RUTGERS
New Jersey Agricultural Experiment Station

After the Dust Settles We Still Need Implementation: Achieving Reductions in the Raritan Basin

Presented to the Watershed Conference
November 2, 2018

Christopher Obropta, Ph.D., PPE., Rutgers Water Resources Program, Rutgers Cooperative Extension

Tobiah Horton, Rutgers Dept. Of Landscape Architecture

Patricia Rector-Woods, Environmental County Agent,
Rutgers Cooperative Extension

Pollutants of Concern

N. J. A. C. 7:9B Surface Water Quality Standards

Phosphorus (mg/l):
0.1 mg/l for stream or 0.05 mg/l for lakes

Solids, Suspended (mg/L):
40 mg/l for streams

Total Maximum Daily Load (TMDL)

- "A phosphorus TMDL Condition defined as the combination of point and nonpoint source reductions that will satisfy water quality targets throughout the system" – Kleinfelder/Omni

TMDL =

WLA (point source) +

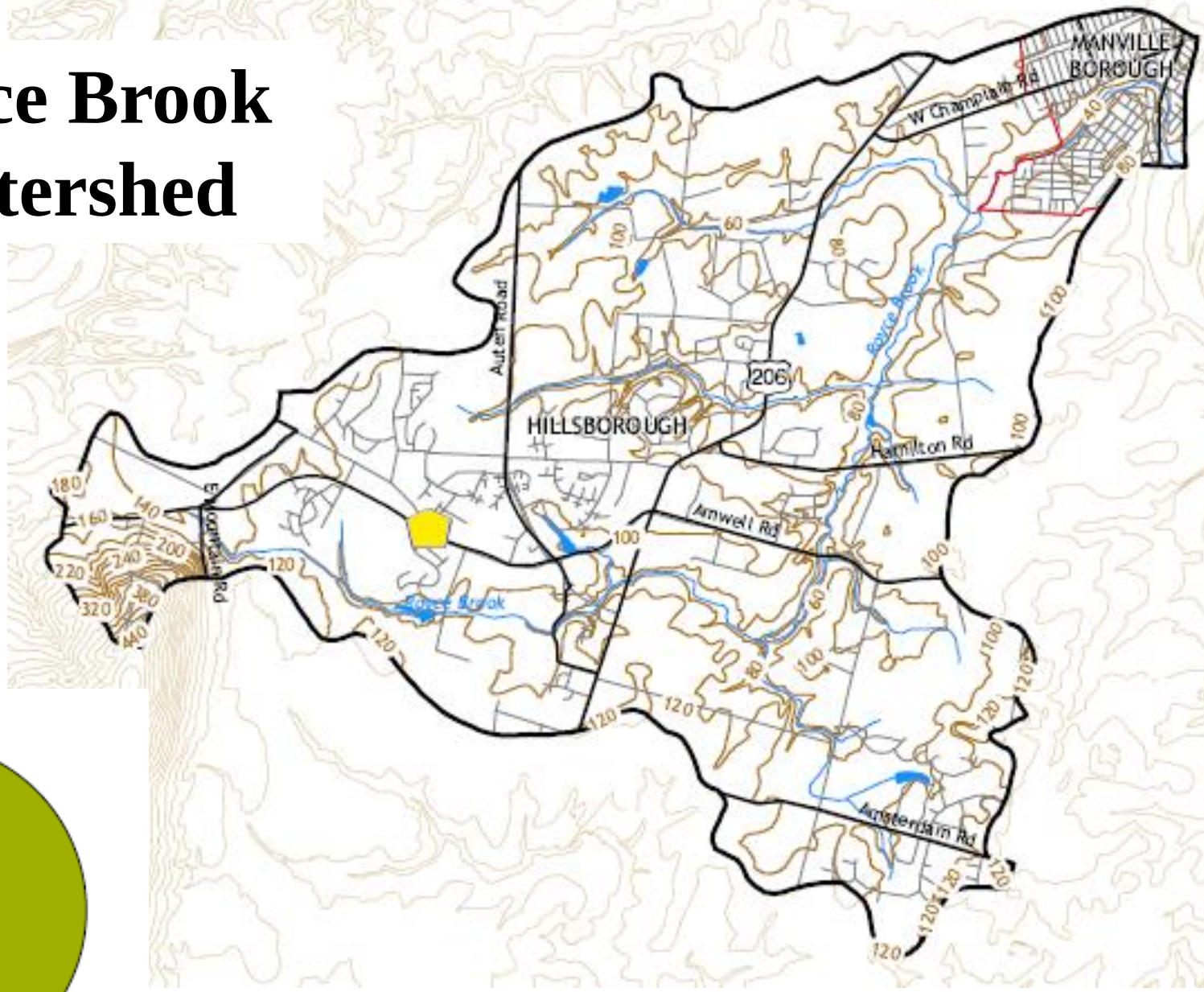
LA (nonpoint sources) +

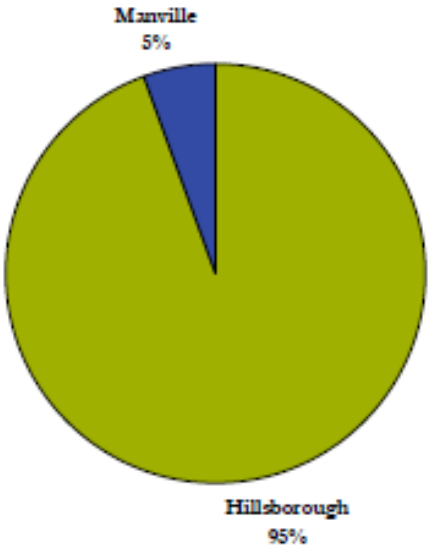
MOS (margin of safety

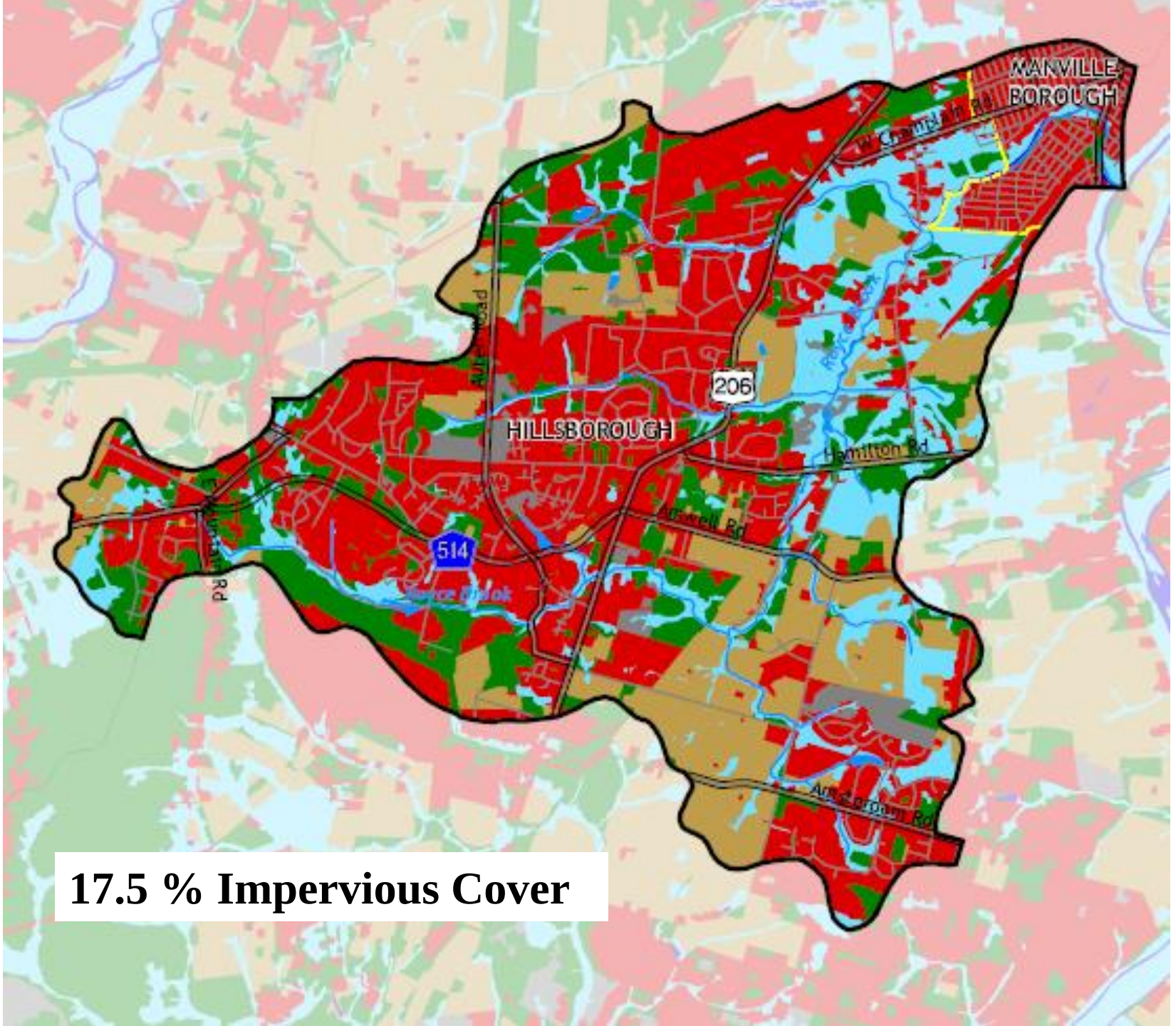
Raritan River Basin
Stormwater and Nonpoint Source TMDL Condition

HUC-14s within Study Area	Subwatershed	Agricultural NPS Percent Reduction	Urban NPS Percent Reduction	Water Quality Targets
