	Ranidae	<i>Lithobates</i>	<i>catesbeiana</i>	American bullfrog	1	2
Animalia	Chordata	Amphibia	Anura	Ranidae	<i>Lithobates</i>	<i>clamitans</i>	green frog	1	

Critical Habitat (Ernest Oros Wildlife Preserve Bioblitz)



Critical Habitat (Ernest Oros Wildlife Preserve Bioblitz) ~ Reptiles

Kingdom	Phylum	Class	Order	Family	Genus	Species	Common Name	Total Species:	3
Animalia	Chordata	Reptilia	Squamata	Colubridae	Thamnophis	sirtalis	garter snake	1	
Animalia	Chordata	Reptilia	Testudines	Chelydridae	Chelydra	serpentina	snapping turtle	1	
Animalia	Chordata	Reptilia	Testudines	Emydidae	Chrysemys	picta	painted turtle	1	



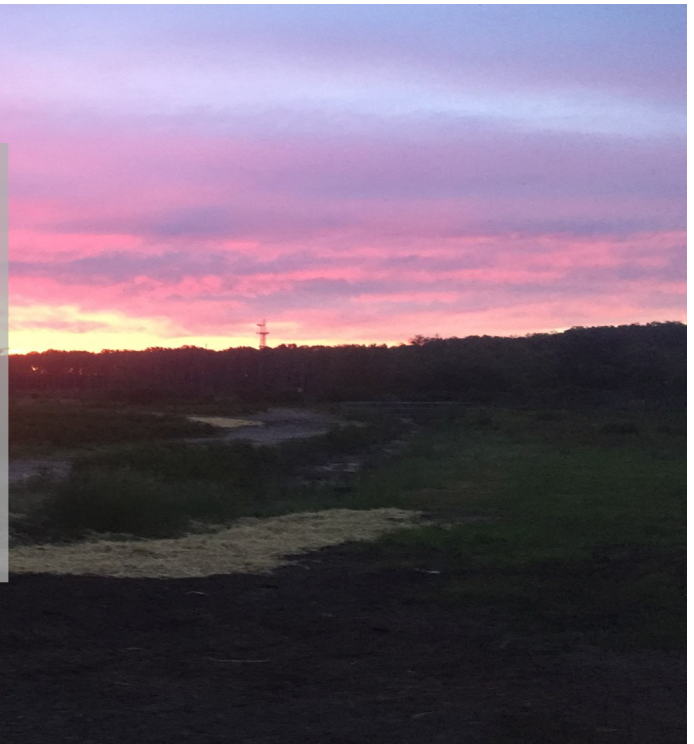
***Critical Habitat (Ernest Oros Wildlife Preserve Bioblitz)***



***Critical Habitat (Ernest Oros Wildlife Preserve Bioblitz) ~ Arthropods***

Family	Genus	Species	Common Name	Total Species:	142
Agelenidae	<i>Agelenopsis</i>		grass spider	1	
Linyphiidae			sheet weaver spider	1	
Oxyopidae			lynx spider	1	
Salticidae			jumping spider 1	1	
Salticidae			jumping spider 2	1	
Salticidae			jumping spider 3	1	
Salticidae	<i>Salticus</i>	<i>scenicus</i>	zebra jumping spider	1	
Tetragnathidae			orchard spider 1	1	
Tetragnathidae	<i>Leucauge</i>	<i>venusta</i>	orchard orbweaver	1	
Thomisidae			crab spider	1	
Ixodidae	<i>Dermacentor</i>	<i>variabilis</i>	dog tick	1	
			harvestman	1	
Trombidiidae	<i>Dinothrombium</i>		velvet mite	1	
			stone centipede	1	
Carabidae			ground beetle	1	
Chrysomelidae	<i>Labidomera</i>	<i>clivicollis</i>	milkweed leaf beetle	1	
Chrysomeloidea	<i>Ophraella</i>	<i>notulata</i>	leaf beetle	1	
Coccinellidae	<i>Coccinella</i>	<i>septempunctata</i>	7-spotted lady beetle	1	
Coccinellidae	<i>Harmonia</i>	<i>axyridis</i>	Asian lady beetle	1	

***Critical Habitat (Ernest Oros Wildlife Preserve Bioblitz)***



***Critical Habitat (Ernest Oros Wildlife Preserve Bioblitz) ~ Arthropods***

Family	Genus	Species	Common Name	Total Species:	142
Coccinellidae	<i>Propylea</i>	<i>quatuordecimpunctata</i>	14-spotted lady beetle	1	
Curculionidae			weevil	1	
Elateridae	<i>Melanotus</i>		click beetle	1	
Tenebrionidae	<i>Eleodes</i>		darkling beetle 1	1	
Tenebrionidae	<i>Eleodes</i>		darkling beetle 2	1	
Scarabaeidae	<i>Phyllophaga</i>	<i>congrua</i>	May beetle	1	
Silphidae			carrion beetle	1	
Forficulidae	<i>Forficula</i>	<i>auricularium</i>	European earwig	1	
Calliphoridae	<i>Lucilia</i>	<i>sericata</i>	greenbottle fly	1	
Chironomidae	<i>Chironomus</i>		midge	1	
Chloropidae			frit fly	1	
Culicinae	<i>Culex</i>	<i>pipiens</i>	northern house mosquito	1	
Muscidae			green muscid fly	1	
Rhagionidae	<i>Chrysopilus</i>	<i>thoracicus</i>	golden backed snipefly	1	
Sarcophagidae	<i>Sarcophaga</i>		flesh fly	1	
Syrphidae	<i>Toxomerus</i>		hover fly 2	1	
Syrphidae	<i>Toxomerus</i>		hover fly 3	1	
Syrphidae	<i>Toxomerus</i>	<i>marginatus</i>	hover fly 1	1	
Tipulidae			crane fly	1	
Cicadellidae			leafhopper	1	

***Critical Habitat (Ernest Oros Wildlife Preserve Bioblitz)***



***Critical Habitat (Ernest Oros Wildlife Preserve Bioblitz) ~ Arthropods***

Family	Genus	Species	Common Name	Total Species:	142
Corixidae			water boatman 1	1	
Corixidae			water boatman 2	1	
Gerridae	<i>Gerris</i>	<i>remigis</i>	water strider	1	
Miridae	<i>Lygus</i>	<i>hesperus</i>	tarnished plant bug	1	
Pentatomidae	<i>Zicrona</i>	<i>caerulea</i>	blue bug	1	
Rhyparochromi- dae	<i>Myodocha</i>	<i>serripes</i>	long-necked seed bug	1	
Saldidae	<i>Salda</i>		shore bug	1	
Andrenidae	<i>Andrena</i>		digger bee 1	1	
Andrenidae	<i>Andrena</i>		digger bee 2	1	
Apidae			yellow faud bee	1	
Apidae	<i>Apis</i>	<i>mellifera</i>	honey bee	1	
Apidae	<i>Bombus</i>	<i>griseocollis</i>	brown-belted bumblebee	1	
Apidae	<i>Bombus</i>	<i>impatiens</i>	eastern bumblebee	1	
Apidae	<i>Ceratina</i>		little carpenter bee	1	
Apidae	<i>Ceratina</i>	<i>strenua</i>	nimble ceratina bee	1	
Apidae	<i>Nomada</i>		cuckoo bee	1	
Halictidae	<i>Augochlorella</i>		green sweat bee	1	
Megachilidae	<i>Anthidium</i>		mason bee	1	
Coleophoridae	<i>Coleophora</i>	<i>sp.</i>	Coleophora	1	
Crambidae	<i>Anania</i>	<i>coronata</i>	crowned phlyctaenia	1	



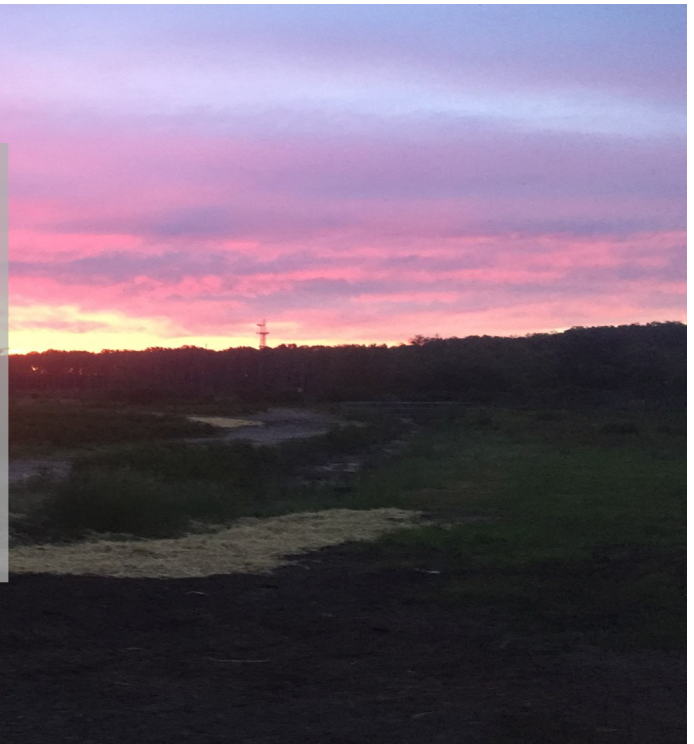
***Critical Habitat (Ernest Oros Wildlife Preserve Bioblitz)***



