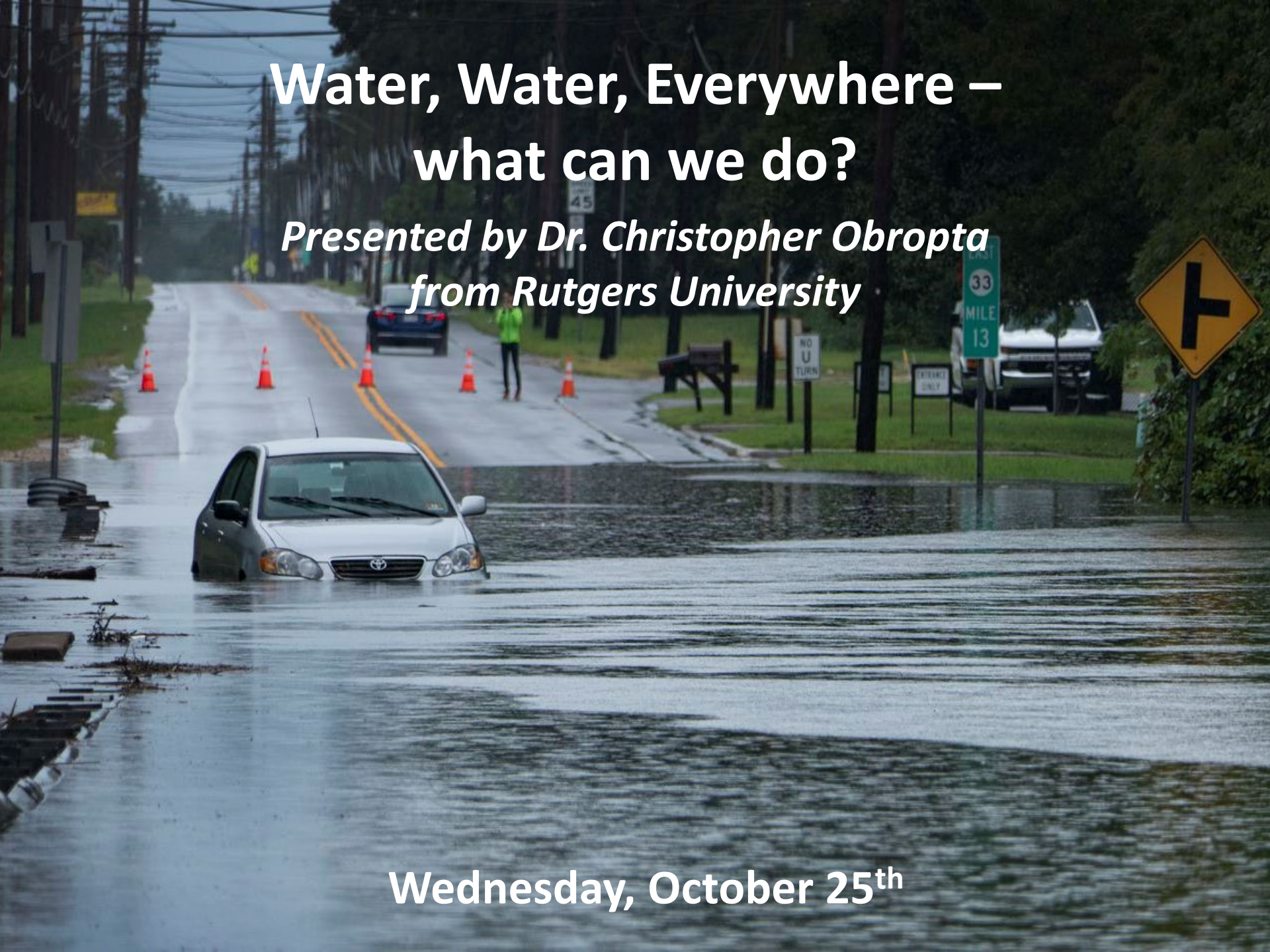


Water, Water, Everywhere – what can we do?

Presented by Dr. Christopher Obropta from Rutgers University

Wednesday, October 25th

Rutgers Cooperative Extension

Rutgers Cooperative Extension (RCE) helps the diverse population of New Jersey adapt to a rapidly changing society and improves their lives through an educational process that uses science-based knowledge.

Water Resources Program

Our mission is to identify and address water resources issues by engaging and empowering communities to employ practical science-based solutions to help create a more equitable and sustainable New Jersey.

Community Rating System (CRS)

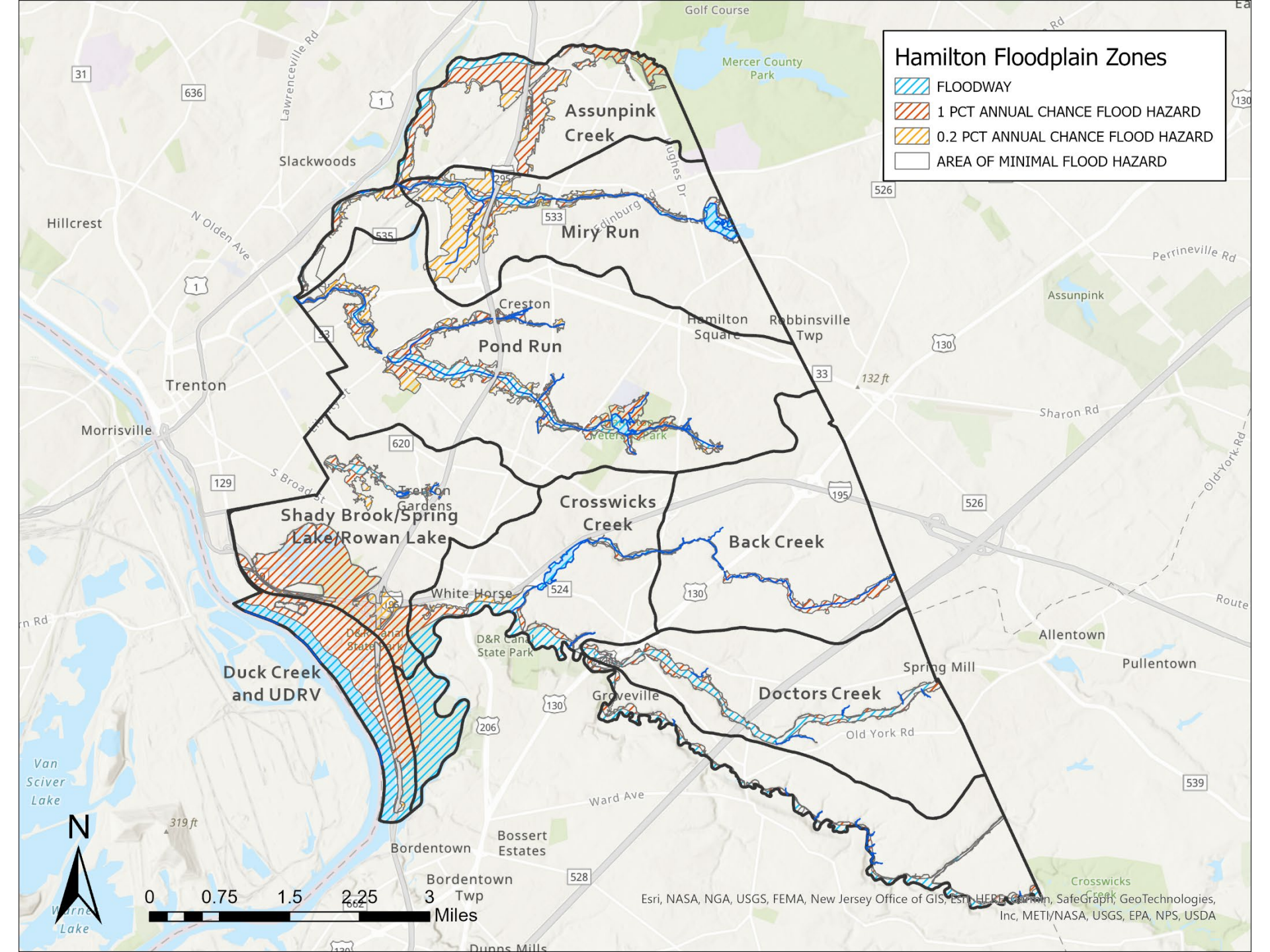
- The Community Rating System (CRS) is a national program developed by the Federal Emergency Management Agency (FEMA).
- The National Flood Insurance Program (NFIP) provides federally backed flood insurance within communities that enact and enforce floodplain regulations.
- Under the Community Rating System (CRS), communities can be rewarded for doing more than simply regulating construction of new buildings to the minimum national standards.

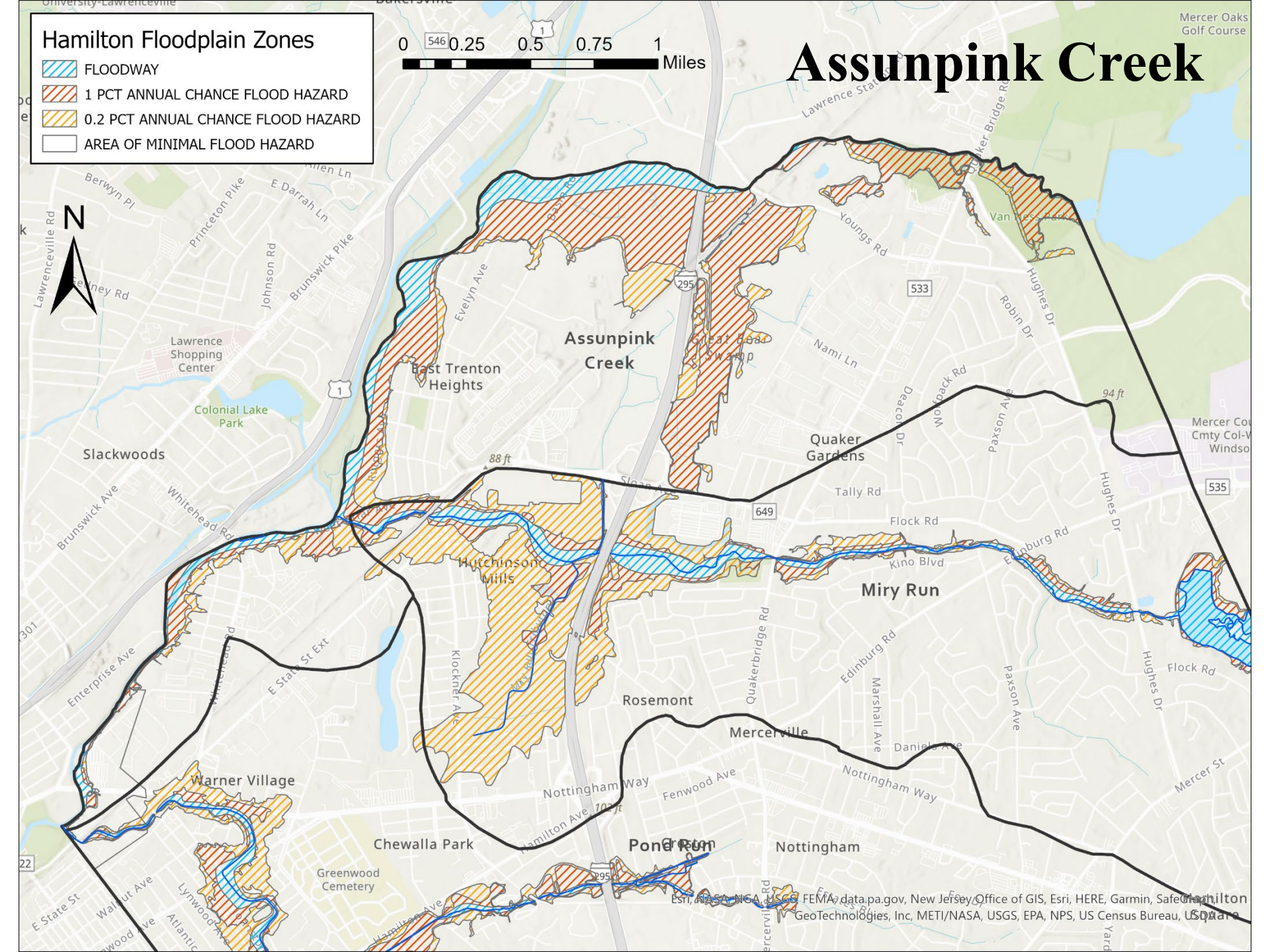
Community Rating System (CRS)