02030105110010	Heathcote Brook	60% TSS Reduction		100% Compliance with 40 mg/l TSS Criterion at HUC Outlets within Modeled Streams
02030105110030	Millstone R (Beden Bk to Heathcote Bk)			
02030105110040	Beden Brook (above Province Line Rd)	68% TP & TSS Reduction		100% Compliance with 0.1 mg/l TP Criterion & applicable TSS Criteria at HUC Outlets within Modeled Streams
02030105110050	Beden Brook (below Province Line Rd)			
02030105110060	Rock Brook (above Camp Meeting Ave)			
02030105110070	Rock Brook (below Camp Meeting Ave)			
02030105110080	Pike Run (above Cruser Brook)			
02030105110090	Cruser Brook / Roaring Brook			
02030105110100	Pike Run (below Cruser Brook)			
02030105110110	Millstone R (BlackwellsMills to BedenBk)	60% TSS Reduction		100% Compliance with 40 mg/l TSS Criterion at HUC Outlets within Modeled Streams
02030105110120	Sixmile Run (above Middlebush Rd)			
02030105110130	Sixmile Run (below Middlebush Rd)			
02030105110140	Millstone R (AmwellRd to BlackwellsMills)			
02030105110150	Royce Brook (above Branch Royce Brook)			
02030105110160	Royce Brook (below/incl Branch Royce Bk)			