***Critical Habitat (Ernest Oros Wildlife Preserve Bioblitz) ~ Arthropods***

Family	Genus	Species	Common Name	Total Species:	142
Crambidae	<i>Crambus</i>	<i>laqueatellus</i>	eastern grass veneer	1	
Crambidae	<i>Fissicrambus</i>	<i>mutabilis</i>	changeable grass veneer	1	
Crambidae	<i>Hahncappsia</i>	<i>marculenta</i>	Hahncappsia	1	
Crambidae	<i>Herpetogramma</i>	<i>bipunctalis</i>	southern beet webworm	1	
Crambidae	<i>Microcrambus</i>	<i>elegans</i>	elegant grass veneer	1	
Crambidae	<i>Palpita</i>	<i>magniferalis</i>	splendid palpita	1	
Crambidae	<i>Palpita</i>	<i>quadrastigmatalis</i>	four-spotted palpita	1	
Crambidae	<i>Parapediasia</i>	<i>tererrella</i>	bluegrass webworm	1	
Crambidae	<i>Perispasta</i>	<i>caeculalis</i>	titian Peale's pyralid	1	
Crambidae	<i>Petrophila</i>	<i>bifascialis</i>	two-banded petrophila	1	
Crambidae	<i>Sclerocona</i>	<i>acutella</i>	Phrag Moth	1	
Crambidae	<i>Udea</i>	<i>rubigalis</i>	celery leaf-tier	1	
Depressariidae	<i>Antaeotricha</i>	<i>schlaegeri</i>	Schlaeger's fruitworm	1	
Erebidae	<i>Cyncia</i>	<i>tenera</i>	delicate cyncia	1	
Erebidae	<i>Hypena</i>	<i>scabra</i>	green cloverworm	1	
Erebidae	<i>Idia</i>	<i>aemula</i>	common idia	1	
Erebidae	<i>Palthis</i>	<i>angulalis</i>	dark-spotted palthis	1	
Erebidae	<i>Palthis</i>	<i>asopialis</i>	faint-spotted palthis	1	
Erebidae	<i>Pyrrharctia</i>	<i>isabella</i>	Isabella tiger moth	1	

***Critical Habitat (Ernest Oros Wildlife Preserve Bioblitz)***



***Critical Habitat (Ernest Oros Wildlife Preserve Bioblitz) ~ Arthropods***

Family	Genus	Species	Common Name	Total Species:	142
Erebidae	<i>Spilosoma</i>	<i>virginica</i>	Virginian tiger moth	1	
Erebidae	<i>Tetanolita</i>	<i>floridana</i>	Florida tetanolita	1	
Gelechiidae	<i>Dichomeris</i>	<i>inversella</i>	Dichomeris	1	
Gelechiidae	<i>Laris</i>	<i>subsolana</i>	Olethreutine	1	
Gelechiidae	<i>Xenolechia</i>	<i>ontariensis</i>	Xenolechia	1	
Geometridae	<i>Campaea</i>	<i>perlata</i>	pale beauty	1	
Geometridae	<i>Euchlaena</i>	<i>amoenaria</i>	eeep yellow euchlaena	1	
Geometridae	<i>Eupithecia</i>	<i>miserulata</i>	common pug	1	
Geometridae	<i>Eusarca</i>	<i>confusaria</i>	confused eusarca	1	
Geometridae	<i>Hypagyrtis</i>	<i>unipunctata</i>	one-spotted variant	1	
Geometridae	<i>Nemoria</i>	<i>lixaria</i>	red-bordered emerald	1	
Geometridae	<i>Pasiphila</i>	<i>rectangulata</i>	green pug	1	
Geometridae	<i>Synchlora</i>	<i>aerata</i>	wavy-lined emerald	1	
Lycaenidae	<i>Celastrina</i>	<i>neglecta</i>	summer azure	1	
Noctuidae	<i>Agriopodes</i>	<i>fallax</i>	green marvel	1	
Noctuidae	<i>Condica</i>	<i>videns</i>	white-dotted groundling	1	
Noctuidae	<i>Lacinipolia</i>	<i>renigera</i>	bristly cutworm	1	
Noctuidae	<i>Leucania</i>	<i>linita</i>	linen wainscot	1	
Noctuidae	<i>Mythimna</i>	<i>oxygala</i>	lesser wainscot	1	
Noctuidae	<i>Mythimna</i>	<i>unipuncta</i>	white speck	1	
Noctuidae	<i>Nipponyx</i>	<i>segregata</i>	Nipponyx	1	

***Critical Habitat (Ernest Oros Wildlife Preserve Bioblitz)***



***Critical Habitat (Ernest Oros Wildlife Preserve Bioblitz) ~ Arthropods***

Family	Genus	Species	Common Name	Total Species:	142
Noctuidae	<i>Noctua</i>	<i>pronuba</i>	large yellow underwing	1	
Noctuidae	<i>Orthodes</i>	<i>detracta</i>	disparaged arches	1	
Noctuidae	<i>Paectes</i>	<i>oculatrix</i>	eyed Paectes	1	
Noctuidae	<i>Simyra</i>	<i>insularis</i>	Henry's marsh moth	1	
Noctuidae	<i>Xestia</i>	<i>dolosa</i>	greater black-letter dart	1	
Nolidae	<i>Nola</i>	<i>cereella</i>	sorghum webworm	1	
Notodontidae	<i>Peridea</i>	<i>angulosa</i>	angulose prominent	1	
Nymphalidae	<i>Danaus</i>	<i>plexippus</i>	monarch butterfly	1	
Nymphalidae	<i>Polygonia</i>	<i>interrogationis</i>	question mark butterfly	1	
Nymphalidae	<i>Vanessa</i>	<i>virginiensis</i>	American lady butterfly	1	
Nymphalidae	<i>Vanessa</i>	<i>atalanta</i>	red admiral butterfly	1	
Pieridae	<i>Pieris</i>	<i>rapae</i>	cabbage white butterfly	1	
Pyalidae	<i>Aphomia</i>	<i>sociella</i>	the bee moth	1	
Pyalidae	<i>Myelopsis</i>	<i>subtetricella</i>	phycitine moth	1	
Pyalidae	<i>Oneida</i>	<i>lunulalis</i>	orange-tufted oneida	1	
Tortricidae	<i>Acleris</i>	<i>semipurpurana</i>	oak leaftier	1	
Tortricidae	<i>Aethes</i>		Aethes	1	
Tortricidae	<i>Archips</i>	<i>argyrospila</i>	fruit-tree leafroller	1	
Tortricidae	<i>Argyrotaenia</i>	<i>quercifoliana</i>	yellow-winged oak leafroller	1	
Tortricidae	<i>Catastega</i>	<i>aceriella</i>	maple trumpet skeletonizer	1	



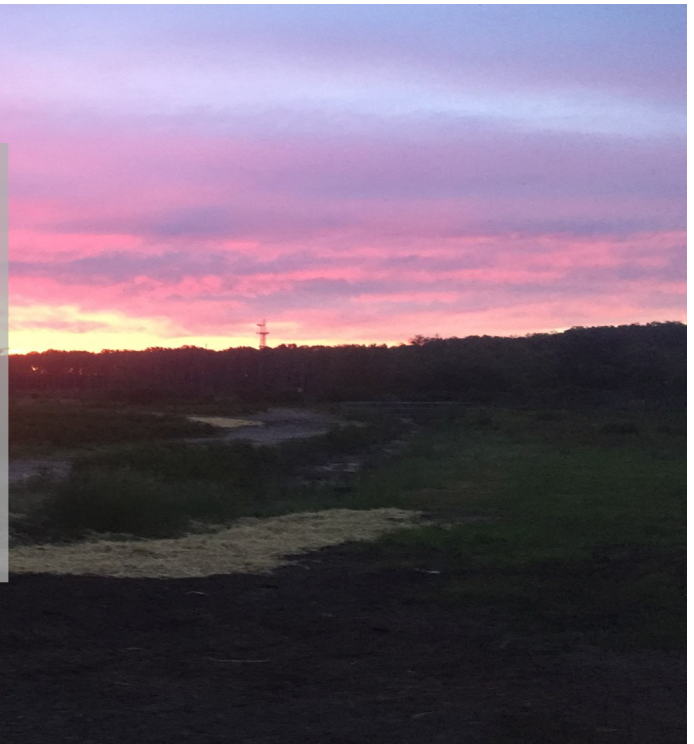
***Critical Habitat (Ernest Oros Wildlife Preserve Bioblitz)***



***Critical Habitat (Ernest Oros Wildlife Preserve Bioblitz) ~ Arthropods***

Family	Genus	Species	Common Name	Total Species:	142
Tortricidae	<i>Choristoneura</i>	<i>fractivittana</i>	broken-banded leafroller	1	
Tortricidae	<i>Choristoneura</i>	<i>rosaceana</i>	oblique-banded leafroller	1	
Tortricidae	<i>Ecdytolopha</i>	<i>insitiana</i>	locust twig borer	1	
Tortricidae	<i>Gymnandrosoma</i>	<i>punctidiscanum</i>	dotted gymnanrosema	1	
Tortricidae	<i>Pammene</i>	<i>felicitana</i>	happy pammene	1	
Tortricidae	<i>Pandemis</i>	<i>limitata</i>	three-lined leafroller	1	
Tortricidae	<i>Platynota</i>	<i>idaeusalis</i>	tufted apple bud moth	1	
Tortricidae	<i>Sparganothis</i>	<i>sulfureana</i>	sparganothis fruitworm	1	
Tortricidae	<i>Xenotemna</i>	<i>pallorana</i>	leafroller	1	
Chrysopidae			green lacewing	1	
Aeshnidae	<i>Anax</i>	<i>junius</i>	green darner dragonfly	1	
Calopterygidae	<i>Calopteryx</i>	<i>maculata</i>	ebony jewelwing	1	
Coenagrionidae			narrow-winged damselfly	1	
Coenagrionidae	<i>Enallagma</i>	<i>civile</i>	familiar bluet	1	
Chironomidae			lakefly	1	
Coenagrionidae	<i>Enallagma</i>	<i>signatum</i>	orange bluet	1	
Lestidae			spread-wing damselfly 1	1	
Lestidae			spread-wing damselfly 2	1	
Libellulidae	<i>Pachydiplax</i>	<i>longipennis</i>	blue dasher	1	
			Caddis fly larva	1	
Gammarus			scud	1	
			crayfish	1	
			sow bug	1	