- Under the CRS, the flood insurance premiums of a community's residents and businesses are discounted to reflect that community's work to reduce flood damage to existing buildings, manage development in areas not mapped by the NFIP, protect new buildings beyond the minimum NFIP protection level, preserve and/or restore natural functions of floodplains, help insurance agents obtain flood data, and help people obtain flood insurance.
- The goals of the NFIP are to provide flood insurance to property owners, to encourage flood loss reduction activities by communities, and to save taxpayers' money. As a part of the NFIP, the CRS provides both incentives and tools to further these goals.

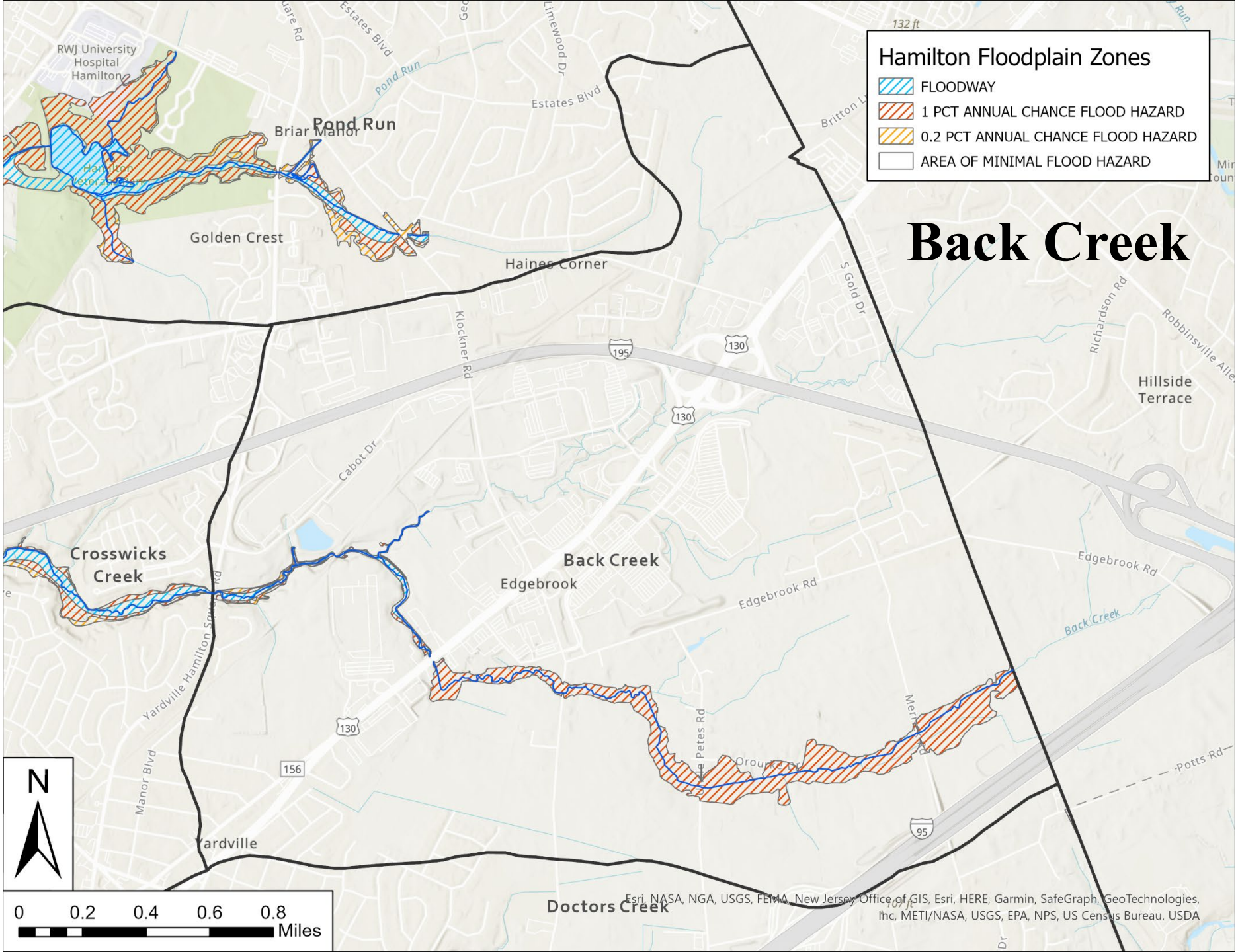

Sweet Briar Ave at Whitehead Road
04.16.2007


45
EAST
33
MILE
13
NO
U
TURN

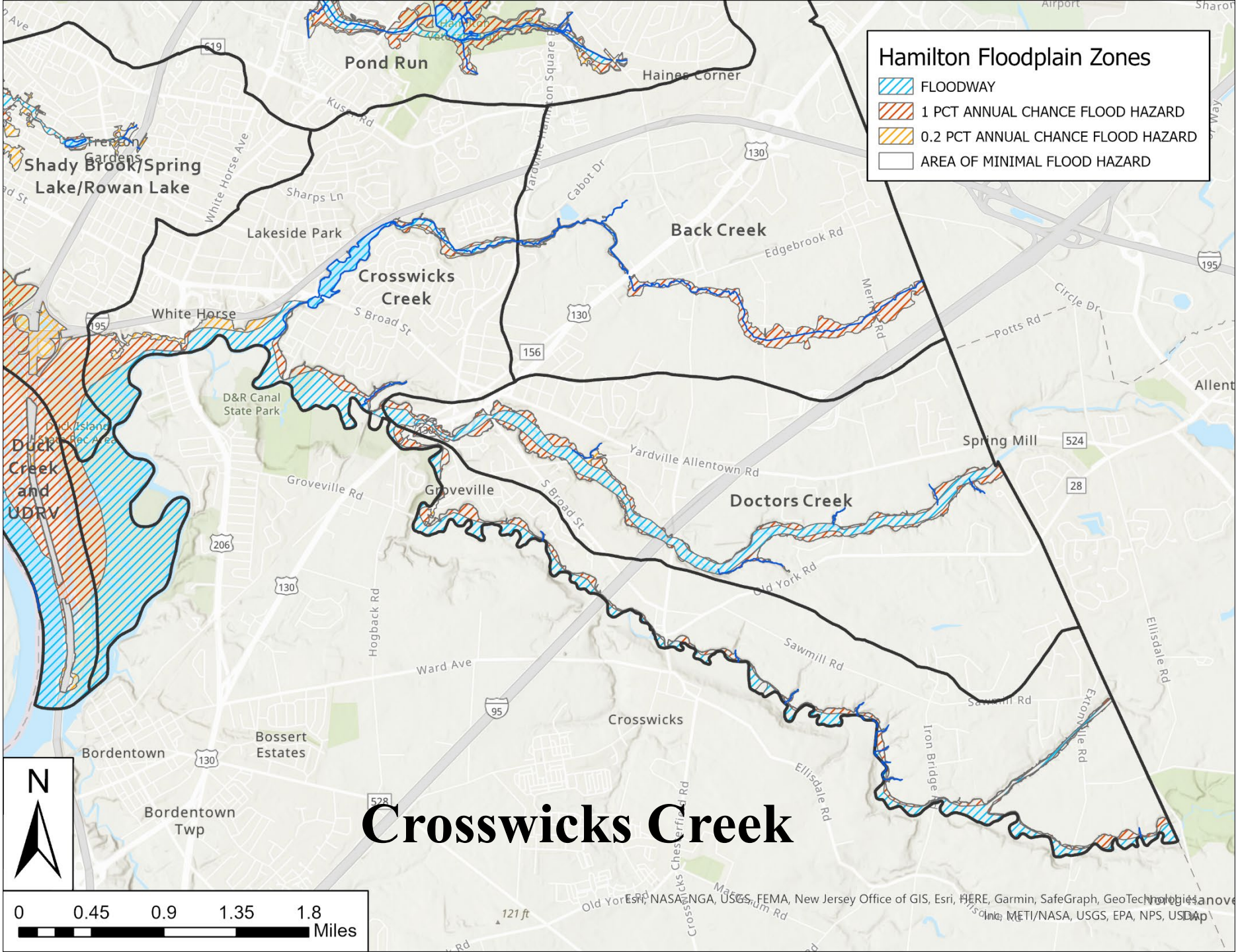

Hamilton Floodplain Zones
FLOODWAY
1 PCT ANNUAL CHANCE FLOOD HAZARD
0.2 PCT ANNUAL CHANCE FLOOD HAZARD
AREA OF MINIMAL FLOOD HAZARD
Assunpink Creek
Miry Run
Pond Run
Crosswicks Creek
Back Creek
Shady Brook/Spring Lake/Rowan Lake
Duck Creek and UDRV
Doctors Creek
Trenton
Morrisville
Hamilton Square
Robbinsville Twp
Allentown
Pullentown
Spring Mill
Groveville
White Horse
Bordentown
Bossert Estates
Bordentown Twp
Slackwoods
Hillcrest
Creston
Assunpink
Mercer County Park
Golf Course
D&R Canal State Park
Old York Rd
Ward Ave
Sharon Rd
Perrineville Rd
N Olden Ave
Lawrenceville Rd
S Broad St
Van Sciver Lake
Warner Lake
N
0 0.75 1.5 2.25 3 Miles
Esri, NASA, NGA, USGS, FEMA, New Jersey Office of GIS, Esri, HERE, Garmin, SafeGraph, GeoTechnologies, Inc, METI/NASA, USGS, EPA, NPS, USDA