Royce Brook Watershed





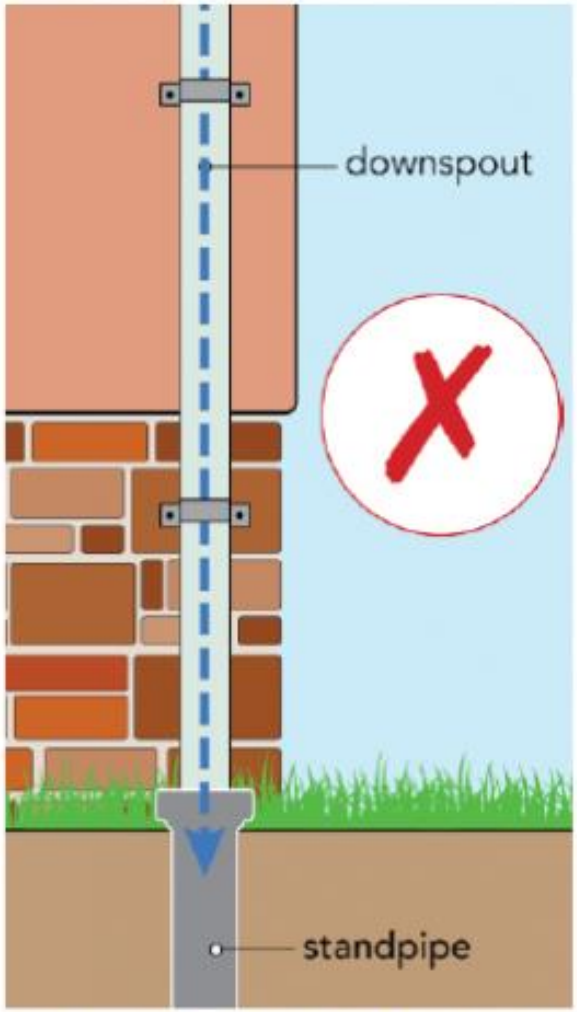


17.5 % Impervious Cover

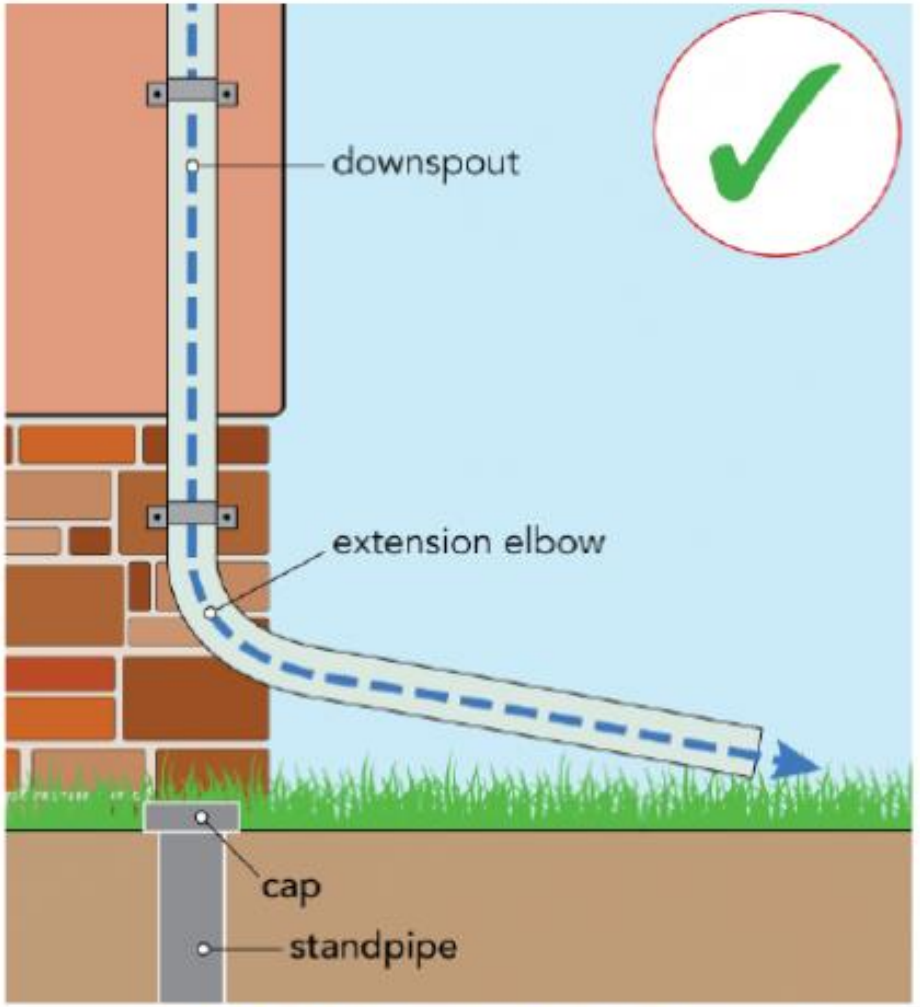
Let's start with controlling runoff from impervious surfaces

Step 1: Depave

Step 2: Simple Disconnection

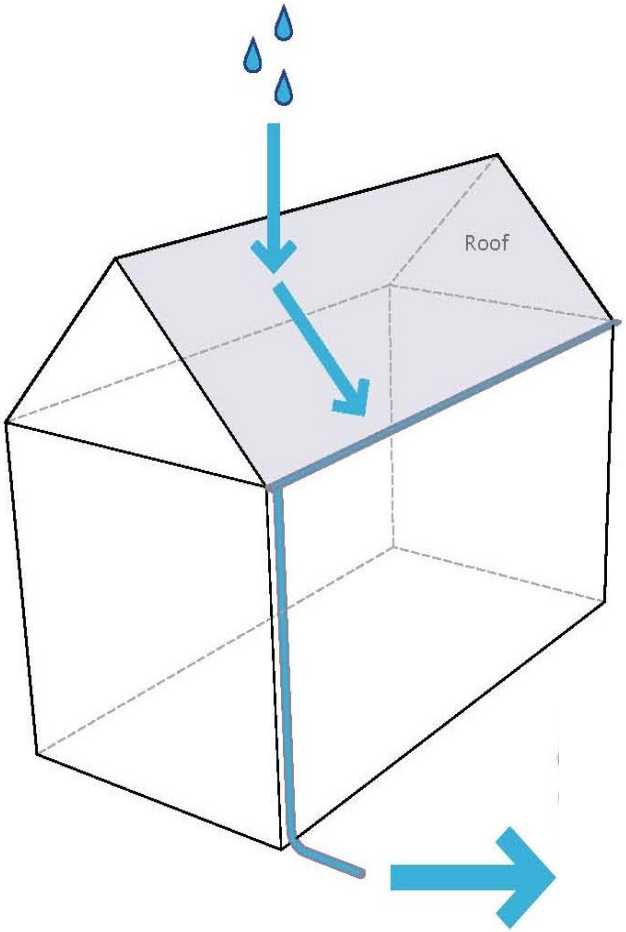


DOWNSPOUT CONNECTED TO SEWER SYSTEM



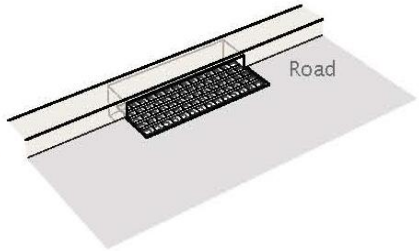
DOWNSPOUT DISCONNECTED FROM SEWER SYSTEM