**Critical Habitat (Ernest Oros Wildlife Preserve Bioblitz)**



**Critical Habitat (Ernest Oros Wildlife Preserve Bioblitz) ~ other**

Kingdom	Phylum	Class	Order	Family	Genus	Species	Common Name	Total Species:	12
Animalia	Annelida	Clitellata	Haplotaxida	Lumbricidae	<i>Aporrec-</i>	<i>caligi-</i>	earthworm	1	
					<i>todea</i>	<i>nosa</i>			
					<i>Den-</i>				
Animalia	Annelida	Clitellata	Haplotaxida	Lumbricidae	<i>drobaena</i>	<i>octaedra</i>	earthworm	1	
					<i>Dendro-</i>				
Animalia	Annelida	Clitellata	Haplotaxida	Lumbricidae	<i>drilis</i>	<i>rubidus</i>	red wiggler	1	
Animalia	Annelida	Clitellata	Haplotaxida	Lumbricidae	<i>Lumbricus</i>	<i>rubellus</i>	red worm	1	
							Canada night-		
Animalia	Annelida	Clitellata	Haplotaxida	Lumbricidae	<i>Lumbricus</i>	<i>terrestris</i>	crawler	1	
					<i>Megascole-</i>		crazy snake		
Animalia	Annelida	Clitellata	Haplotaxida	cidae	<i>Amyntas</i>	<i>agrestis</i>	worm	1	
Animalia	Mollusca	Gastropoda	Hygrophila	Physidae	<i>Physa</i>		snail	1	
			<i>Stylomma-</i>						
Animalia	Mollusca	Gastropoda	tophora	Limacoidea	<i>Limax</i>	<i>maximus</i>	leopard slug	1	
	Platyhel-			Clinoso-	<i>Clinosto-</i>				
Animalia	minthes	Trematoda	Strigeidida	matidae	<i>mum</i>		trematode	1	
	Amoe-						dog vomit		
Protista	bozoa	Myxogastria	Physarales	Physaraceae	<i>Fuligo</i>	<i>septica</i>	slime mold	1	
	Amoe-			Stemoni-	<i>Stemoniti</i>				
Protista	bozoa	Myxogastria	Stemonitida	tidae	<i>s</i>	<i>axifera</i>	slime mold	1	
	Amoe-						carnival candy		
Protista	bozoa	Myxogastria	Trichiida	Arcyriaceae	<i>Arcyria</i>		slime	1	

**Critical Habitat (Ernest Oros Wildlife Preserve Bioblitz)**



**Critical Habitat (Ernest Oros Wildlife Preserve Bioblitz) ~ Fungi**

King- dom	Phylum	Class	Order	Family	Genus	Species	Common Name	Total Species:	13
Fungi	Ascomy- cota	Lecanoromy- cetes	Candelar- iales	Candelari- aceae	<i>Candelaria</i>	<i>concolor</i>	candle flame li- chen	1	
Fungi	Ascomy- cota	Lecanoromy- cetes	Incertae sedis	Leprocau- laceae	<i>Leprocaulon</i>		mealy roseate lichen	1	
Fungi	Ascomy- cota	Lecanoromy- cetes	Lecano- rales	Cladonia- ceae	<i>Cladonia</i>		reindeer lichen	1	
Fungi	Ascomy- cota	Lecanoromy- cetes	Lecano- rales	Lecano- raceae	<i>Lechinora</i>	<i>strobilina</i>	rim lichen	1	
Fungi	Ascomy- cota	Lecanoromy- cetes	Lecano- rales	Par- meliaceae	<i>Flavopar- melia</i>	<i>caperata</i>	common green- shield lichen	1	
Fungi	Ascomy- cota	Lecanoromy- cetes	Teloschist ales	Physciace- ae	<i>Phae- ophyscia</i>	<i>rubropul- chra</i>	wreath lichen	1	
Fungi	Ascomy- cota	Lecanoromy- cetes	Teloschist ales	Physciace- ae	<i>Punctelia</i>	<i>rudecta</i>	wreath lichen	1	
Fungi	Ascomy- cota	Sordariomy- cetes	Xylariales	Xylaria- ceae	<i>Hypoxylon</i>		sac fungi	1	
Fungi	Basidio- mycota	Agaricomy- cetes	Agaricales	Schizo- phyllaceae	<i>Schizophyl- lum</i>	<i>commune</i>	common slit gill	1	
Fungi	Basidio- mycota	Agaricomy- cetes	Polypora- les	Polypo- raceae	<i>Pycnoporus</i>	<i>coccineus</i>	red bracket fun- gus	1	
Fungi	Basidio- mycota	Agaricomy- cetes	Polypora- les	Polypo- raceae	<i>Trametes</i>		turkeytail	1	
Fungi	Basidio- mycota	Agaricomy- cetes	Russulales	Auriscalpi- aceae	<i>Artomyces</i>	<i>pyxidatus</i>	crown-tipped coral fungus	1	
Fungi	Basidio- mycota	Agaricomy- cetes	Russulales	Stereace- ae	<i>Stereum</i>	<i>ostrea</i>	false turkey-tail	1	



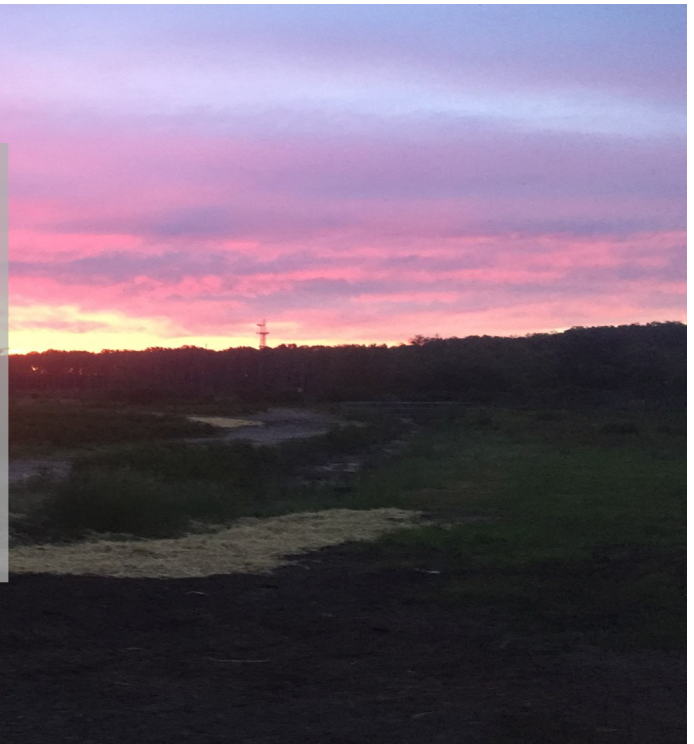
**Critical Habitat (Ernest Oros Wildlife Preserve Bioblitz)**



**Critical Habitat (Ernest Oros Wildlife Preserve Bioblitz) ~ Plants**

Family	Genus	Species	Common Name	Total Species:	144
Dicranales	Dicranaceae		windswept moss	1	
Dicranales	Leucobryaceae	<i>Leucobryum</i>	<i>glaucum</i> pin cushion moss	1	
Zygnematales	Zygnemataceae	<i>Spirogyra</i>	water silk	1	
Alismatales	Araceae	<i>Arisaema</i>	<i>triphyllum</i> jack-in-the-pulpit	1	
Alismatales	Araceae	<i>Lemna</i>	duckweed	1	
Asparagales	Amaryllidaceae	<i>Allium</i>	<i>vineale</i> wild garlic	1	
Asparagales	Asparagaceae	<i>Asparagus</i>	<i>officinalis</i> asparagus	1	
Asparagales	Asparagaceae	<i>Maianthemum</i>	<i>racemosum</i> false Solomon's seal	1	
Asparagales	Asparagaceae	<i>Iris</i>	<i>versicolor</i> blue flag	1	
Asparagales	Iridaceae	<i>Sisyrinchium</i>	<i>angustifolium</i> blue-eyed grass	1	
Liliales	Smilacaceae	<i>Smilax</i>	<i>rotundifolia</i> greenbriar	1	
Poales	Cyperaceae	<i>Cyperus</i>	<i>esculentus</i> yellow nut sedge	1	
Poales	Cyperaceae	<i>Carex</i>	<i>scirpoidea</i> singlespike sedge	1	
Poales	Cyperaceae	<i>Carex</i>	<i>stricta</i> upright sedge	1	
Poales	Cyperaceae	<i>Carex</i>	species 1	1	
Poales	Cyperaceae	<i>Carex</i>	species 2	1	
Poales	Cyperaceae	<i>Carex</i>	species 3	1	
Poales	Cyperaceae	<i>Carex</i>	species 4	1	
Poales	Cyperaceae	<i>Carex</i>	species 5	1	

***Critical Habitat (Ernest Oros Wildlife Preserve Bioblitz)***



***Critical Habitat (Ernest Oros Wildlife Preserve Bioblitz) ~ Plants***

Family	Genus	Species	Common Name	Total Species:	144
Poales	Cyperaceae	<i>Carex</i>	species 6	1	
Poales	Cyperaceae	<i>Carex</i>	species 7	1	
Poales	Cyperaceae	<i>Carex</i>	species 8	1	
Poales	Juncaceae	<i>Juncus</i>	<i>bufonius</i> toad rush	1	
Poales	Juncaceae	<i>Juncus</i>	<i>effusus</i> common rush	1	
Poales	Juncaceae	<i>Juncus</i>	<i>tenuis</i> slender rush	1	
Poales	Poaceae		grass species 1	1	
Poales	Poaceae		grass species 2	1	
Poales	Poaceae		grass species 3	1	
Poales	Poaceae		grass species 4	1	
Poales	Poaceae	<i>Dactylis</i>	<i>glomerata</i> orchard grass	1	
Poales	Poaceae	<i>Elytrigia</i>	<i>repens</i> quackgrass	1	
Poales	Poaceae	<i>Microstegium</i>	<i>vimineum</i> Japanese stilt grass	1	
Poales	Poaceae	<i>Phragmites</i>	<i>australis</i> common reed	1	
Poales	Poaceae	<i>Poa</i>	<i>annua</i> annual bluegrass	1	
Poales	Typhaceae	<i>Typha</i>	<i>latifolia</i> cattail	1	
Apiales	Apiaceae	<i>Daucus</i>	<i>carota</i> wild carrot	1	
Apiales	Araliaceae	<i>Aralia</i>	<i>elata</i> devil's walking stick	1	
Asterales	Asteraceae	<i>Ageratina</i>	<i>altissima</i> white snakeroot	1	
Asterales	Asteraceae	<i>Artemisia</i>	<i>vulgaris</i> mugwort	1	