Hamilton Floodplain Zones
FLOODWAY
1 PCT ANNUAL CHANCE FLOOD HAZARD
0.2 PCT ANNUAL CHANCE FLOOD HAZARD
AREA OF MINIMAL FLOOD HAZARD
0 0.25 0.5 0.75 1 Miles
N
Assunpink Creek
Assunpink Creek
East Trenton Heights
Great Bear Swamp
Lawrence Shopping Center
Colonial Lake Park
Slackwoods
Quaker Gardens
Hutchinson Mills
Miry Run
Rosemont
Mercerville
Warner Village
Chewalla Park
Pond Run
Nottingham
Greenwood Cemetery
Mercer Oaks Golf Course
Van Hess Park
Lawrence Station
Youngs Rd
Nami Ln
Tally Rd
Flock Rd
Kino Blvd
Edinburg Rd
Hughes Dr
Robin Dr
Paxson Ave
Quakerbridge Rd
Marshall Ave
Daniels Ave
Nottingham Way
Fenwood Ave
Hamilton Ave
Mercer St
Enterprise Ave
E State St Ext
Whitehead Rd
Klockner Ave
Brunswick Ave
Princeton Pike
Johnson Rd
Brunswick Pike
Evelyn Ave
Berwyn Pl
E Darrah Ln
Lawrenceville Rd
Walnut Ave
Lynwood Ave
Atlantic Ave
88 ft
94 ft
102 ft
295
1
533
649
535
22
Esri, NASA, NGA, USGS, FEMA, data.pa.gov, New Jersey Office of GIS, Esri, HERE, Garmin, SafeGraph, GeoTechnologies, Inc, METI/NASA, USGS, EPA, NPS, US Census Bureau, USDA
Hamilton Square

“Don’t enter a flooded building until it’s been cleared by an inspector.”


Hamilton Floodplain Zones
FLOODWAY
1 PCT ANNUAL CHANCE FLOOD HAZARD
0.2 PCT ANNUAL CHANCE FLOOD HAZARD
AREA OF MINIMAL FLOOD HAZARD
Back Creek
RWJ University Hospital Hamilton
Pond Run
Briar Manor
Golden Crest
Haines Corner
Hillside Terrace
Crosswicks Creek
Back Creek
Edgebrook
Yardville
Doctors Creek
Estates Blvd
Klockner Rd
Cabot Dr
Edgebrook Rd
Yardville Hamilton Square Rd
Manor Blvd
Petes Rd
Potts Rd
Richardson Rd
S Gold Dr
Limewood Dr
Pond Run
Back Creek
132 ft
195
130
156
95
N
0 0.2 0.4 0.6 0.8 Miles
Esri, NASA, NGA, USGS, FEMA, New Jersey Office of GIS, Esri, HERE, Garmin, SafeGraph, GeoTechnologies, Inc, METI/NASA, USGS, EPA, NPS, US Census Bureau, USDA

“If your water heater or furnace needs to be replaced, put the new one in a spot above the flood level, so you won’t have to replace it after the next flood.”


Hamilton Floodplain Zones
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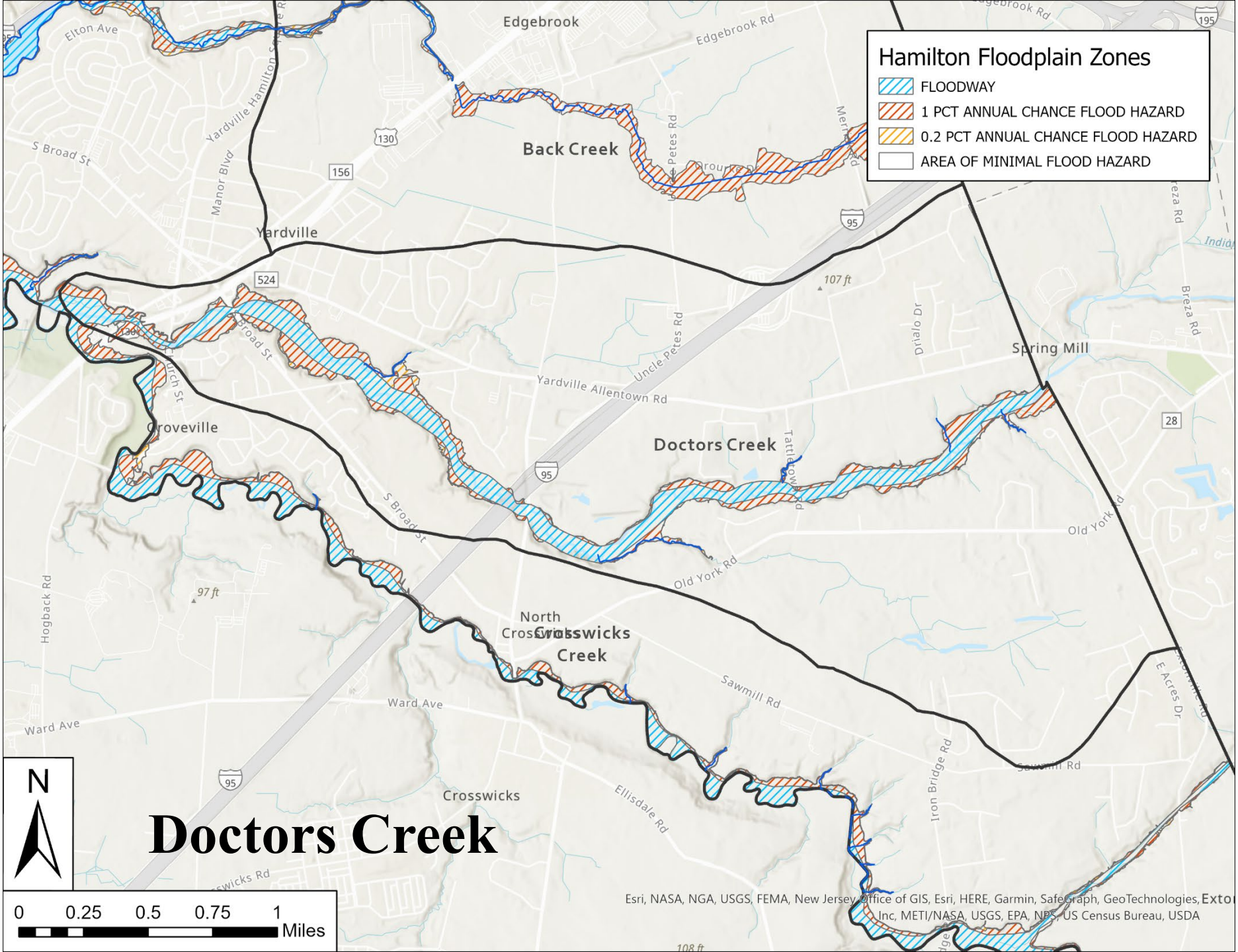
1 PCT ANNUAL CHANCE FLOOD HAZARD
0.2 PCT ANNUAL CHANCE FLOOD HAZARD
AREA OF MINIMAL FLOOD HAZARD
Crosswicks Creek
Pond Run
Haines Corner
Shady Brook/Spring Lake/Rowan Lake
Lakeside Park
Crosswicks Creek
Back Creek
White Horse
D&R Canal State Park
Duck Creek and UDRV
Groveville
Doctors Creek
Spring Mill
Crosswicks
Bordentown
Bossert Estates
Bordentown Twp
N
0 0.45 0.9 1.35 1.8 Miles
Esri, NASA, NGA, USGS, FEMA, New Jersey Office of GIS, Esri, HERE, Garmin, SafeGraph, GeoTechnologies, Inc, METI/NASA, USGS, EPA, NPS, USDA

“Get a building permit before you start your repairs.”