Disconnect to a Rain Barrel or Cistern



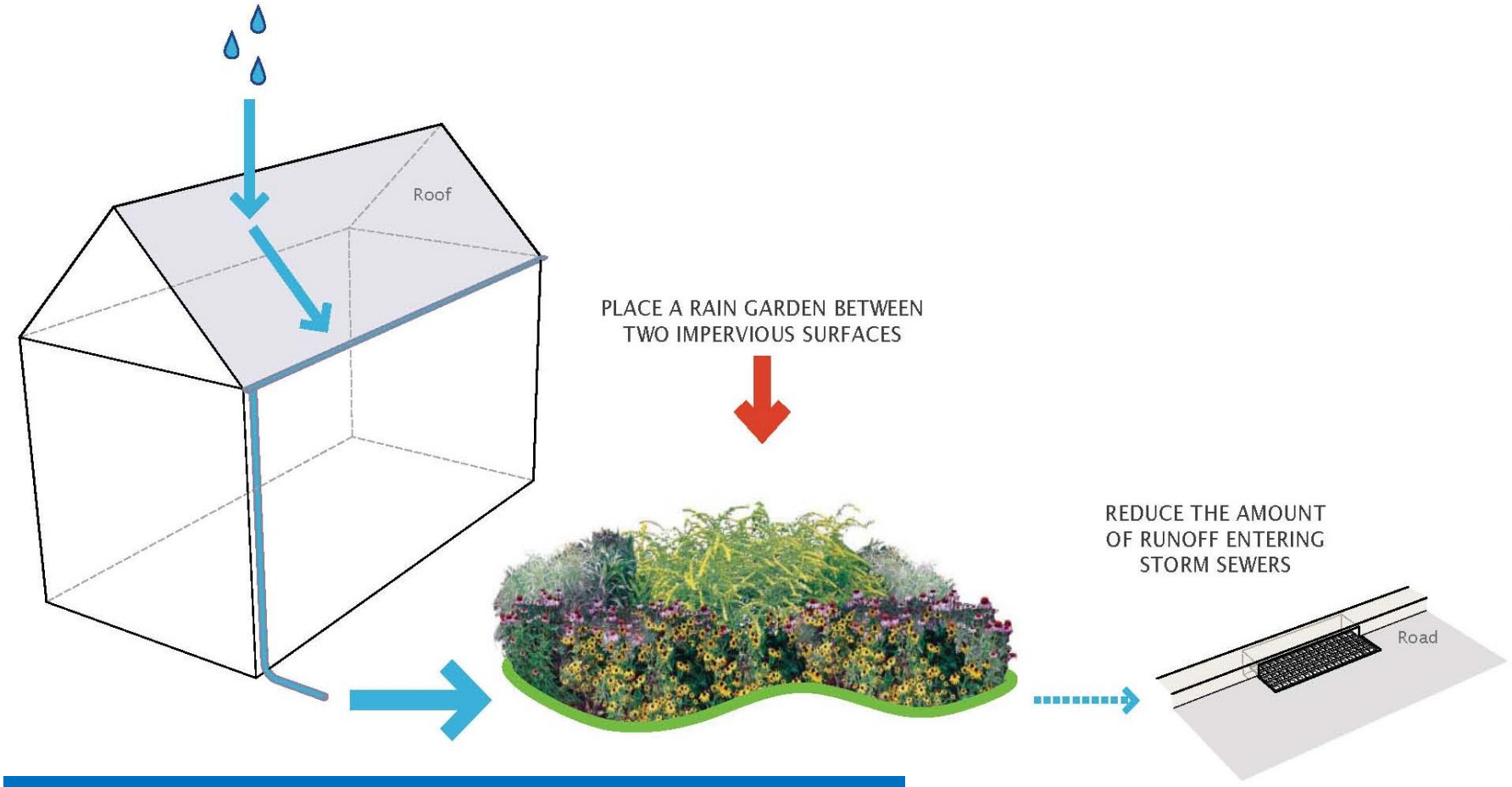
Disconnect your downspout by installing a rain barrel

REDUCE THE AMOUNT OF RUNOFF ENTERING STORM SEWERS



Impervious area is now ***"disconnected"*** from flowing directly into the storm sewer system