***Critical Habitat (Ernest Oros Wildlife Preserve Bioblitz)***



***Critical Habitat (Ernest Oros Wildlife Preserve Bioblitz) ~ Plants***

Family	Genus	Species	Common Name	Total Species:	144
Asterales	Asteraceae	<i>Baccharis</i>	<i>halimifolia</i>	groundsel tree	1
Asterales	Asteraceae	<i>Bidens</i>	<i>frondosa</i>	beggarticks	1
Asterales	Asteraceae	<i>Cirsium</i>	<i>arvense</i>	Canada thistle	1
Asterales	Asteraceae	<i>Cirsium</i>	<i>vulgare</i>	ball thistle	1
Asterales	Asteraceae	<i>Conyza</i>	<i>canadensis</i>	horseweed	1
Asterales	Asteraceae	<i>Erechtites</i>	<i>hieracifolia</i>	pilewort	1
Asterales	Asteraceae	<i>Erigeron</i>	<i>philadelphicus</i>	Philadelphia fleabane	1
Asterales	Asteraceae	<i>Eupatorium</i>	<i>serotinum</i>	late boneset	1
Asterales	Asteraceae	<i>Senecio</i>	<i>vulgaris</i>	common groundsel	1
Asterales	Asteraceae	<i>Taraxacum</i>	<i>officinale</i>	dandelion	1
Asterales	Asteraceae	<i>Solidago</i>		goldenrod	1
Asterales	Asteraceae	<i>Solidago</i>	<i>altissima</i>	late goldenrod	1
Boraginales	Boraginaceae	<i>Myosotis</i>	<i>scorpioides</i>	water forget-me-not	1
Brassicales	Brassicaceae	<i>Brassica</i>		purple leaf	1
Brassicales	Brassicaceae	<i>Alliaria</i>	<i>petiolata</i>	garlic mustard	1
Brassicales	Brassicaceae	<i>Barbarea</i>	<i>vulgaris</i>	yellow rocket	1
Brassicales	Brassicaceae	<i>Cardamine</i>	<i>hirsuta</i>	hairy bittercress	1
Brassicales	Brassicaceae	<i>Lepidium</i>	<i>virginicum</i>	Virginia pepperweed	1
Caryophyllales	Caryophyllaceae	<i>Cerastium</i>	<i>vulgatum</i>	mouse-ear chickweed	1
Caryophyllales	Polygonaceae	<i>Fallopia</i>	<i>japonica</i>	Japanese knotweed	1



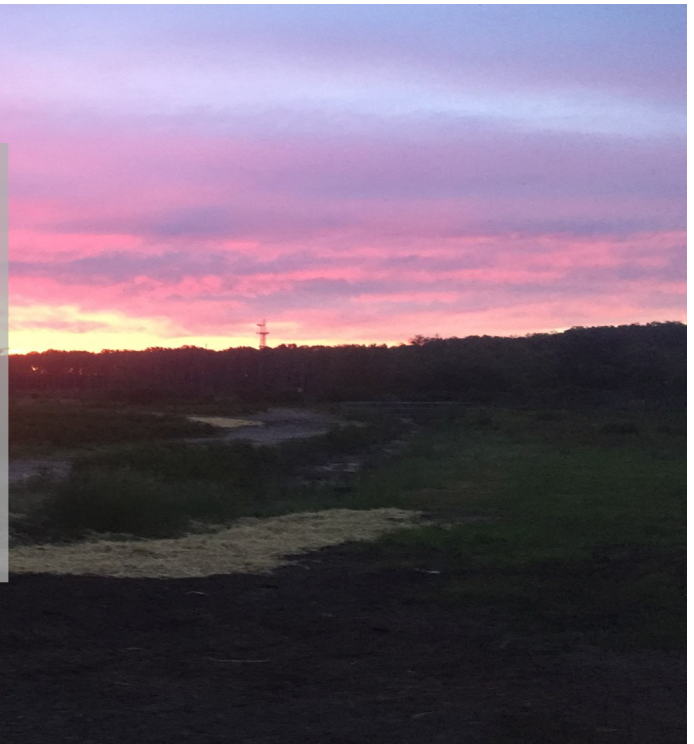
***Critical Habitat (Ernest Oros Wildlife Preserve Bioblitz)***



***Critical Habitat (Ernest Oros Wildlife Preserve Bioblitz) ~ Plants***

Family	Genus	Species	Common Name	Total Species:	144
Caryophyllales	Polygonaceae	<i>Polygonum</i>	<i>aviculare</i>	prostrate knotweed	1
Caryophyllales	Polygonaceae	<i>Polygonum</i>	<i>persicaria</i>	lady's thumb	1
Caryophyllales	Polygonaceae	<i>Rumex</i>	<i>crispis</i>	curly dock	1
Caryophyllales	Polygonaceae	<i>Rumex</i>	<i>obtusifolius</i>	broadleaf dock	1
Celastrales	Celastraceae	<i>Celastrus</i>	<i>orbiculatus</i>	Oriental bittersweet	1
Cornales	Cornaceae	<i>Cornus</i>	<i>amomum</i>	swamp dogwood	1
Cornales	Cornaceae	<i>Cornus</i>	<i>racemosa</i>	gray-stemmed dogwood	1
Dipsacales	Caprifoliaceae	<i>Lonicera</i>	<i>japnonica</i>	wood	1
Dipsacales	Caprifoliaceae	<i>Lonicera</i>	<i>mackii</i>	Japanese honeysuckle	1
Dipsacales	Adoxaceae	<i>Sambucus</i>	<i>canadensis</i>	bush honeysuckle	1
Dipsacales	Adoxaceae	<i>Viburnum</i>	<i>dentatum</i>	common elderberry	1
Dipsacales	Adoxaceae	<i>Viburnum</i>	<i>prunifolium</i>	arrowwood viburnum	1
Dipsacales	Adoxaceae	<i>Viburnum</i>	<i>prunifolium</i>	blackhaw	1
Ericales	Balsaminaceae	<i>Impatiens</i>	<i>capensis</i>	jewelweed	1
Ericales	Ericaceae	<i>Vaccinium</i>	<i>corymbosum</i>	highbush blueberry	1
Ericales	Primulaceae	<i>Lysimachia</i>	<i>nummularia</i>	moneywort	1
Fabales	Fabaceae	<i>Lotus</i>	<i>corniculatus</i>	birdsfoot trefoil	1
Fabales	Fabaceae	<i>Medicago</i>	<i>lupulina</i>	black medic	1
Fabales	Fabaceae	<i>Robinia</i>	<i>pseudoacacia</i>	black locust	1
Fabales	Fabaceae	<i>Securigera</i>	<i>varia</i>	crown vetch	1
Fabales	Fabaceae	<i>Trifolium</i>	<i>dubium</i>	little hop clover	1

***Critical Habitat (Ernest Oros Wildlife Preserve Bioblitz)***



***Critical Habitat (Ernest Oros Wildlife Preserve Bioblitz) ~ Plants***

Family	Genus	Species	Common Name	Total Species:	144
Fabales	Fabaceae	<i>Trifolium repens</i>	white clover	1	
Fabales	Fabaceae	<i>Viola serroria</i>	blue violet	1	
Fabales	Fabaceae	<i>Vicia tetrasperma</i>	slender vetch	1	
Fagales	Betulaceae	<i>Betula nigra</i>	river birch	1	
Fagales	Betulaceae	<i>Betula populifolia</i>	gray birch	1	
Fagales	Juglandaceae	<i>Carya glabra</i>	pignut hickory	1	
Fagales	Juglandaceae	<i>Carya ovata</i>	shagbark hickory	1	
Fagales	Juglandaceae	<i>Juglans nigra</i>	black walnut	1	
Fagales	Fagaceae	<i>Quercus alba</i>	white oak	1	
Fagales	Fagaceae	<i>Quercus bicolor</i>	swamp white oak	1	
Fagales	Fagaceae	<i>Quercus palustris</i>	pin oak	1	
Fagales	Fagaceae	<i>Quercus rubra</i>	red oak	1	
Fagales	Fagaceae	<i>Quercus velutina</i>	black oak	1	
Gentianales	Apocynaceae	<i>Apocynum cannabinum</i>	dogbane	1	
Gentianales	Apocynaceae	<i>Asclepias syriaca</i>	common milkweed	1	
Gentianales	Rubiaceae	<i>Cephalanthus occidentalis</i>	buttonbush	1	
Gentianales	Rubiaceae	<i>Galium aparine</i>	catchweed bedstraw	1	
Gentianales	Rubiaceae	<i>Mitchella repens</i>	partridgeberry	1	
Geraniales	Geraniaceae	<i>Geranium carolinianum</i>	Carolina cranesbill	1	
Lamiales	Bignoniaceae	<i>Campsis radicans</i>	trumpet creeper	1	

***Critical Habitat (Ernest Oros Wildlife Preserve Bioblitz)***



***Critical Habitat (Ernest Oros Wildlife Preserve Bioblitz) ~ Plants***

Family	Genus	Species	Common Name	Total Species:	144
Lamiales	Oleaceae	<i>Fraxinus</i>	<i>pennsylvanica</i> green ash	1	
Lamiales	Plantaginaceae	<i>Plantago</i>	<i>lanceolata</i> buckhorn plantain	1	
Lamiales	Plantaginaceae	<i>Plantago</i>	<i>rugelii</i> blackseed plantain	1	
Lamiales	Plantaginaceae	<i>Veronica</i>	<i>arvensis</i> corn speedwell	1	
Lamiales	Scrophulariaceae	<i>Verbascum</i>	<i>thapsus</i> mullein	1	
Malpighiales	Euphorbiaceae	<i>Euphorbia</i>	<i>virgata</i> leafy spurge	1	
Malpighiales	Salicaceae	<i>Populus</i>	<i>deltoides</i> eastern cottonwood	1	
Malpighiales	Salicaceae	<i>Salix</i>	<i>alba</i> white willow	1	
Malvales	Malvaceae	<i>Hibiscus</i>	<i>moscheutos</i> swamp rose mallow	1	
Myrtales	Onagraceae	<i>Ludwigia</i>	<i>paulustris</i> marsh seedbox	1	
Nymphaeales	Nymphaeaceae	<i>Nuphar</i>	<i>lutea</i> yellow water lily	1	
Oxalidales	Oxalidaceae	<i>Oxalis</i>	<i>stricta</i> common wood sorrel	1	
Ranunculales	Papaveraceae	<i>Chelidonium</i>	<i>majas</i> greater celandine	1	
Ranunculales	Ranunculus	<i>Ranunculus</i>	<i>sceleratus</i> crowfoot	1	
Rosales	Cannabaceae	<i>Humulus</i>	<i>japonicus</i> Japanese hops	1	
Rosales	Elaeagnacea	<i>Elaeagnus</i>	<i>umbellata</i> autumn olive	1	
Rosales	Moraceae	<i>Morus</i>	<i>alba</i> white mulberry	1	
Rosales	Rhamnaceae	<i>Rhamnus</i>	<i>cathartica</i> buckkthorn	1	
Rosales	Rhamnaceae	<i>Rhamnus</i>	<i>frangula</i> blackthorn alder	1	
Rosales	Rosaceae	<i>Crataegus</i>	<i>crus-galli</i> cockspur hawthorn	1	