Hamilton Floodplain Zones
FLOODWAY
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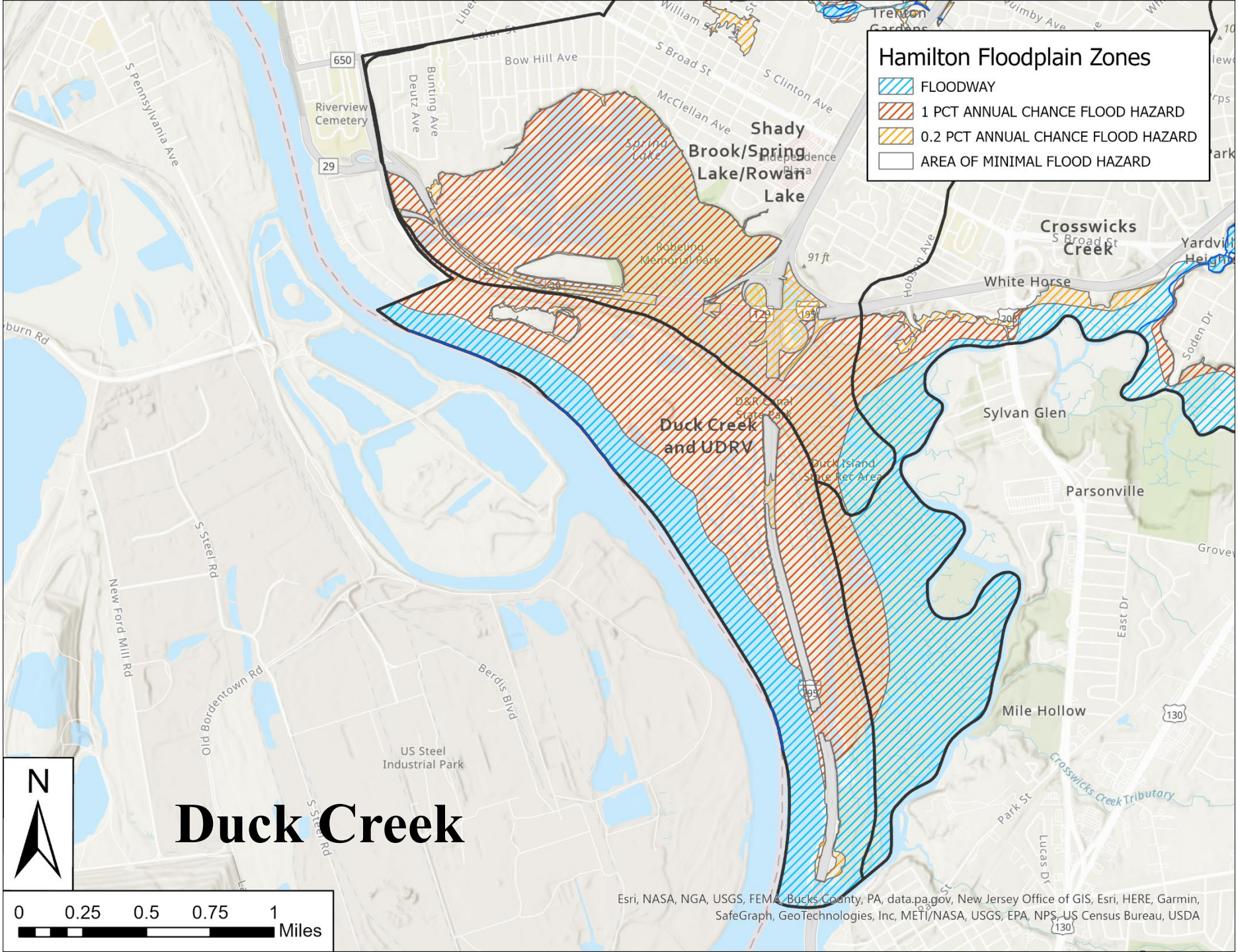
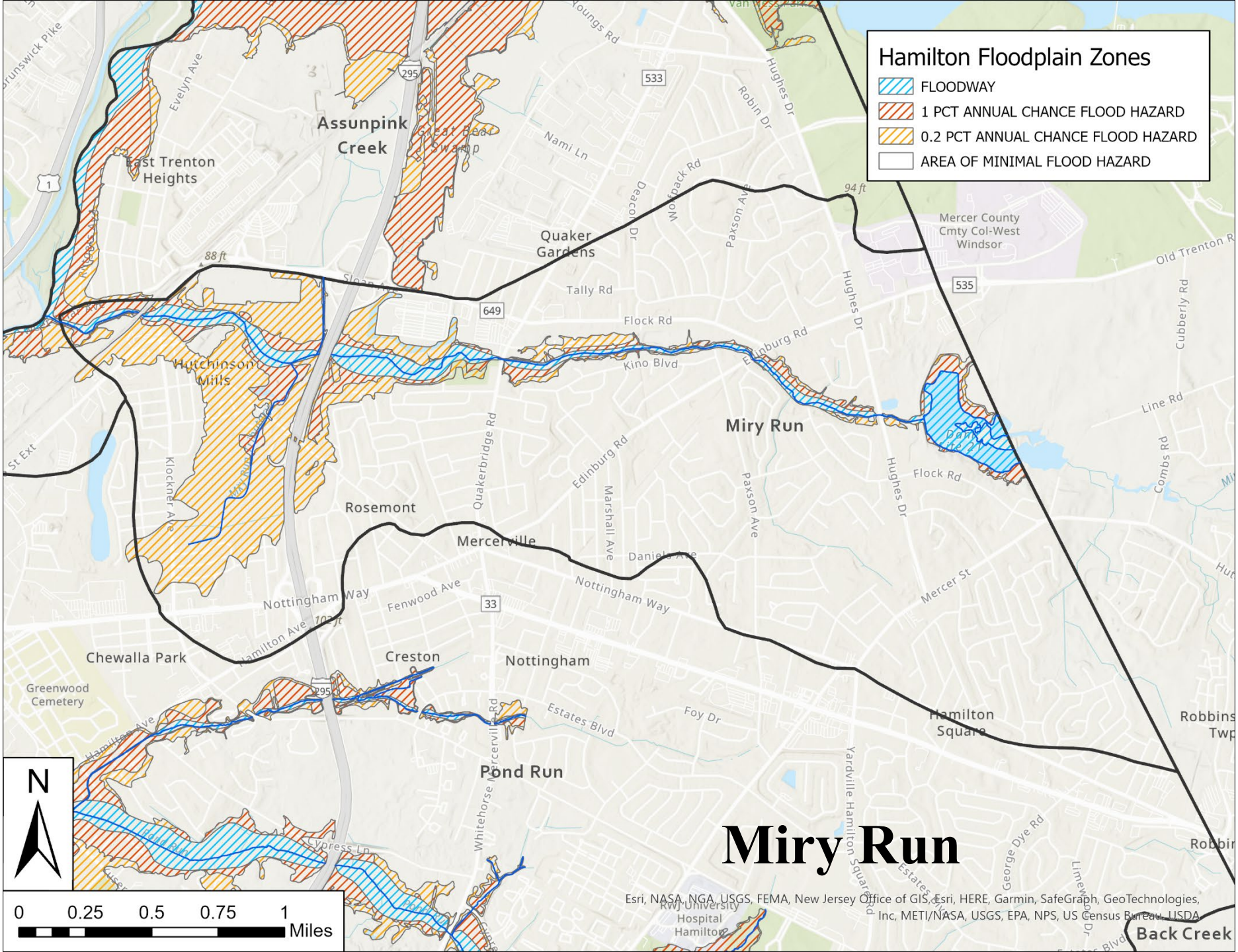
0.2 PCT ANNUAL CHANCE FLOOD HAZARD
AREA OF MINIMAL FLOOD HAZARD
Doctors Creek
Edgebrook
Back Creek
Yardville
Groveville
Spring Mill
Doctors Creek
North Crosswicks
Crosswicks Creek
Crosswicks
Elton Ave
Edgebrook Rd
S Broad St
Manor Blvd
Yardville Allentown Rd
Uncle Petes Rd
Drialo Dr
Breza Rd
Old York Rd
Hogback Rd
Ward Ave
Sawmill Rd
Iron Bridge Rd
Ellisdale Rd
E Acres Dr
107 ft
97 ft
108 ft
130
156
524
95
28
195
N
0 0.25 0.5 0.75 1 Miles
Esri, NASA, NGA, USGS, FEMA, New Jersey Office of GIS, Esri, HERE, Garmin, SafeGraph, GeoTechnologies, Inc, METI/NASA, USGS, EPA, NPS, US Census Bureau, USDA

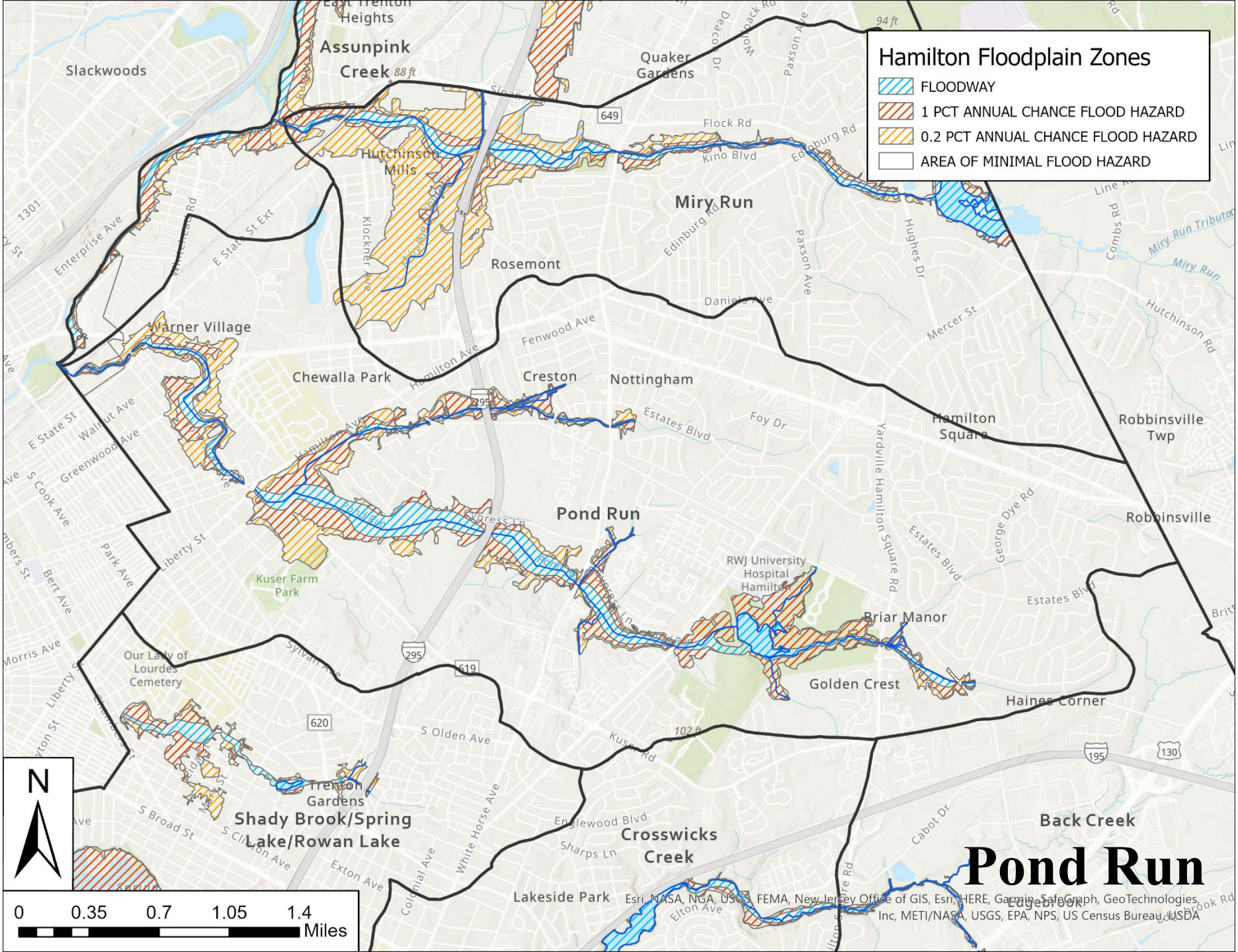
“If the street is under water, turn Around Don’t Drown.”