Disconnect to a Rain Garden



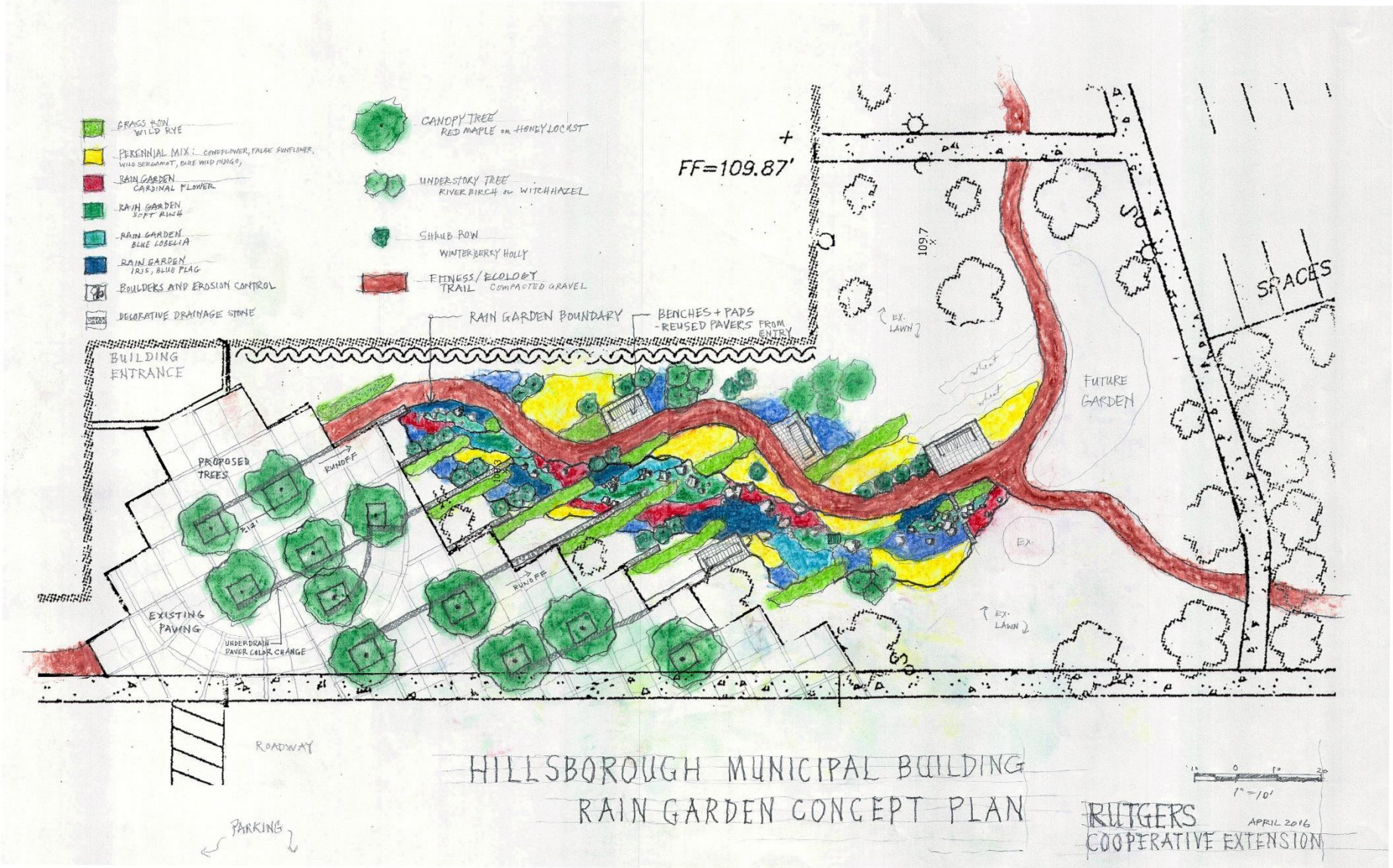
Rooftop runoff is now ***"disconnected"*** from flowing directly into the storm sewer system

Green Infrastructure Champion

RUTGERS
New Jersey Agricultural
Experiment Station

RUTGERS
New Jersey Agricultural Experiment Station

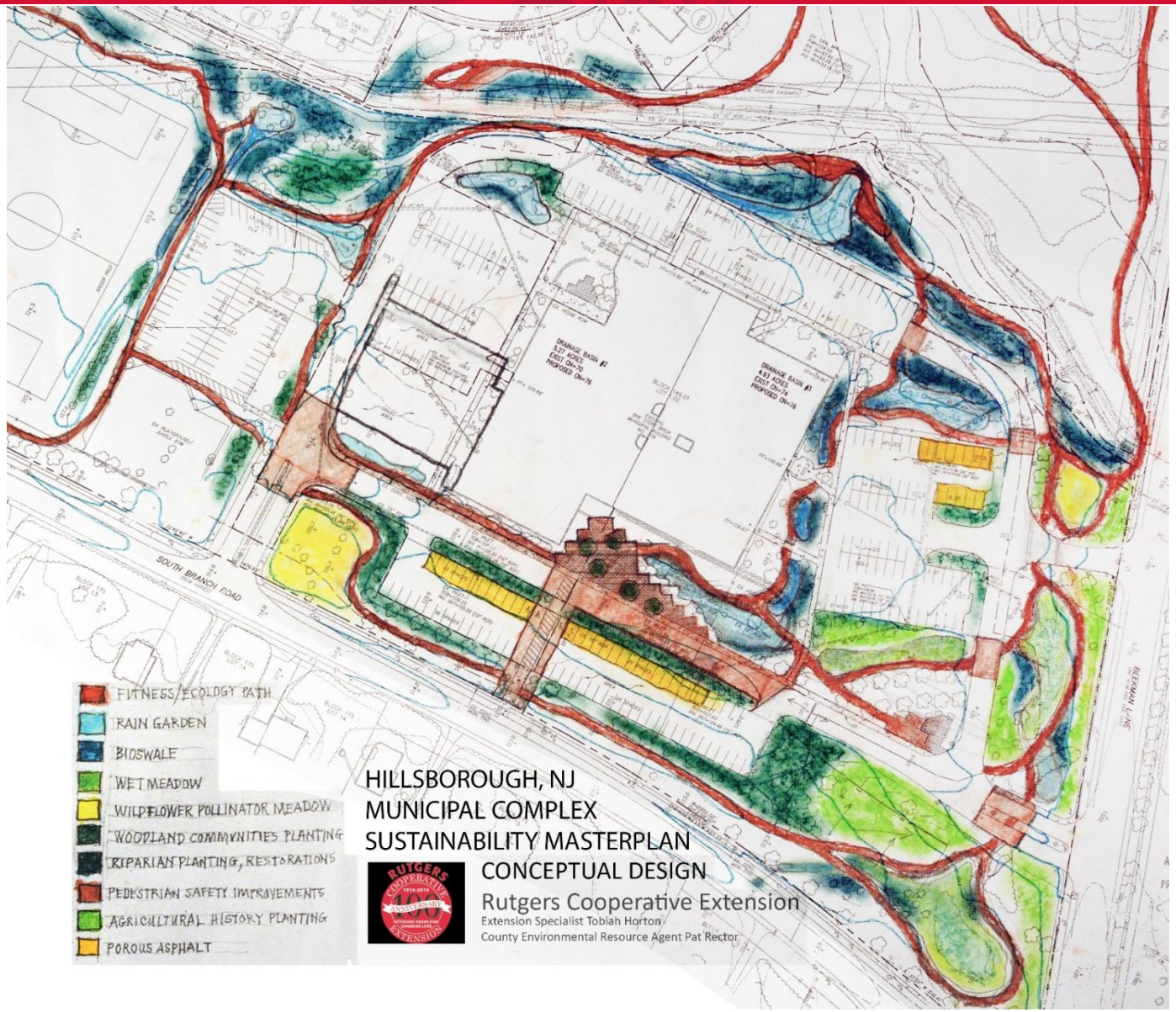
Demonstration Gardens to Full Site Sustainability Masterplans