**Critical Habitat (Ernest Oros Wildlife Preserve Bioblitz)**



**Critical Habitat (Ernest Oros Wildlife Preserve Bioblitz) ~ Plants**

Family	Genus	Species	Common Name	Total Species:	144
Rosales	Rosaceae	<i>Malus</i>	apple	1	
Rosales	Rosaceae	<i>Potentilla simplex</i>	common cinquefoil	1	
Rosales	Rosaceae	<i>Prunus serotina</i>	black cherry	1	
Rosales	Rosaceae	<i>Pyrus calleryana</i>	callary pear	1	
Rosales	Rosaceae	<i>Rosa eglanteria</i>	sweet briar	1	
Rosales	Rosaceae	<i>Rosa multiflora</i>	multiflora rose	1	
Rosales	Rosaceae	<i>Rosa virginiana</i>	Virginina rose	1	
Rosales	Rosaceae	<i>Rubus alleghaniensus</i>	Alleghany blackberry	1	
Rosales	Rosaceae	<i>Rubus hispidus</i>	swamp dewberry	1	
Rosales	Ulmaceae	<i>Ulmus americana</i>	American elm	1	
Sapindales	Anacardiaceae	<i>Rhus copallinum</i>	winged sumac	1	
Sapindales	Anacardiaceae	<i>Rhus glabra</i>	smooth sumac	1	
Sapindales	Anacardiaceae	<i>Toxicodendron radicans</i>	posion ivy	1	
Sapindales	Sapindaceae	<i>Acer platanooides</i>	Norway maple	1	
Sapindales	Sapindaceae	<i>Acer rubrum</i>	red maple	1	
Sapindales	Sapindaceae	<i>Acer saccharinum</i>	silver maple	1	
Sapindales	Simaroubaceae	<i>Ailanthus altissima</i>	tree of heaven	1	
Saxifragales	Altingiaceae	<i>Liquidambar styraciflua</i>	sweetgum	1	
Solanales	Solanaceae	<i>Solanum carolinense</i>	horsenettle	1	
Vitales	Vitaceae	<i>Parthenocissus quincefolia</i>	Virginia creeper	1	
Vitales	Vitaceae	<i>Vitis</i>	grape	1	

Critical Habitat (Ernest Oros Wildlife Preserve Bioblitz)



Critical Habitat (Ernest Oros Wildlife Preserve Bioblitz) ~ Plants

Family	Genus	Species	Common Name	Total Species:	144
Equisetales	Equisetaceae	<i>Equisetum</i>	<i>arvense</i> field equisetum	1	
	Dennstaedtiaceae				
Polypodiales		<i>Dennstaedtia</i>	<i>punctilobula</i> hay-scented fern	1	
Polypodiales	Onocleacea	<i>Onoclea</i>	<i>sensibilis</i> sensitive fern	1	
Polytrichop-sida	Polytrichaceae	<i>Polytrichum</i>	haircap moss	1	

## *Overview of 2019 ERI Update: Urban Heat Island*

- Urban heat Island effects cause serve environmental and human health concerns. But, in Woodbridge Township, dedication to ensure mitigation measures are planned and action is taken to combat such issues embody the backbone of the Township's sustainability initiatives. This section includes the newly designed and engineered means by which to contest such disturbances caused by waste heat. This endeavor exemplifies that in Woodbridge we adapt, design, and rebuild with resiliency and community health in mind. The enclosed Heat Island Assessment report was adopted by the Woodbridge Township municipal council on August 21, 2018.



## *Woodbridge Township*

### *Urban Heat Island*

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# Potential Urban Heat Island Mitigation Projects

## Woodbridge Township, Middlesex County

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# Executive Summary

## Introduction:

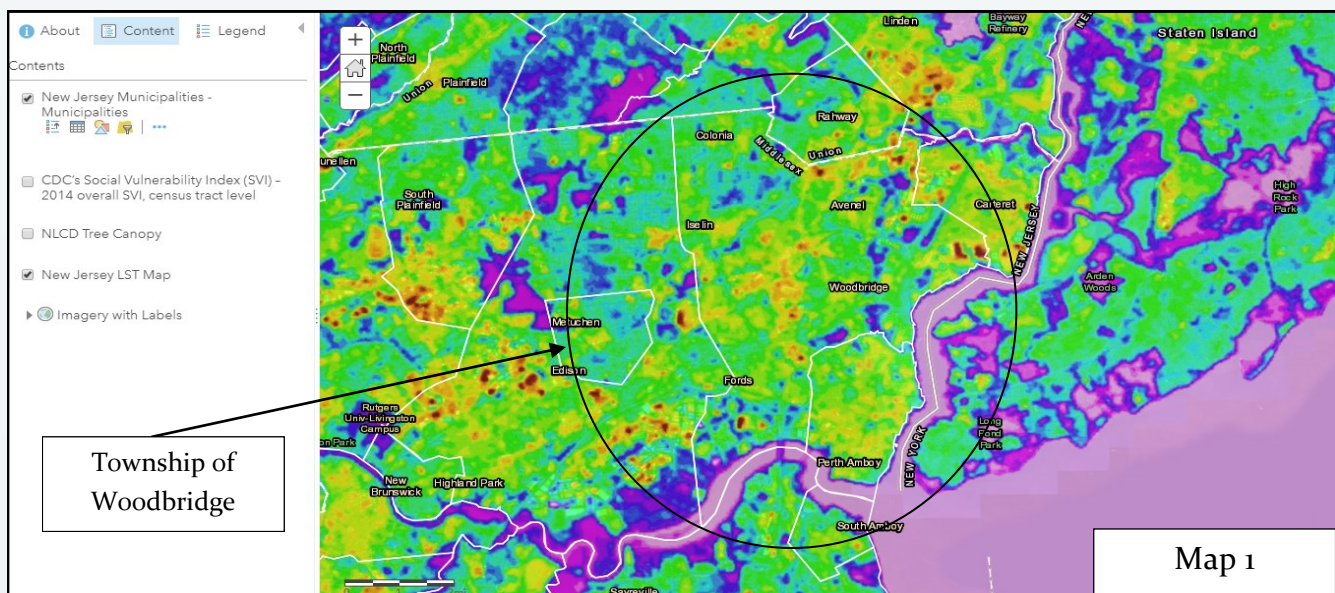
Urban heat Island effects cause serve, environmental and human health concerns. But, in Woodbridge Township, dedication to ensure mitigation measures are planned and action is taken to combat such issues embody the backbone of the Township's sustainability initiatives. This section includes the newly designed and engineered means by which to contest such disturbances caused by waste heat. This endeavor exemplifies that in Woodbridge we adapt, design, and re-build with resiliency and community health in mind. The enclosed Heat Island Assessment report was adopted by the Woodbridge Township municipal council on August 21, 2018.

## Municipal Background:

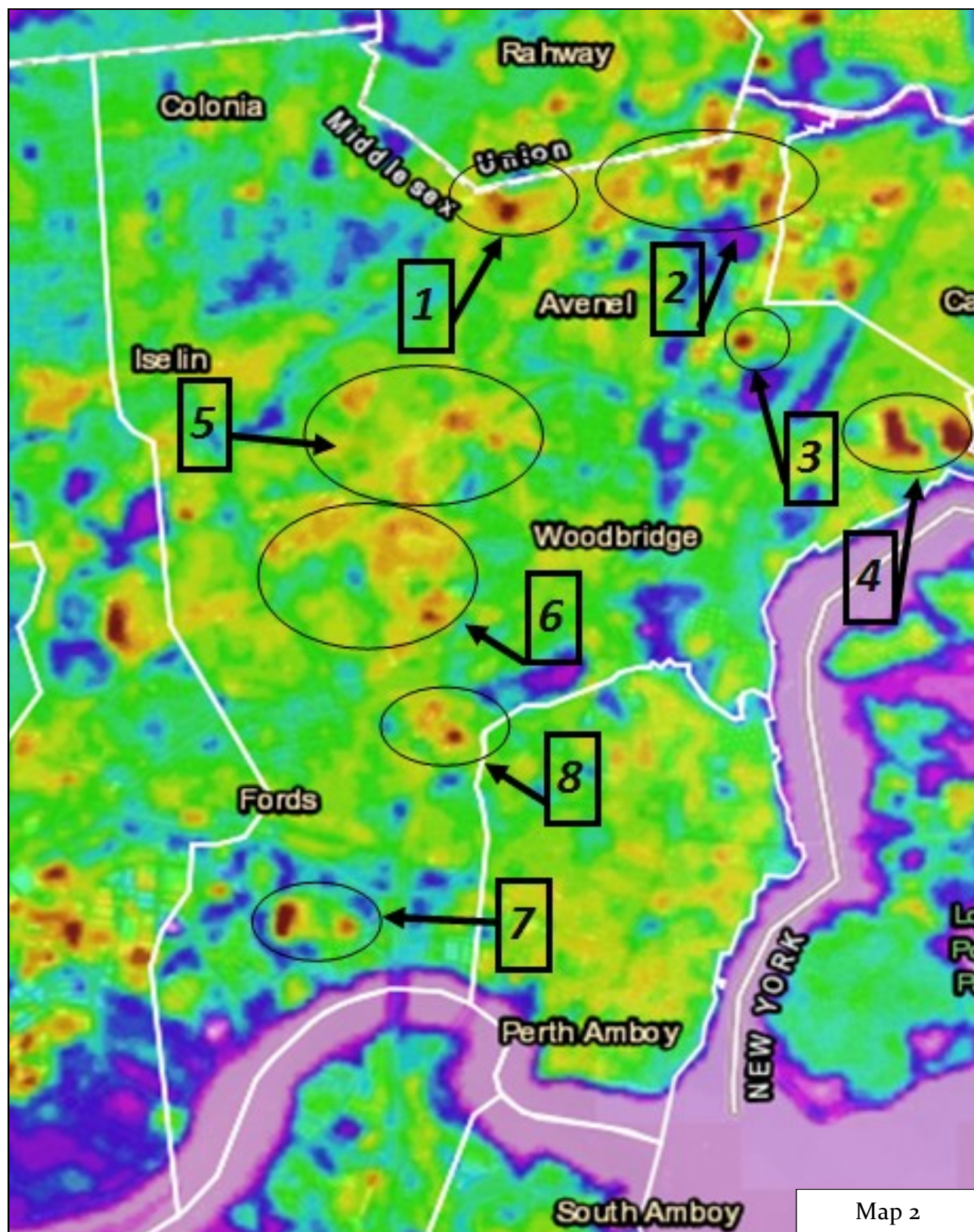
Spread across twenty-four square miles with varying densities and land uses, Woodbridge is a mature suburb in need of linking amenities, neighborhoods, and commercial industry with one another through a diverse means. Woodbridge Township is the State of New Jersey's sixth largest municipality and has one of the largest populations (99,585 – 2010 US Census) in New Jersey. The Township is as diverse in its people as it is in its geography. As a result, it's imperative that substantive actions be taken to explore, evaluate, and implement measures to mitigate the negative causes and impacts linked to extreme isolated temperature rises. Current Township operational standards abide by technical planning and engineering examinations which outline site plan criteria for new development. Said principles create a means by which developers, the Township, and the community fulfill environmental function, pleasing aesthetics, and site utility. The sites denoted below contain elements of dated site plan measures which have then since been replaced with modernized approaches to site improvement.