Hamilton Floodplain Zones
FLOODWAY
1 PCT ANNUAL CHANCE FLOOD HAZARD
0.2 PCT ANNUAL CHANCE FLOOD HAZARD
AREA OF MINIMAL FLOOD HAZARD
Duck Creek
N
0 0.25 0.5 0.75 1 Miles
Shady Brook/Spring Lake/Rowan Lake
Duck Creek and UDRV
Crosswicks Creek
Sylvan Glen
Parsonville
Mile Hollow
White Horse
Yardville Heights
Trenton Gardens
Riverview Cemetery
Robeling Memorial Park
Duck Island State Rec Area
D&R Canal State Park
US Steel Industrial Park
Bow Hill Ave
S Broad St
S Clinton Ave
McClellan Ave
Bunting Ave
Deutz Ave
S Pennsylvania Ave
Hobson Ave
Soden Dr
East Dr
Park St
Lucas Dr
S Steel Rd
New Ford Mill Rd
Old Bordentown Rd
Berdis Blvd
Crosswicks Creek Tributary
91 ft
650
29
129
195
206
130
Esri, NASA, NGA, USGS, FEMA, Bucks County, PA, data.pa.gov, New Jersey Office of GIS, Esri, HERE, Garmin, SafeGraph, GeoTechnologies, Inc, METI/NASA, USGS, EPA, NPS, US Census Bureau, USDA

“Know your evacuation route”


Hamilton Floodplain Zones
FLOODWAY
1 PCT ANNUAL CHANCE FLOOD HAZARD
0.2 PCT ANNUAL CHANCE FLOOD HAZARD
AREA OF MINIMAL FLOOD HAZARD
Miry Run
N
0 0.25 0.5 0.75 1 Miles
Esri, NASA, NGA, USGS, FEMA, New Jersey Office of GIS, Esri, HERE, Garmin, SafeGraph, GeoTechnologies, Inc, METI/NASA, USGS, EPA, NPS, US Census Bureau, USDA
Assunpink Creek
East Trenton Heights
Quaker Gardens
Hutchinson Mills
Rosemont
Mercerville
Chewalla Park
Creston
Nottingham
Pond Run
Miry Run
Hamilton Square
Back Creek
Mercer County Cmty Col-West Windsor
RWJ University Hospital Hamilton
Great Bear Swamp
Greenwood Cemetery
Robbins Twp
88 ft
94 ft
103 ft
Sloan Ave
Tally Rd
Flock Rd
Kino Blvd
Edinburg Rd
Quakerbridge Rd
Marshall Ave
Paxson Ave
Hughes Dr
Nottingham Way
Fenwood Ave
Hamilton Ave
Mercer St
Line Rd
Cubberly Rd
Combs Rd
Old Trenton Rd
Foy Dr
Estates Blvd
Yardville Hamilton Square Rd
George Dye Rd
Whitehorse Mercerville Rd
Cypress Ln
Klockner Ave
Evelyn Ave
Youngs Rd
Nami Ln
Robin Dr
Woodpack Rd
Limewood Dr
649
535
533
33
295
1

“Know where the evacuation shelters are”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0.2 PCT ANNUAL CHANCE FLOOD HAZARD
AREA OF MINIMAL FLOOD HAZARD
Pond Run
N
0 0.35 0.7 1.05 1.4 Miles
Esri, NASA, NGA, USGS, FEMA, New Jersey Office of GIS, Esri, HERE, Garmin, SafeGraph, GeoTechnologies, Inc, METI/NASA, USGS, EPA, NPS, US Census Bureau, USDA
Assunpink Creek
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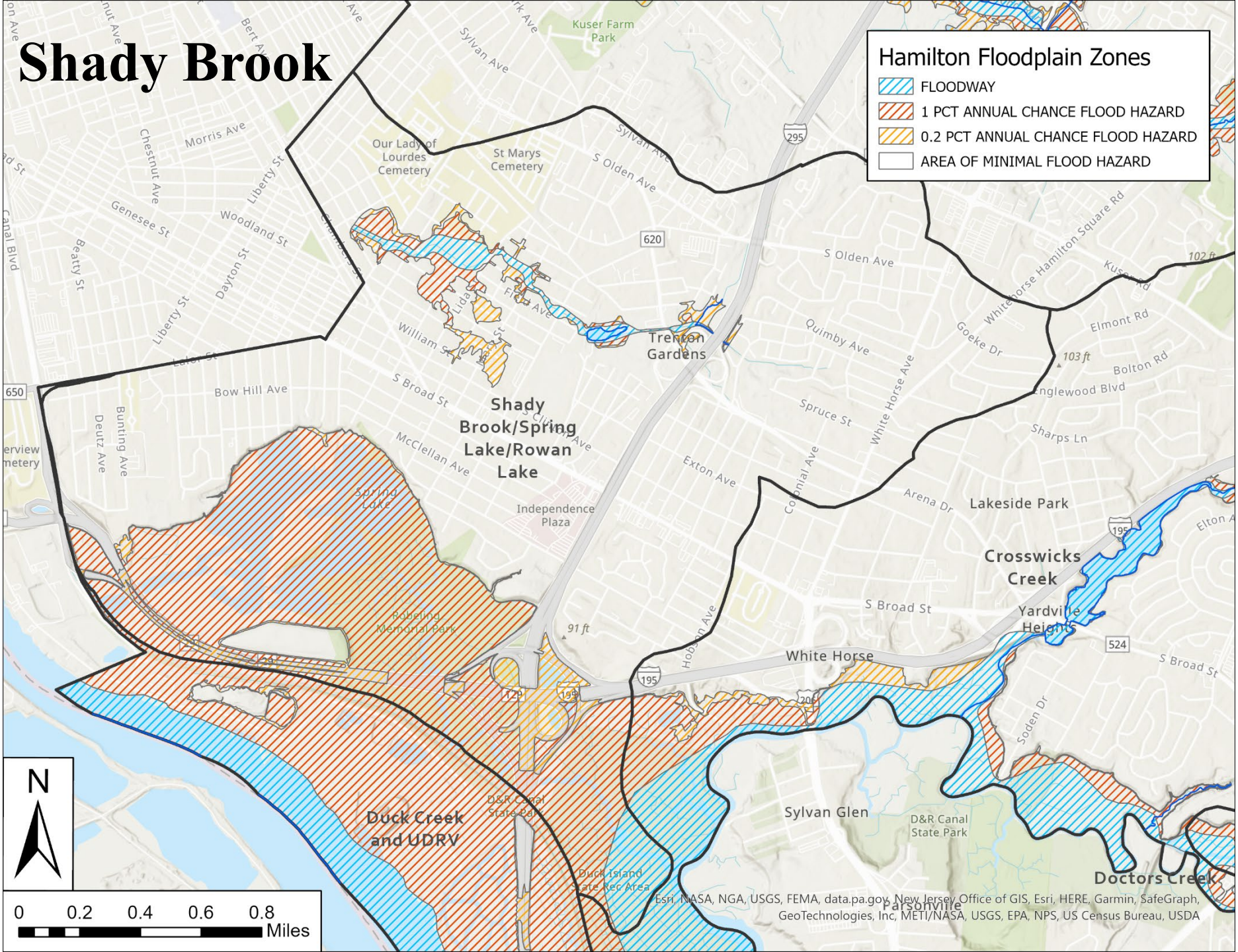
Creston
Nottingham
Hamilton Square
Robbinsville Twp
Robbinsville
Pond Run
Kuser Farm Park
RWJ University Hospital Hamilton
Briar Manor
Golden Crest
Haines Corner
Our Lady of Lourdes Cemetery
Trenton Gardens
Shady Brook/Spring Lake/Rowan Lake
Crosswicks Creek
Back Creek
Lakeside Park
Edgebrook
649
295
619
620
195
130
Flock Rd
Kino Blvd
Edinburg Rd
Fenwood Ave
Hamilton Ave
Estates Blvd
Foy Dr
Yardville Hamilton Square Rd
George Dye Rd
Mercer St
Hughes Dr
Paxson Ave
Enterprise Ave
E State St
Liberty St
Park Ave
Sylvan Ave
S Olden Ave
Kuser Rd
Englewood Blvd
Sharps Ln
Cabot Dr
White Horse Ave
Colonial Ave
Exton Ave
S Broad St
Elton Ave
Hutchinson Rd
Miry Run Tributary
Miry Run
94 ft
102 ft
88 ft

“DON’T operate a generator indoors or in a closed space.”


Shady Brook
Hamilton Floodplain Zones
FLOODWAY
1 PCT ANNUAL CHANCE FLOOD HAZARD
0.2 PCT ANNUAL CHANCE FLOOD HAZARD
AREA OF MINIMAL FLOOD HAZARD
Shady Brook/Spring Lake/Rowan Lake
Duck Creek and UDRV
Crosswicks Creek
Doctors Creek
Trenton Gardens
Lakeside Park
Yardville Heights
White Horse
Sylvan Glen
Parsonville
Kuser Farm Park
Our Lady of Lourdes Cemetery
St Marys Cemetery
Independence Plaza
Robelind Memorial Park
Spring Lake
D&R Canal State Park
Duck Island State Rec Area
N
0 0.2 0.4 0.6 0.8 Miles
Esri, NASA, NGA, USGS, FEMA, data.pa.gov, New Jersey Office of GIS, Esri, HERE, Garmin, SafeGraph, GeoTechnologies, Inc, METI/NASA, USGS, EPA, NPS, US Census Bureau, USDA

“DON’T operate a generator near doors, windows, fans, or vents.”

Basement Flooding

Don't go down into the water

- Flood water is mixed in with storm water, could be sanitary sewer mixture, could be oils from the street.
- There's so many contaminants in the runoff water that you wouldn't want anyone touching it unless they're wearing the proper protective gear to protect themselves.

Electric Panel

- If the main circuit panel is under water the next step is to not touch anything in the house and to get out of the house and call 911 or a reputable contractor to assess the situation.

Be Prepared

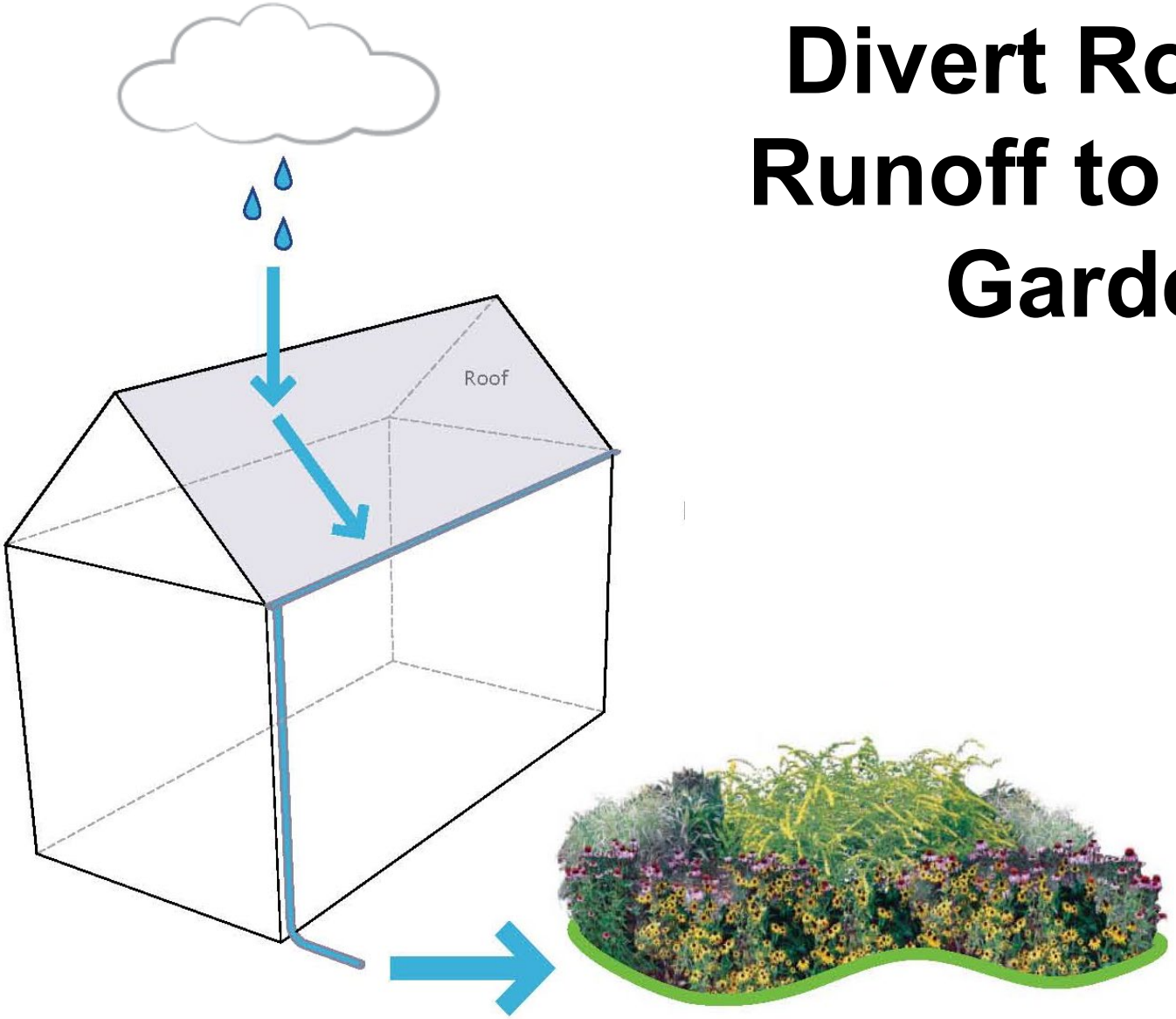
- Get a sump pumps and shop vac
- Install a French drain to help capture and divert water to sump pumps
- Consider a backup generator
- Know the location of your electric panel and what breakers control basement outlets
- Know the location of your gas meter.
- Unplug any powered items that may become submerged
- After the event contact your insurance company, take lots of pictures and document everything.