RUTGERS
New Jersey Agricultural

Demonstration Gardens to Full Site Sustainability Masterplans

RUTGERS
New Jersey Agricultural Experiment Station



RUTGERS
New Jersey Agricultural Experiment Station

Goals of a Landscape Sustainability Masterplan

- Fundamentally change the way people experience their towns/cities
- Combine currently disconnected efforts in Green Stormwater Infrastructure, Transportation Planning, Engineered approaches to Stormwater, Greenspace advocacy, etc.
- Collaborate across disciplines, fields and interests to improve the quality of life through improving the quality and access to nature

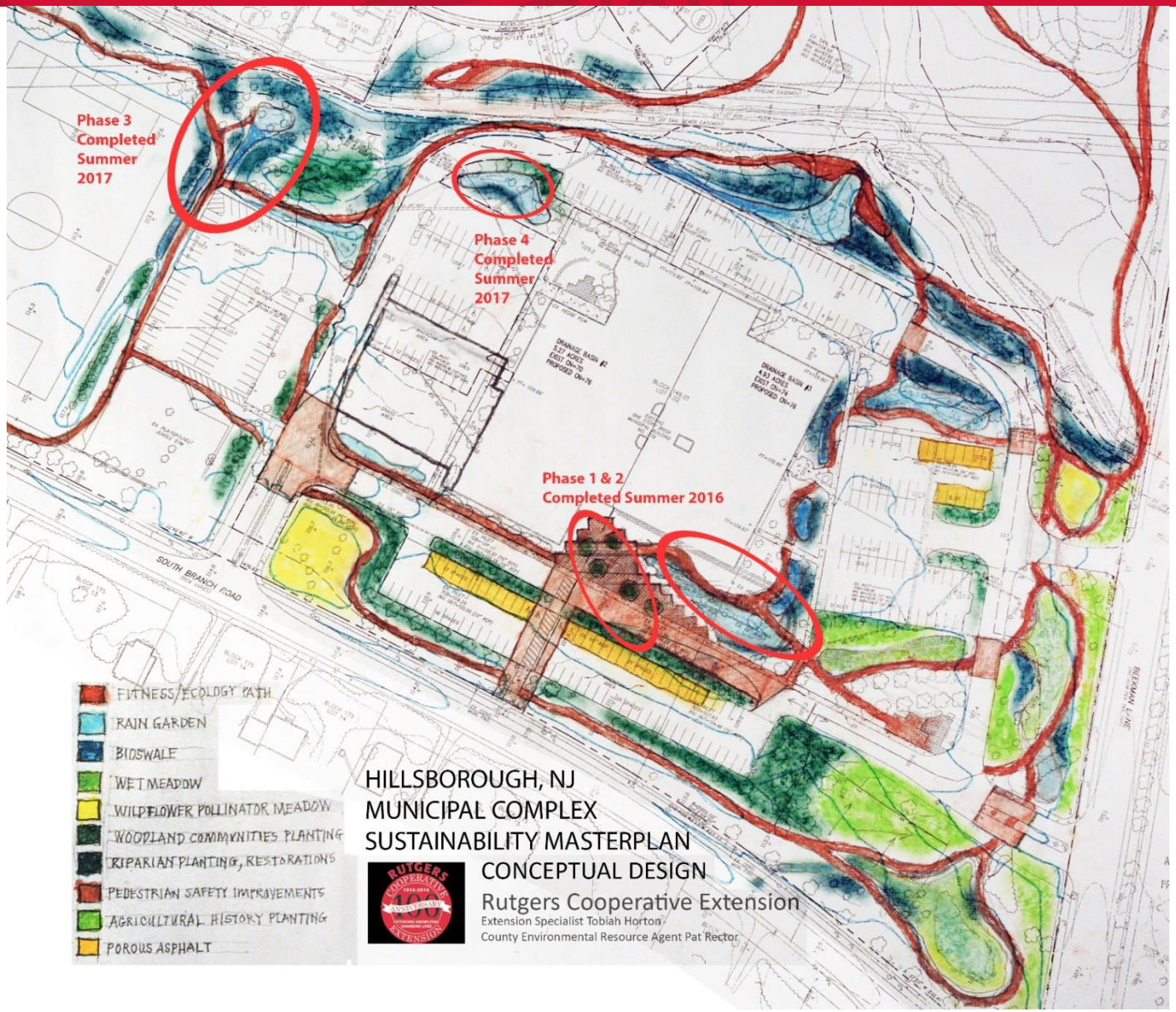
RUTGERS
New Jersey Agricultural Experiment Station

Objectives of a Landscape Sustainability Masterplan

- Work from funded installation projects towards a larger vision
- Strengthen working groups developed during small project planning and installation
- Appeal to different interest groups using themes in the Plan to join effort
- Conceptualize ‘ways forward’ to future projects
- Synthesize with existing and ongoing municipal and regional plans