*Urban Heat Island Effects as denoted on map two (2). The areas of concern (AOC's) enumerated below encompass specific characteristics associated with exacerbating factors which are directly correlated to a*

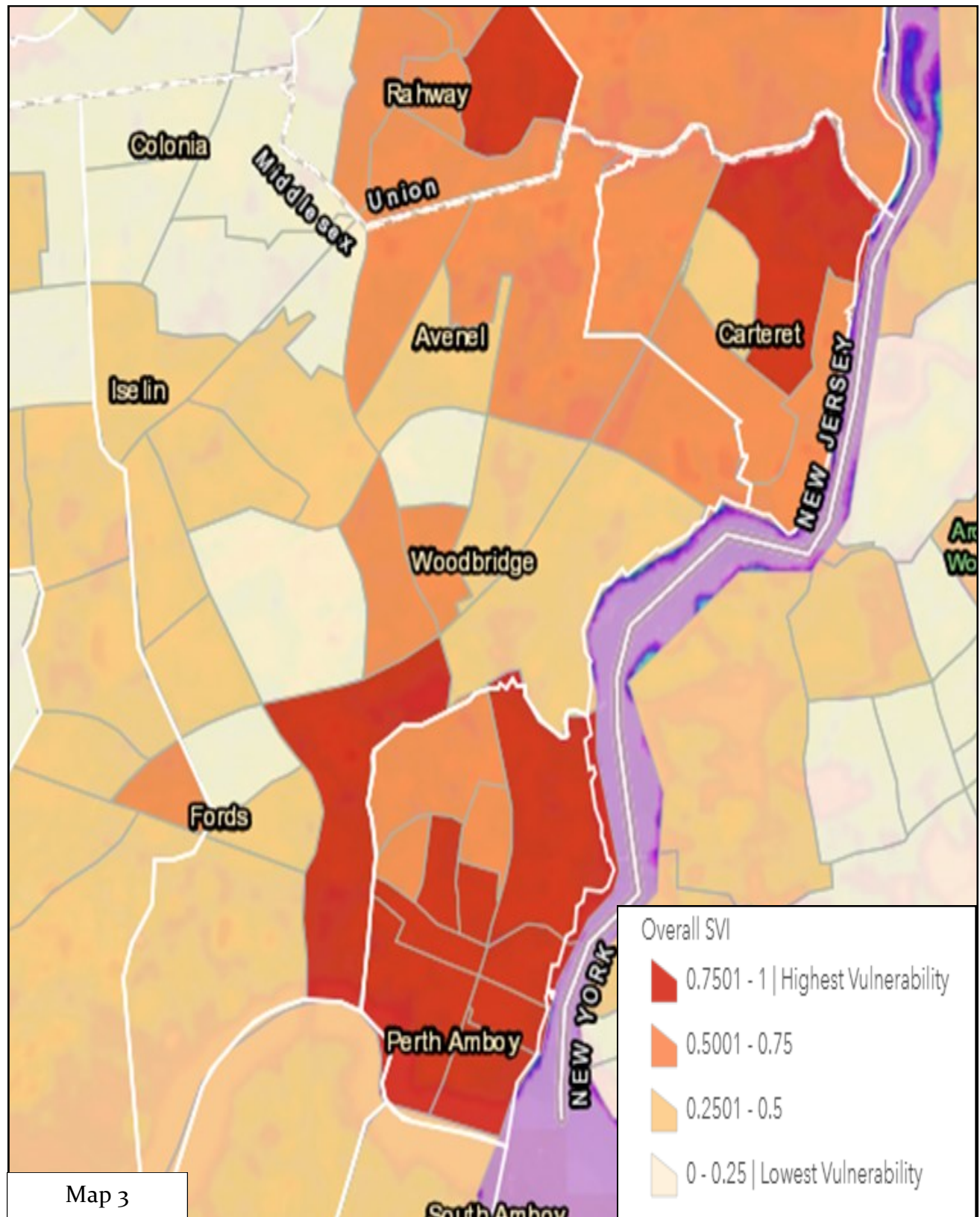


*Township of Woodbridge ~ Urban Heat Island Effects (AOC's)*



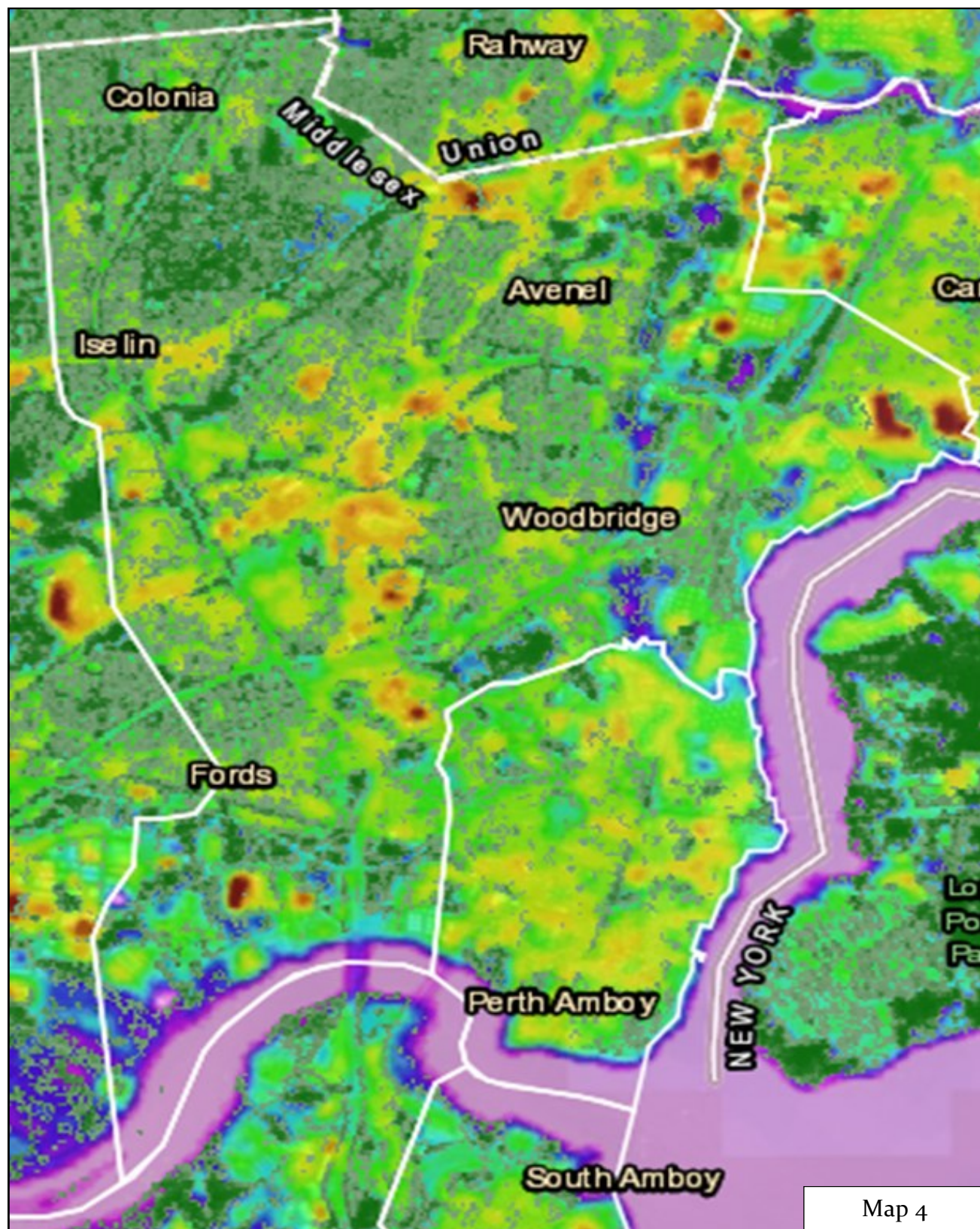


## *Township of Woodbridge ~ Social Vulnerability Effects*





## *Township of Woodbridge ~ Tree Cover with LST Overlay*



## TOWNSHIP OF WOODBRIDGE

### URBAN HEAT ISLAND ENVIRONMENTAL REVIEW PROCESS

#### SUMMARY OF EXISTING CONCERN AREAS

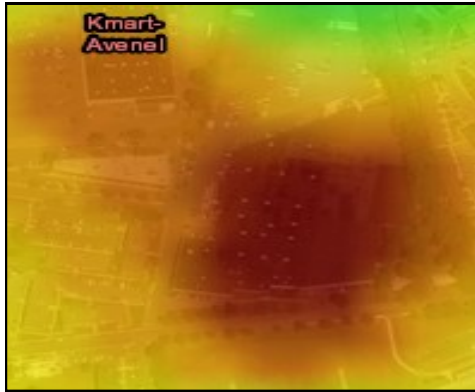
##### Area of Concern One (1) ~ Social Vulnerability 50%-75%

Community: Avenel, Woodbridge Township

Approximate Geographic Location: 40.590740, -74.287743

Type: Retail establishments located in an outdoor shopping complex.