Drainage Problems from Smaller Storms

- Direct rainwater away from the house
- Keep inlets clean
- Divert rooftop runoff to a rain garden
- Install a rain barrel to harvest the rainwater
- Consider a permeable driveway

Keep inlets clean

Divert Rooftop Runoff to a Rain Garden



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New Jersey Agricultural Experiment Station

Rain Gardens

A rain garden is a landscaped, shallow depression that is designed to capture, treat, and infiltrate stormwater at the source before it becomes runoff.

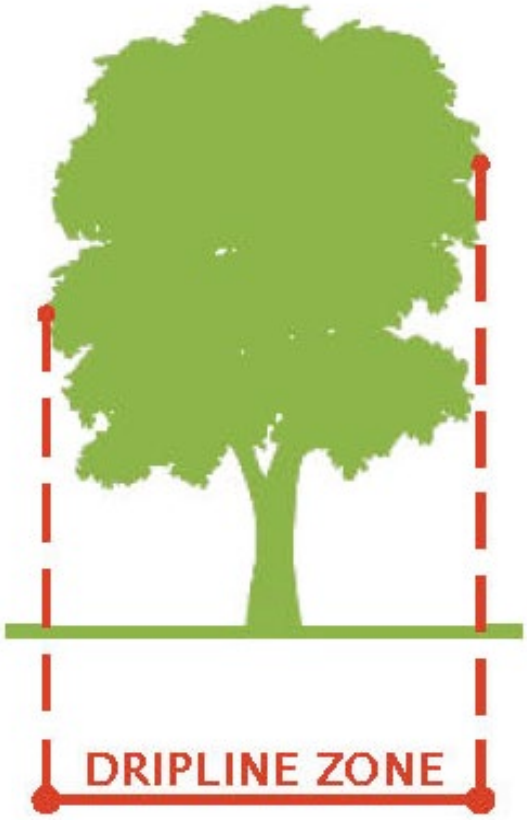
Rain Gardens

- Landscaped areas that treat stormwater runoff
- Designed to merge two important goals: aesthetics and water quality
- Can be blended into the landscape and made to look natural
- Water is directed into them by pipes, swales, or curb openings

RUTGERS
New Jersey Agricultural Experiment Station

Site Selection

1. Next to a building with a basement, rain garden should be located at a minimum of 10′ from building; no basement, 2′ from building
2. Do not place rain garden within 25′ of a septic system
3. Do not situate rain garden in soggy places where water already ponds
4. Avoid seasonably-high water tables within 2′ of rain garden depth
5. Consider flat areas first – easier digging
6. Avoid placing rain garden within dripline of trees



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Native Vegetation









8. 2. 2004





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Here is the website for the rain garden manual:
http://www.water.rutgers.edu/Rain_Gardens/RGWebsite/RainGardenManualofNJ.html

Rain Garden App

A Mobile App for designing, installing, and maintaining a Rain Garden

Download the Rain Garden App first. "Rain Garden" is a **FREE app** designed to help you properly install a rain garden at your home, office, or job site. Through video tutorials, diagrams, text, and tools, the App guides you through determining the size and placement of your garden, selecting plants, digging and planting your garden, and maintaining your garden. It also includes tools for determining your soil type, measuring the size of the area that will drain to your garden, and managing multiple rain garden projects.

Download on the App Store

Download for Android

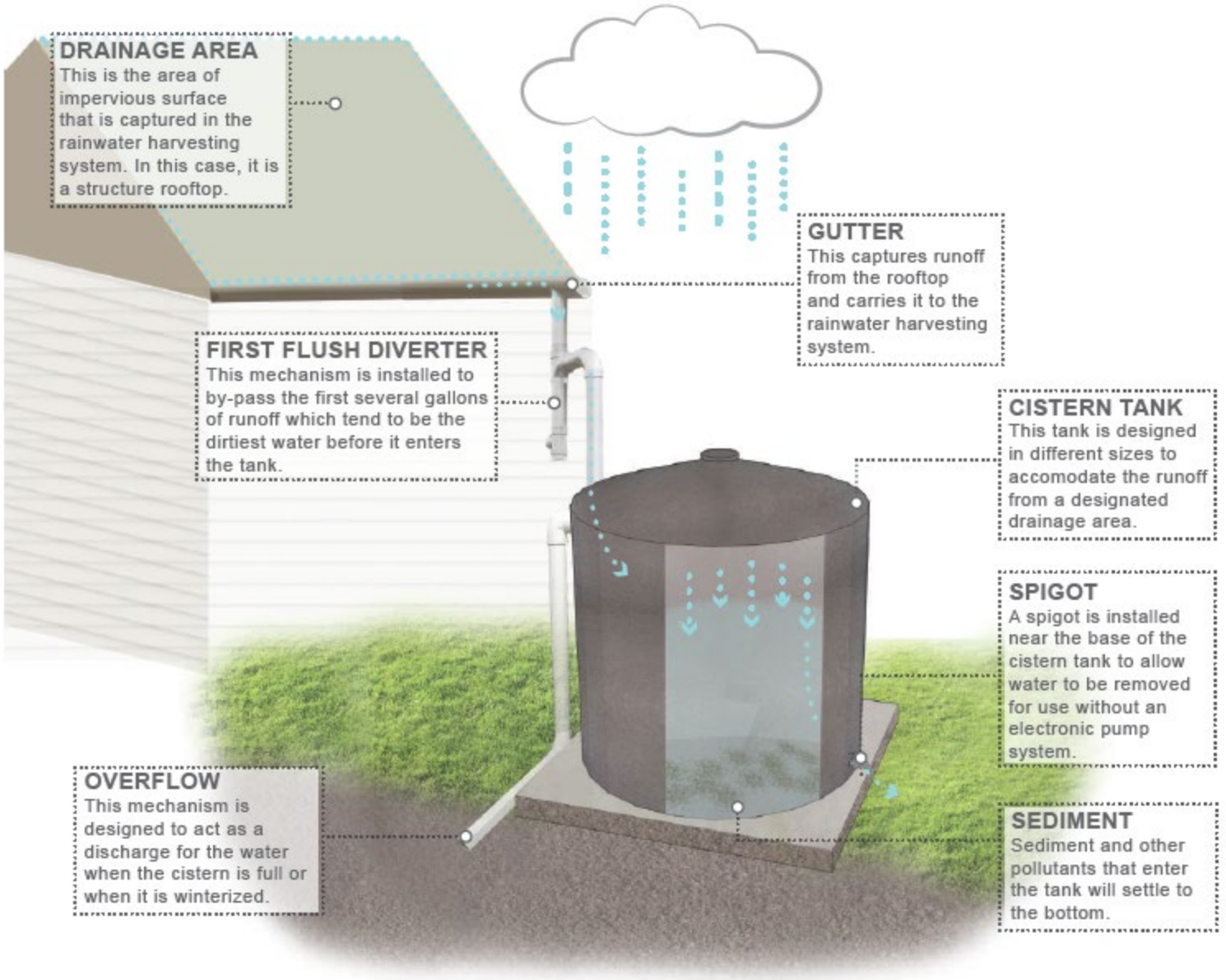
Help Promote the App! Click here to request App promo cards to display in your town hall or business.

To learn more about Rain Gardens visit the NEMO Rain Garden Website.

For more information about the App, if you are interested in expanding the App's tools to your area, to make suggestions or to simply heap praise upon the heads of your humble App designers, please contact us.

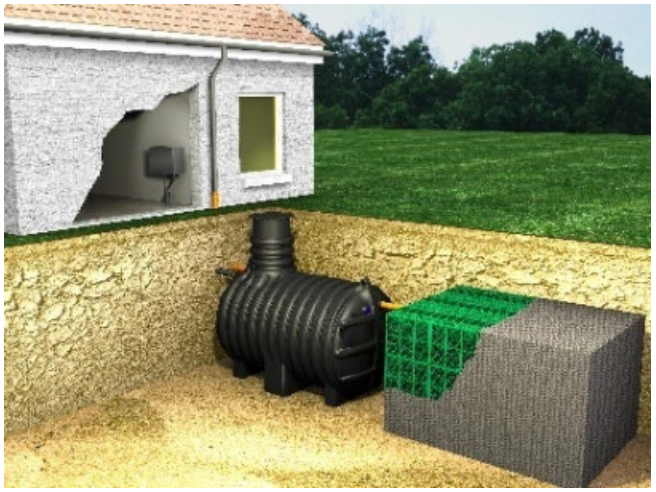
Funding for national expansion of this app was provided by the United States Department of Agriculture/National Institute of Food and Agriculture, project #CONS2013-05768.