Demonstration Gardens to Full Site Sustainability Masterplans

RUTGERS
New Jersey Agricultural Experiment Station



RUTGERS
New Jersey Agricultural Experiment Station

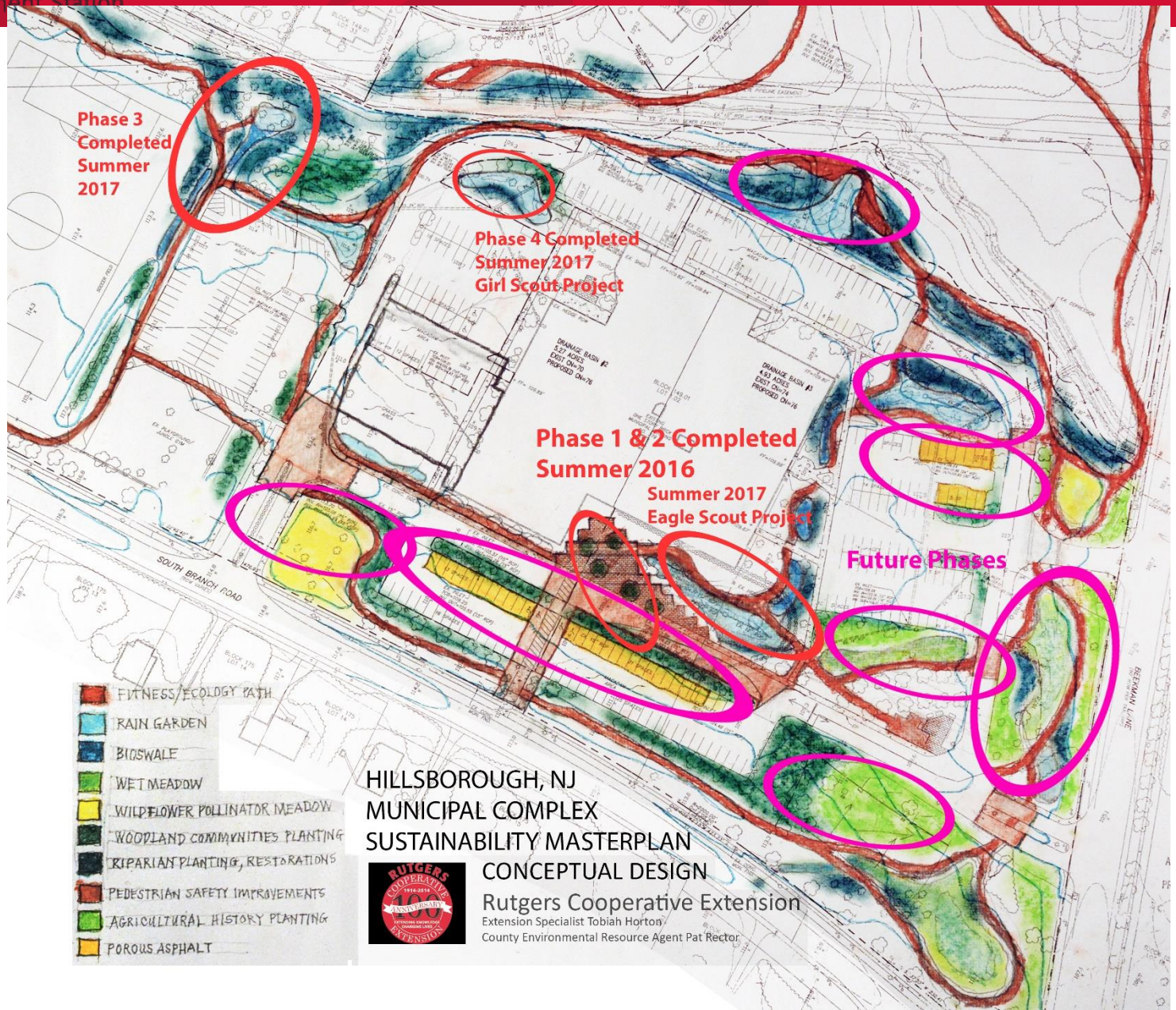
Phase 2 of the Hillsborough Municipal Complex Landscape Sustainability Masterplan

RUTGERS
New Jersey Agricultural Experiment Station

Hillsborough Municipal Complex Landscape Sustainability Masterplan
Eagle Scout Project

Demonstration Gardens to Full Site Sustainability Masterplans

RUTGERS
New Jersey Agricultural Experiment Station



RUTGERS
New Jersey Agricultural Experiment Station

Elements of a Landscape Sustainability Masterplan

- Destinations connected to neighborhoods by walkable/bikeable corridors
- Stormwater kept on the surface in attractive amenities that mimic the performance of natural systems
- Remnant natural lands preserved and restored
- Social and cultural features and activities are integrated with environmental improvements

RUTGERS
New Jersey Agricultural Experiment Station

Elements of a Landscape Sustainability Masterplan

Nodes – Places – Destinations

Large: parks, school campuses, municipal complexes, large historic sites, cemeteries, corporate parks, business parks, shopping areas, etc.

these are sites for large scale Green Infrastructure Plans – knitting together smaller installations

Small: pocket parks, urban sites, vacant lots, schools w/out land, small historic sites, detention basins, lakes/ponds

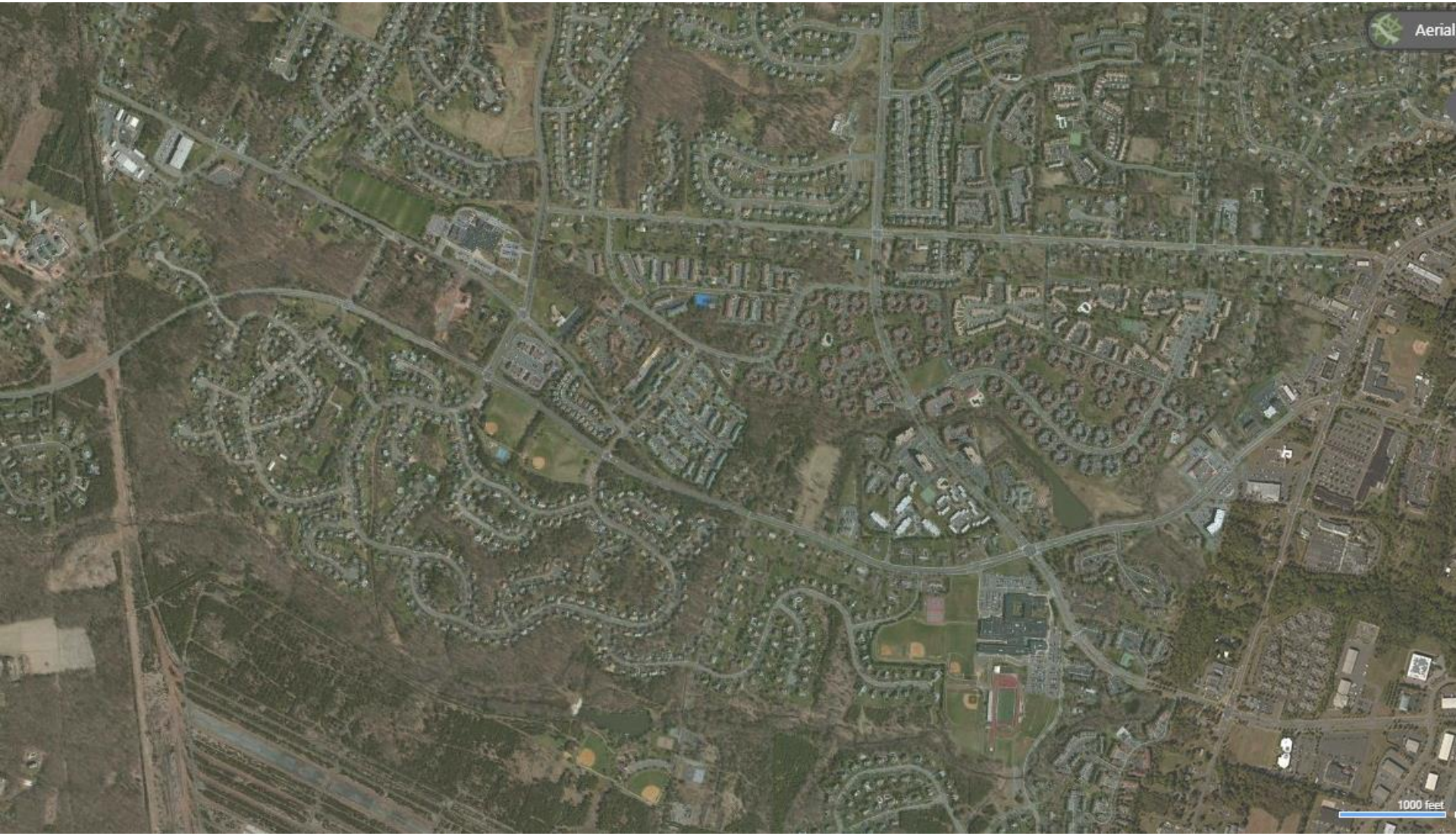
these are the locations for site scale green infrastructure installations