##### Site Conditions:



Land Surface Temperature overlay –ON



Land Surface Temperature overlay –OFF

##### Profiled Dark Spots:

- ⇒ Dark roofs
- ⇒ Parking lots
- ⇒ Tree cover—landscaped, and buffered suburban stream corridors

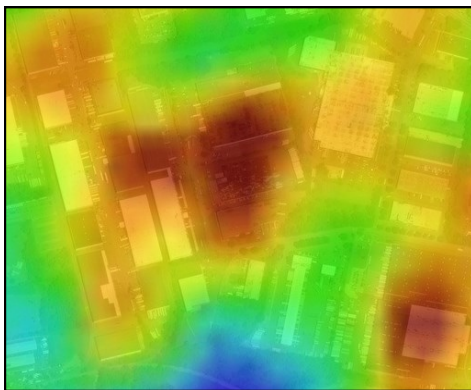
##### Area of Concern Two (2) ~ Social Vulnerability 50%-75%

Community: Avenel, Woodbridge Township

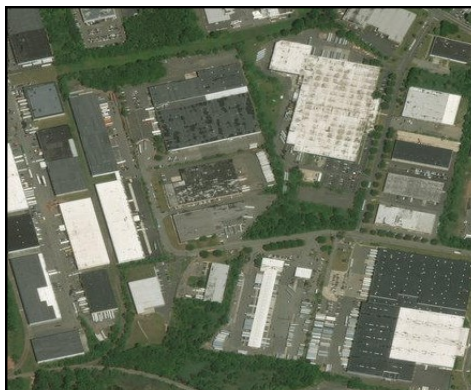
Approximate Geographic Location: 40.593012, -74.256776

Type: Commercial business complex

##### Site Conditions:



Land Surface Temperature overlay –ON



Land Surface Temperature overlay –OFF

##### Profiled Dark Spots:

- ⇒ Dark roofs
- ⇒ Parking lots
- ⇒ Tree cover—landscaped, but site adjacent to 100 acre wildlife preserve.



# TOWNSHIP OF WOODBRIDGE

## URBAN HEAT ISLAND ENVIRONMENTAL REVIEW PROCESS

### SUMMARY OF EXISTING CONCERN AREAS (CONTINUED)

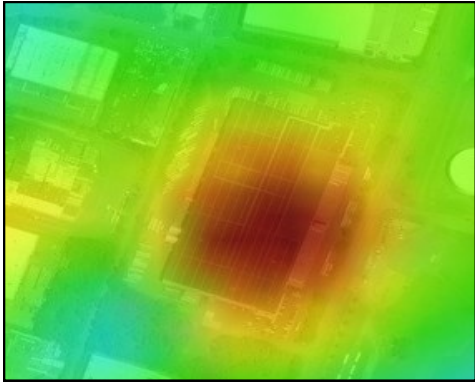
#### Area of Concern Three (3) ~ Social Vulnerability 50%-75%

Community: Avenel, Woodbridge Township

Approximate Geographic Location: 40.575325, -74.258112

Type: Commercial businesses establishments

#### Site Conditions:



Land Surface Temperature overlay –ON



Land Surface Temperature overlay –OFF

#### Profiled Dark Spots:

⇒ Dark roof,, however, over 75% of the roof 's surface is lined with solar arrays

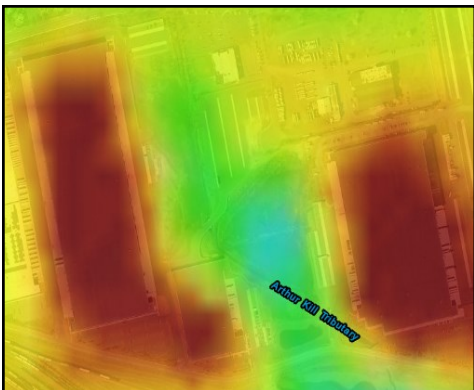
#### Area of Concern Four (4) ~ Social Vulnerability 50%-75%

Community: Port Reading, Woodbridge Township

Approximate Geographic Location: 40.565288, -74.239777

Type: Industrial businesses

#### Site Conditions:



Land Surface Temperature overlay –ON



Land Surface Temperature overlay –OFF

#### Profiled Dark Spots:

⇒ Dark roofs  
⇒ Parking lots

## TOWNSHIP OF WOODBRIDGE

### URBAN HEAT ISLAND ENVIRONMENTAL REVIEW PROCESS

#### SUMMARY OF EXISTING CONCERN AREAS (CONTINUED)

##### Area of Concern Five (5)~ Social Vulnerability 0 - 25%

Community: Woodbridge Proper, Woodbridge Township

Approximate Geographic Location: 40.556659, -74.299387

Type: Commercial businesses, apartment complexes, and retail establishments located in outdoor shopping complex.

##### Site Conditions:



Land Surface Temperature overlay -ON



Land Surface Temperature overlay -OFF

##### Profiled Dark Spots:

- ⇒ Parking lots, however, canopy solar arrays have recently been installed in parking area.
- ⇒ Tree cover

##### Area of Concern Six (6) ~ Social Vulnerability 0 - 25%

Community: Woodbridge, Woodbridge Township

Approximate Geographic Location: 40.548557, -74.295803

Type: Retail establishments located in outdoor shopping complex

##### Site Conditions:



Land Surface Temperature overlay -ON



Land Surface Temperature overlay -OFF

##### Profiled Dark Spots:

- ⇒ Dark roofs
- ⇒ Parking lots
- ⇒ Tree cover

# TOWNSHIP OF WOODBRIDGE

## URBAN HEAT ISLAND ENVIRONMENTAL REVIEW PROCESS

### SUMMARY OF EXISTING CONCERN AREAS (CONTINUED)

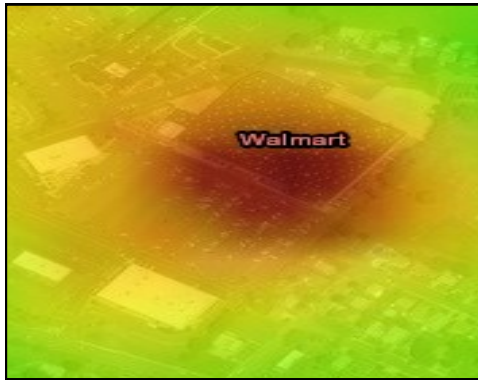
#### Area of Concern One (7) ~ Social Vulnerability 75% - 100%

Community: Avenel, Woodbridge Township

Approximate Geographic Location: 40.519241, -74.312081

Type: Commercial businesses retail establishments located in the outdoor shopping complex.

#### Site Conditions:



Land Surface Temperature overlay –ON



Land Surface Temperature overlay –OFF

#### Profiled Dark Spots:

- ⇒ Dark roof
- ⇒ Parking lot
- ⇒ Tree cover

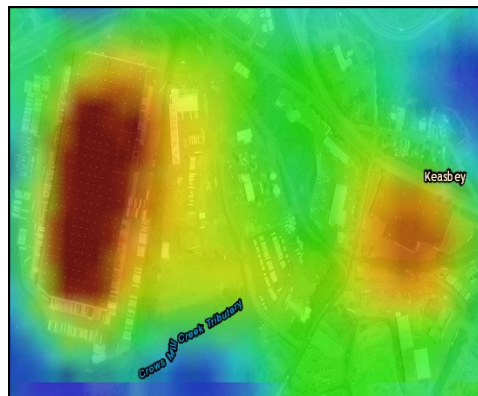
#### Area of Concern One (8) ~ Social Vulnerability 25% - 50%

Community: Fords, Woodbridge Township

Approximate Geographic Location: 40.535157, -74.294232

Type: Retail establishments located in outdoor shopping complex.

#### Site Conditions:



Land Surface Temperature overlay –ON



Land Surface Temperature overlay –OFF

#### Profiled Dark Spots:

- ⇒ Dark roof
- ⇒ Parking lot
- ⇒ Parcel tree cover



## Recommendations / Action Items / Monitoring

### Recommendations:

Potential mitigation techniques would seek to address tree cover enhancement and street-scaping using green infrastructure practices in Township right-of-ways. Site visits confirm said ascertains, as the development of many parcels noted above supersede the existing parameters associated with low impact development recommendations which occur during the Township's review of proposed development.

In addition, project considerations should also take into account improved viewsapes and socioeconomic factors that might lead to an increase in community enhancement areas. These circumstances lend to the consideration of implementing techniques that incorporate tree planting, native landscaping recommendations to business owners, rain gardens, tree canopy cover improvements within the Township's right-of-way.

### Action Items:

1. Plan and/or construct LST mitigation project(s) that will serve as a draw and attract sustainable development. Elements of the project will be designed to compliment redevelopment efforts in the Township of Woodbridge within known LST concern areas.
2. Design and/or construct project(s) that will mitigate the effects of isolated surface temperatures through nature based techniques like, rain gardens and native plantings.
3. Design and/or construct project(s) that integrate design elements of publicly oriented improvements associated with social vulnerability and LST.
4. Enhance the livability and economic viability by contacting business owners in order to promote sustainability in LST concern areas
5. Support green business opportunity and reduce LST.