Rainwater Harvesting Systems

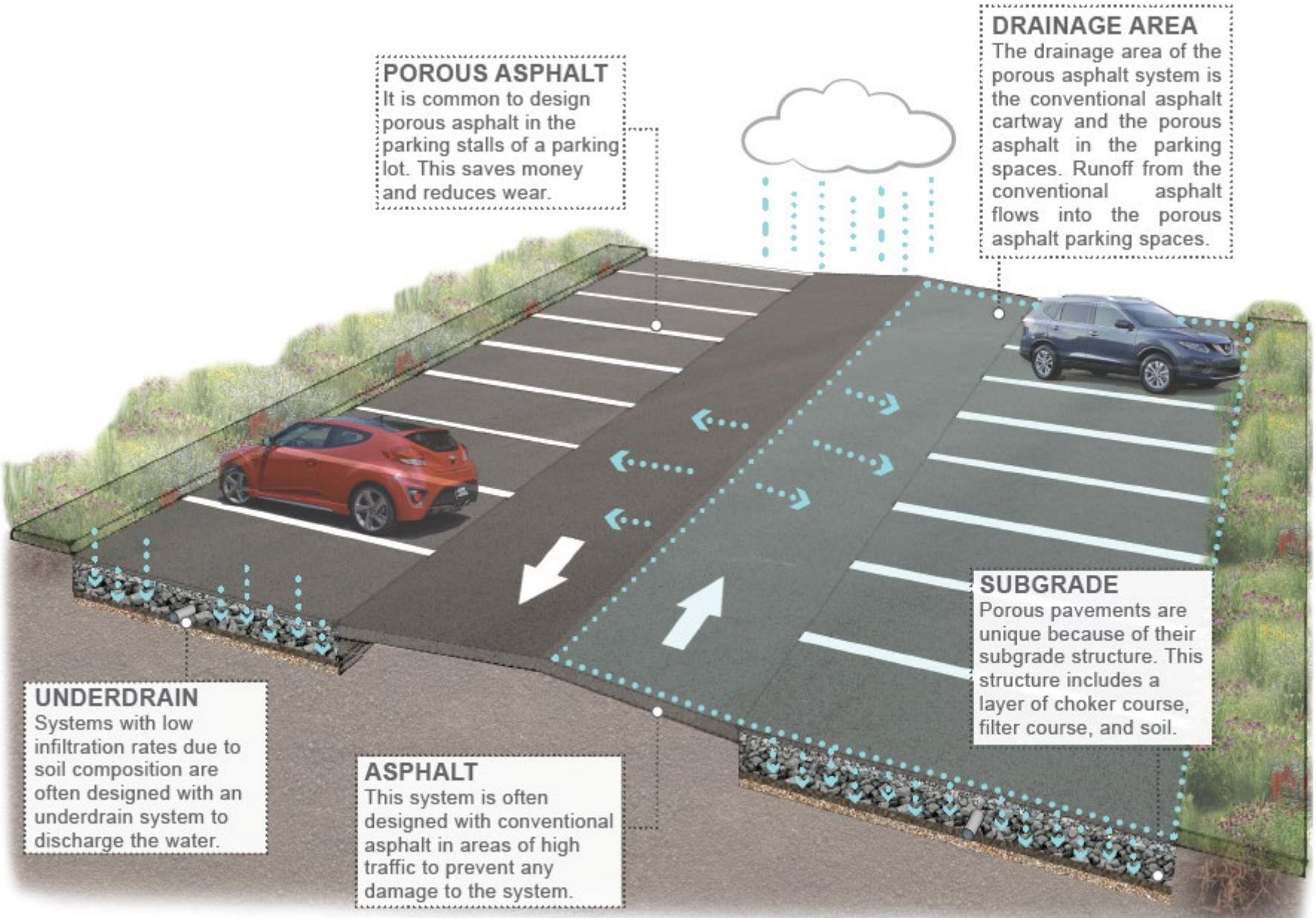


Rain Barrels

Cisterns

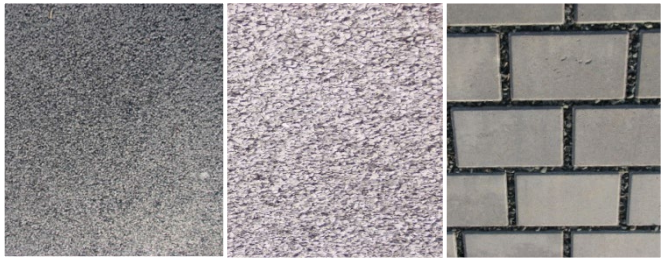


Permeable Pavement



Permeable Pavements

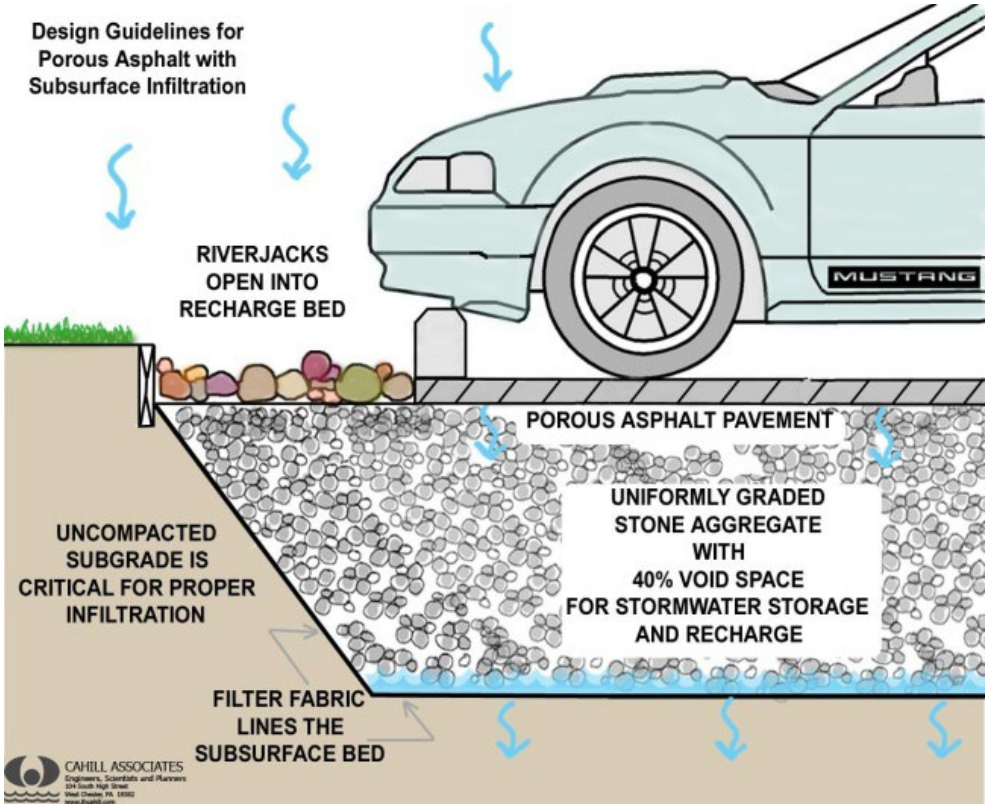
- Underlying stone reservoir
- Porous asphalt and pervious concrete are manufactured without "fine" materials to allow infiltration
- Grass pavers are concrete interlocking blocks with open areas to allow grass to grow
- Permeable pavers systems are concrete pavers with infiltration between the spaces of the pavers
- Ideal application for porous pavement is to treat a low traffic or overflow parking area



ADVANTAGES

- Manage stormwater runoff
- Minimize site disturbance
- Promote groundwater recharge
- Low life cycle costs, alternative to costly traditional stormwater management methods
- Mitigation of urban heat island effect
- Contaminant removal as water moves through layers of system

COMPONENTS



Porous Asphalt

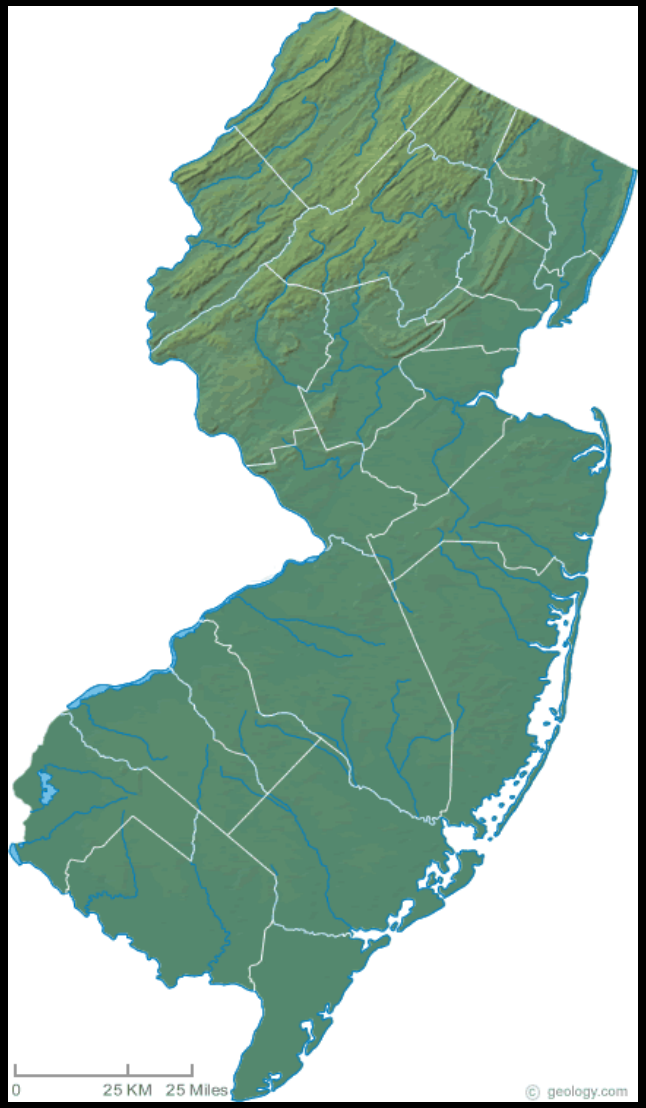

Pervious Concrete


Permeable Pavers


Grass Pavers

Climate Change in New Jersey

- More warm extremes and fewer cold extremes
- Heavy rains become more intense
- More intense dry spells
- Rising sea level with increased frequency and intensity of coastal flooding



NEW JERSEY 24 HOUR RAINFALL FREQUENCY DATA

Rainfall Amounts in Inches

County	1 year	2 year	5 year	10 year	25 year	50 year	100 year
Atlantic	2.72	3.31	4.30	5.16	6.46	7.61	8.90
Bergen	2.75	3.34	4.27	5.07	6.28	7.32	8.47
Burlington	2.77	3.36	4.34	5.18	6.45	7.56	8.81
Camden	2.73	3.31	4.25	5.06	6.28	7.34	8.52
Cape May	2.67	3.25	4.22	5.07	6.34	7.47	8.73
Cumberland	2.69	3.27	4.25	5.09	6.37	7.49	8.76
Essex	2.85	3.44	4.40	5.22	6.44	7.49	8.66
Gloucester	2.71	3.29	4.24	5.05	6.29	7.36	8.55
Hudson	2.73	3.31	4.23	5.02	6.19	7.20	8.31
Hunterdon	2.80	3.38	4.26	5.00	6.09	7.02	8.03
Mercer	2.74	3.31	4.23	5.01	6.19	7.20	8.33
Middlesex	2.76	3.35	4.30	5.12	6.36	7.43	8.63
Monmouth	2.79	3.38	4.38	5.23	6.53	7.66	8.94
Morris	2.94	3.54	4.47	5.24	6.37	7.32	8.35
Ocean	2.81	3.42	4.45	5.33	6.68	7.87	9.20
Passaic	2.87	3.47	4.42	5.23	6.43	7.47	8.62
Salem	2.69	3.26	4.20	5.00	6.22	7.28	8.45
Somerset	2.76	3.34	4.25	5.01	6.15	7.13	8.21
Sussex	2.68	3.22	4.02	4.70	5.72	6.60	7.58
Union	2.80	3.39	4.35	5.17	6.42	7.49	8.69
Warren	2.78	3.34	4.18	4.89	5.93	6.83	7.82