### Monitoring Considerations :

Draft log below (to be completed by the Township Green Infrastructure Team – i.e. Mayor's Office. Planning, Engineering, Department of Public Works):

Project Location	Projected Implementation date	Mitigation Technique	How was the project planned?	Benefits	Considerations (i.e. Social Vulnerability)

## *Overview of 2019 ERI Update: Landscape Projects*

- The use of green infrastructure encourages the idea that stormwater is a resource that can be reused, instead of being treated as a nuisance that needs to be removed as quickly as possible
- Green infrastructure projects are a cost-effective and environmentally sustainable approach to stormwater management



## *Woodbridge Township*

### *Landscape & Projects*

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# Mayor John E. McCormac's Commitment to Green Infrastructure

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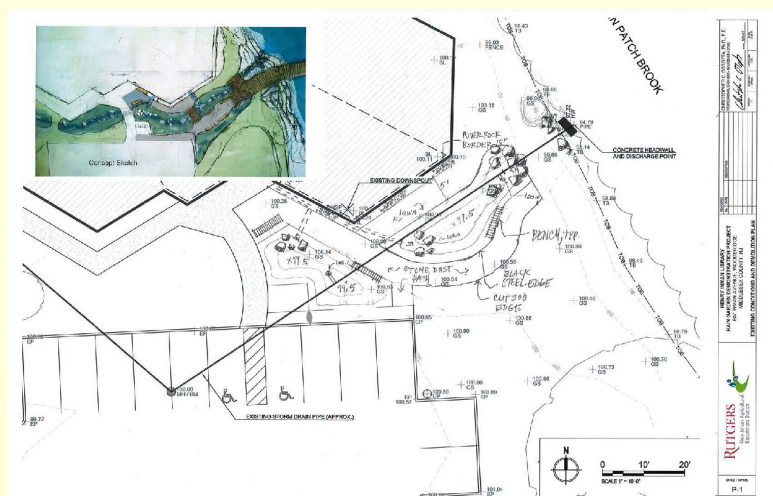
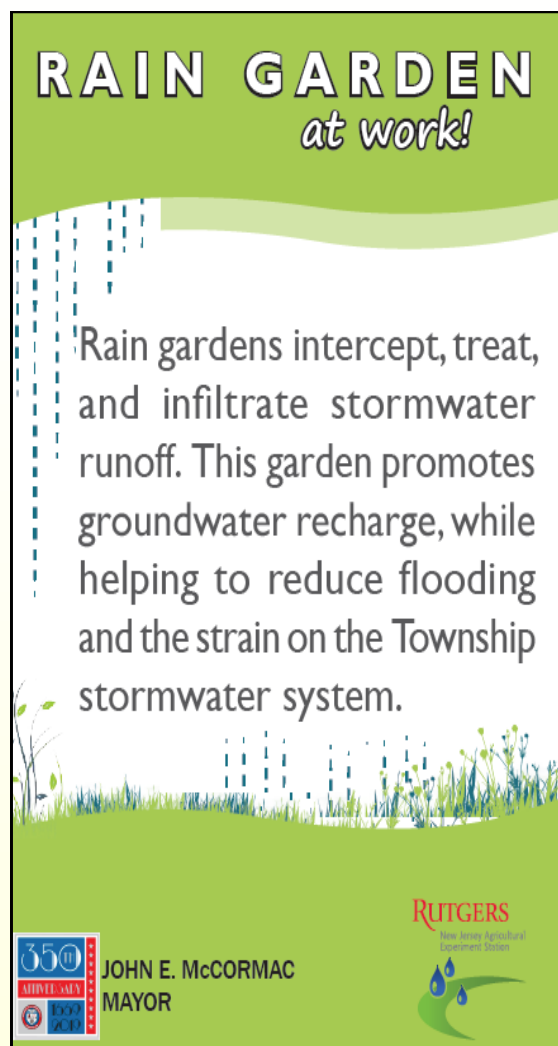


## Scientific & Engineering Based Approaches to Storm-Water Management

Infrastructure is the backbone of a community's economic welfare and a function of a municipality's approach to modernize and adapt to shifting climactic forces. As a result infrastructure holds the power to paint a variety of pictures. Aging infrastructure meagerly speaks to inefficiency and deterioration, while modifying existing infrastructure can ignite social ambition, economic development and environmental sustainability. Storm-water infrastructure is especially susceptible to the aches and pains associated with getting older. Fortunately, becoming more nimble is an option, and with flexibility come strength and resilience.

Green infrastructure serves as a means by which to apply Best Management Practices (BMP's) to handle storm water run-off, but it also integrates science-based applications in solving drainage issues while enhancing the community's social-welfare. So what exactly is Green Infrastructure, and how does it serve so many purposes? In a nutshell - consider it an alternative to conventional storm-sewer pipes, as green infrastructure helps to filter storm-water before it reaches our waterways.

Green infrastructure is unique in its ability to collect, treat, and manage run-off from roofs, roads and other hardened surfaces, as run-off can carry with it many kinds of pollutants (trash, contaminants, etc.) before it influences nearby rivers and open water bodies. Green infrastructure such as, rain gardens and bioswales use plants found in the local ecosystem in conjunction with innovative engineering solutions to help capture and treat storm-water run-off before it enters natural areas



Native flowers within these structures often attract pollinating insects like butterflies, and when strategically designed and implemented near libraries, and/ or in conjunction with walking paths, and educational signage, they become places of interest and learning opportunities within the community.



## Making the Initiative a Mission

So why spend the time, effort, and energy re-thinking something that is often out of sight and out of the way (underground)? Because shedding (day) light on these systems is better for our environmental and social health. Because *out of the way* doesn't always mean out of mind, as all engineered solutions have a shelf life. By designing storm-water management techniques to consider public health, the environment, aesthetics, education, and the potential strain on the overall drainage conveyance system, we create a more resilient and appealing community.

Woodbridge already has a decorated environmental background, and this initiative adds to that fact. The Township was named an "All-American City" through the National Civic League, and has been recognized for its environmental policies and programs – including our Greenable Woodbridge initiatives, and we were the first-ever recipient and multi-year winner of the Sustainable Jersey Champion Award. 2018 stood as the Ninth Year that Woodbridge garnered the Sustainable Jersey Champion title in the large municipality category. Therefore, it quickly became about making this new initiative a mission with only championship level success in mind. My Woodbridge Township Green Infrastructure team was developed in 2016 to better manage storm-water run-off, while delivering a variety of environmental and social benefits, such as, creative ways to better address greenhouse gas emissions, impervious run-off, and healthy mobility for the community.

What makes my green infrastructure team's approach unique is the partnership we have with Rutgers Cooperative Extension Water Resources Program. Local knowledge provided by Township officials coupled with Rutgers advanced understanding of these projects aids the innovation of project designs. Further, the partnership strengthens technical expertise and offers a distinctive hands-on approach which expedites planning and construction processes. The projects that emerge from my team are best described as soft solutions to hard problems, and they are built to last. The implementation and function of these projects is just as important as ensuring their maintenance and ability to hold-up over time. Rutgers has provided excellent training and an extensive workshop to the Township's Department of Public Works employee's which focused on green infrastructure construction, adaptive management, functionality, and aesthetics.

## Volunteers and Education

Projects like rain gardens and other small scale bio-retention structures provide great opportunities for members of the community to join in the build. What's great about these projects is that there's a wide range of flexibility in terms of time and effort on the part of volunteers. Green infrastructure requires many disciplines to share a common goal to better manage storm-water while embracing a multifaceted approach to strengthen community resilience and environmental fortitude. Youth-based leadership organizations like Scouts, and faith-based groups are some of our best community volunteers, and I take pride in the ability for my team to help them help our community. We have been very lucky to have some of the brightest and most hard-working young folks help us in building and coordinating these projects, which is no easy task, as there's certainly a job for everyone: plant selection and procurement, mulching, digging, planting, education, maintenance, etc. Everyone wins in the end – youth volunteers help the Township in creating lasting projects that lead to real results. Furthermore, the Township reduces strain on its storm sewer conveyance system while increasing environmental benefits, enhancing pleasing aesthetics, and creating unique ways for residents and visitors to learn about the importance of these projects.





The learning opportunities are endless when it comes to green infrastructure. From quantifying storm-water reduction to coordinating site preparation; the engineering, design, and construction phases of these projects offer a tremendous amount of knowledge bestowed upon those whom volunteer or take part in project implementation. But, what about everyday passer-byers? And, how can we best educate those who have watched a site transform from typical turf-grass or an impervious surface to a newly re-designed landscape? It's with regard to these situations where I believe we have a terrific opportunity to educate and inspire. In the last year alone, my team has converted lackluster (and poorly drained areas) in front of (and directly adjacent to) three out of the four public libraries within the Township into pedestals of green design practices. Accompanying these re-designed landscapes include educational signage, benches, and beautiful walking paths. Essentially, we are laying the groundwork for new place-making strategies at the heart of where these techniques are truly birthed – places of learning, growth, and imagination. Green infrastructure is a way to bring everyday learning to life for all ages, and we're already gearing up for ways to improve upon their benefit to the community. These gardens are wonderful masterpieces on their own, but I am challenging my team to think even more outside the box and consider ways to include artwork within (or near) these structures, such as, sculptures, murals, etc. Whenever possible it's time for storm-water management to step out of the darkness of the underground pipe network, and work with our existing community and infrastructure.

## Visioning

As the Township celebrates its 350<sup>th</sup> anniversary, we are excited to promote such innovative techniques to manage such as old problems. I applaud my team and our partnership with Rutgers University, and I'm excited to announce that as a result of this relationship, the Rutgers team has helped the Township site potential locations (based on drainage calculations) for over 25 green infrastructure projects. Heavy rain events and strong storms continue to increase in velocity, frequency, and intensity, and Woodbridge is ready to continue to adapt and strengthen the resilience of our community.



Rain garden construction at Fords Branch Library



Modifying the impacts of localized flooding and nuisance run-off takes the ability to allocate appropriate resources to best solve known drainage problems. That's precisely what resiliency is - the manner by which to address issues instead of running from them, and rebounding from strong storms quickly without collapse. We're seeking to co-evolve with previously existing issues which are only escalating in scale and scope. We can't expect our traditional infrastructure to compete with storms and tides that are increasing in strength and magnitude. It's like asking a Major League Baseball pitcher to give you a perfect game while playing on a field designed for little leaguers. The design and expectation is just not practical. So what do you do when Mother Nature's best hitters start corking their bats? I say you throw her your best curve ball and keep them coming. The heavy hitting storms will continue to be relentless, and the reality is that it takes serious thought and consideration to plan these projects in order to ensure success. Through systematic partnerships and the careful examination of engineering and scientific parameters, I envision a future where Woodbridge will be legendary for reshaping the storm-water game.



John E. McCormac, Mayor  
Township of Woodbridge

It's been said that: "*water is the driving force of all nature*," and it's with these words in mind that I take solace in this important undertaking. This mission is about so much more than just the fate and transport of stormwater run-off, it's about the interconnectivity between people and our natural environment. The health and wealth of a community can be recognized by its environmental heartbeat. This pulse can be measured in quantifiable results like pollution reduction, ground water recharge, and peak storm-water volume decreases. But, it's also indicative of the ability for a community to envision a future where these practices are institutionalized as a matter of its cultural fabric. What we are doing in Woodbridge isn't just a few pretty plants; it's a driving force to do the right thing for water and for all life which depends upon it.



# Appendix A

***Woodbridge Township***  
***Impervious Cover Reduction Action Plan***  
***Prepared by:***  
***Rutgers Cooperative Extension Water***  
***Resources Program***

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# Appendix B

## ***Woodbridge Township Recreation & Open Space Inventory***

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# Appendix C

***Woodbridge Township***

***Floodplain Restoration Plan***

***Prepared by: Rutgers Cooperative Extension***

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