Engineering Field Handbook NJ Supplement/ NOAA Atlas 14

Future Adjusted (per NJDEP Factors 2023)

County	2-YR	10-YR	100-YR
Atlantic	4.04	6.40	12.37
Bergen	4.01	6.24	11.60
Burlington	3.93	6.11	11.63
Camden	3.91	6.17	11.84
Cape May	3.93	6.29	11.52
Cumberland	3.92	6.16	12.18
Essex	4.09	6.37	11.52
Gloucester	3.92	6.21	12.06
Hudson	3.94	5.97	10.22
Hunterdon	4.02	6.15	11.40
Mercer	3.84	5.86	11.33
Middlesex	3.99	6.20	11.48
Monmouth	4.02	6.22	11.26
Morris	4.35	6.71	12.19
Ocean	4.04	6.34	11.41
Passaic	4.20	6.64	12.93
Salem	3.91	6.15	11.15
Somerset	3.97	6.21	12.15
Sussex	3.99	6.06	11.37
Union	4.07	6.36	11.73
Warren	4.01	6.11	10.71

DETERMINING THE SIZE OF THE RAIN GARDEN FOR CLIMATE CHANGE

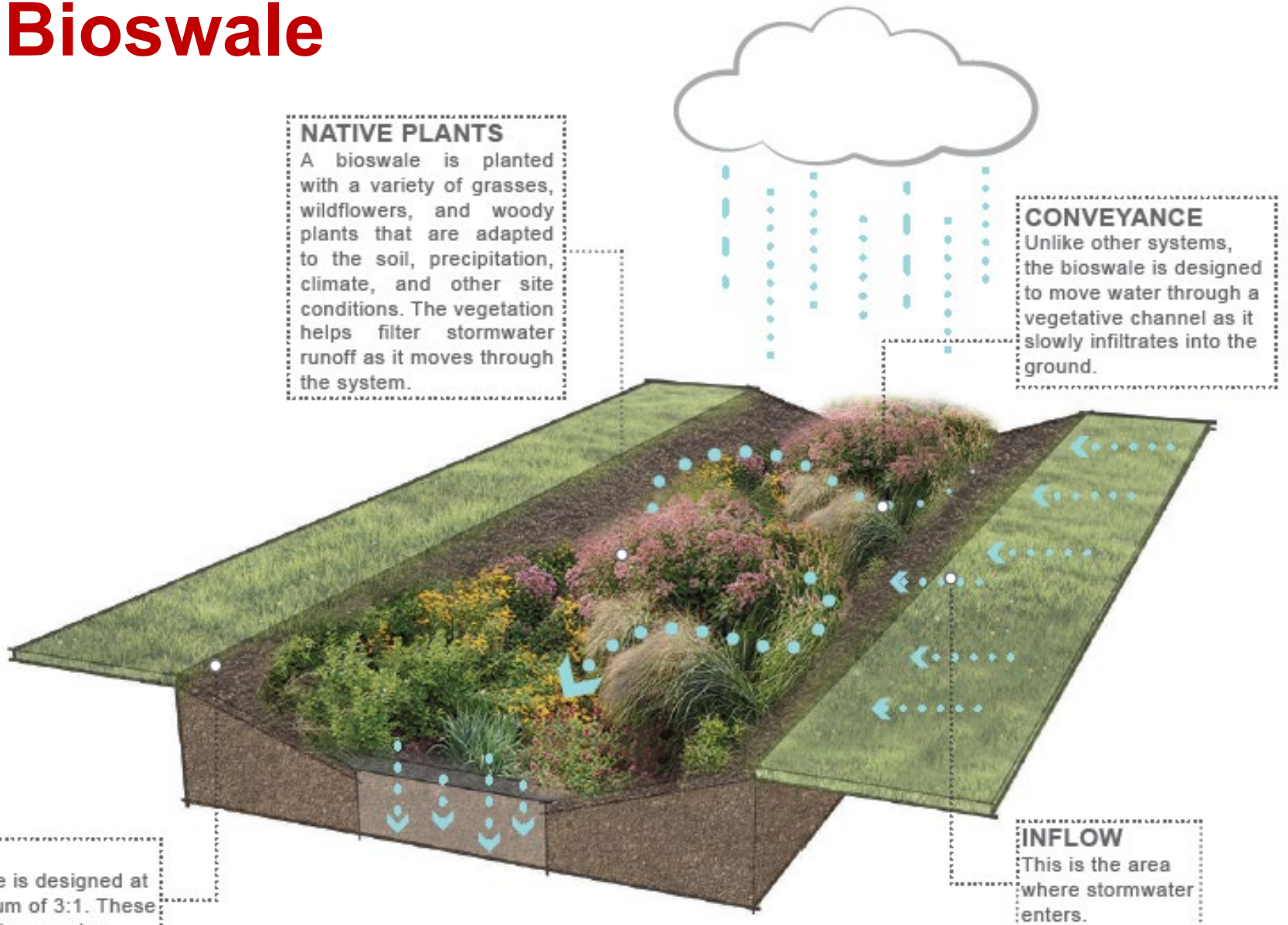
Rain Garden Sizing Table

Based on New Jersey's Water Quality Design Storm (1.5" of rain over 2 hours)

Drainage Area	Size of 3" Deep Rain Garden CLAY SOIL*	Size of 6" Deep Rain Garden SILTY SOIL	Size of 8" Deep Rain Garden SANDY SOIL
500 ft^2	250 ft^2	125 ft^2	94 ft^2
750 ft^2	438 ft^2	188 ft^2	140 ft^2
1,000 ft^2	500 ft^2	250 ft^2	186 ft^2
1,500 ft^2	750 ft^2	375 ft^2	280 ft^2
2,000 ft^2	1000 ft^2	500 ft^2	374 ft^2

*SOIL TEXTURE AMENDMENTS NEEDED

Bioswale



NATIVE PLANTS
A bioswale is planted with a variety of grasses, wildflowers, and woody plants that are adapted to the soil, precipitation, climate, and other site conditions. The vegetation helps filter stormwater runoff as it moves through the system.

CONVEYANCE
Unlike other systems, the bioswale is designed to move water through a vegetative channel as it slowly infiltrates into the ground.

SLOPE
The slope is designed at a maximum of 3:1. These slopes often require erosion control materials for stabilization.

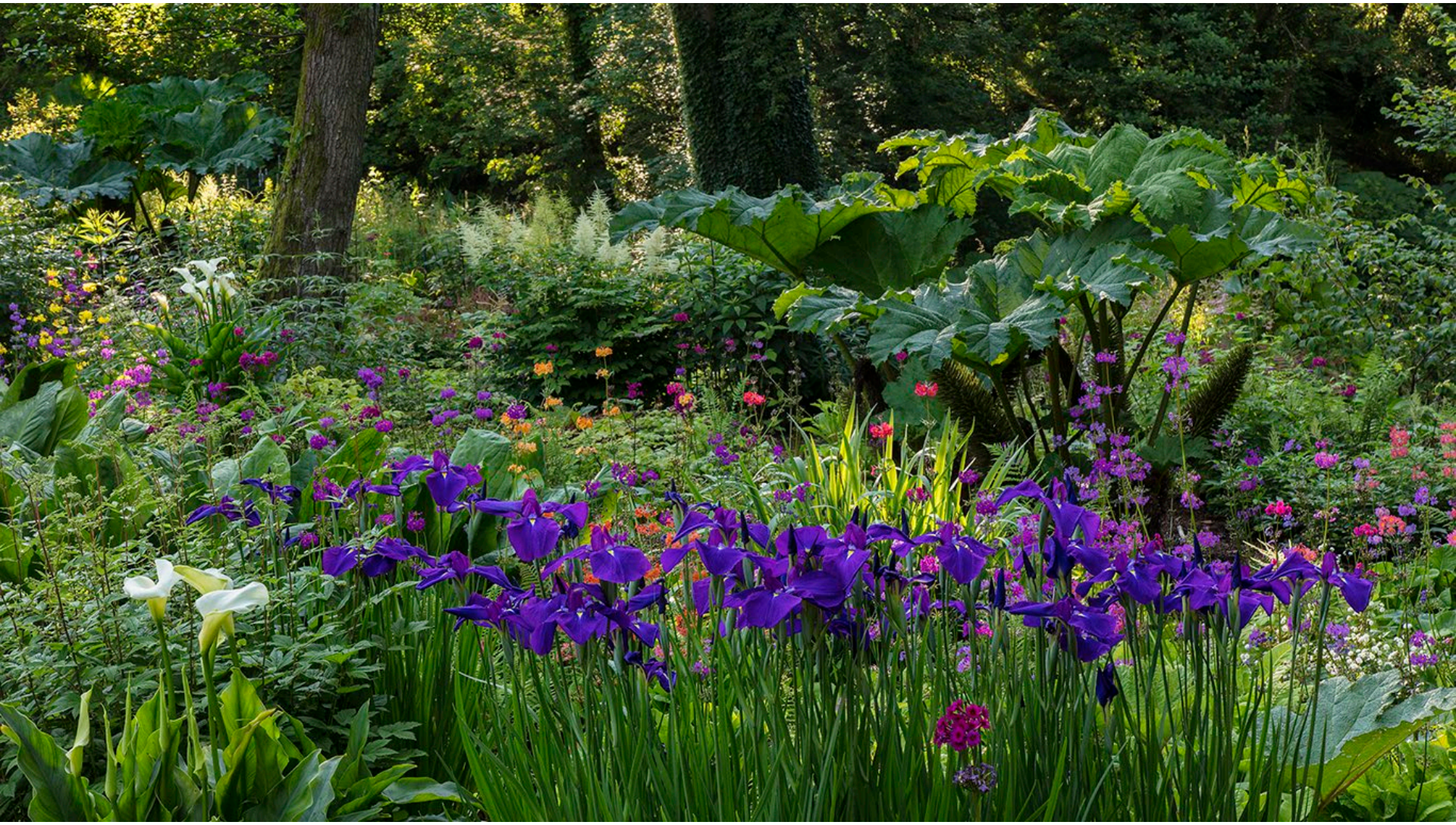
INFLOW
This is the area where stormwater enters.

Bioswale

Native Meadow

Naturalize Detention Basin

If it is too wet,
try a Biofilter Wetland



Questions?