Corridors – Streets – Walks – Paths – Streams

streets (especially wide streets), rails to trails, linear parks, river/floodplain parks, stream corridors, linear parks (e.g. D & R Canal), aggregated vacant lands, infrastructure corridors (wide highway ROWs, rail line ROWs, power line/pipeline ROWs, historical corridors/trails, waterfronts

these are the connective tissues that ensure that people, water and

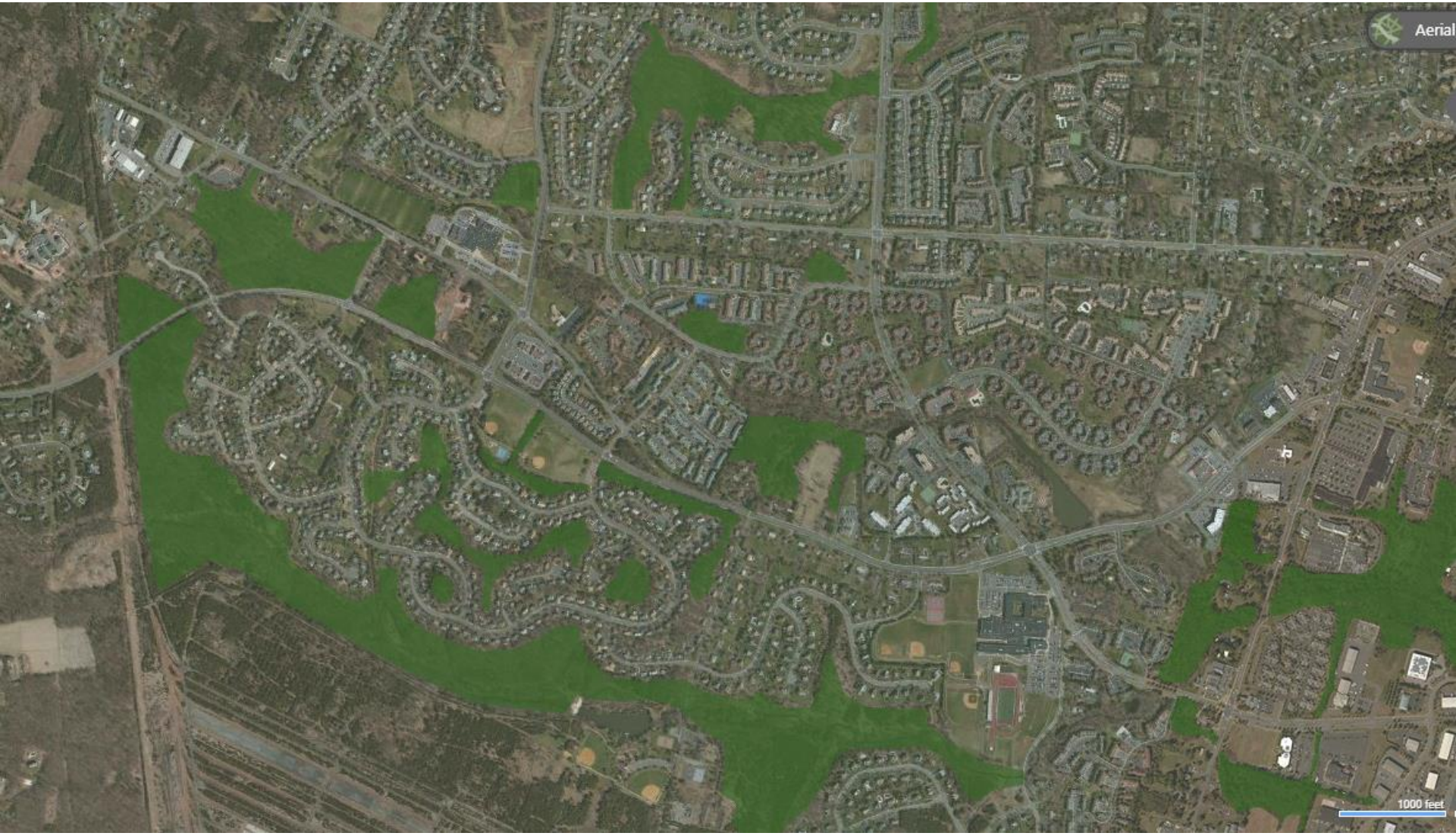
Site Sustainability Masterplans to Neighborhood/Township GSI Initiated Green Infrastructure Sustainability



Hillsborough, New Jersey

RUTGERS
New Jersey Agricultural Experiment Station

Site Sustainability Masterplans to Neighborhood/Township GSI Initiated Green Infrastructure

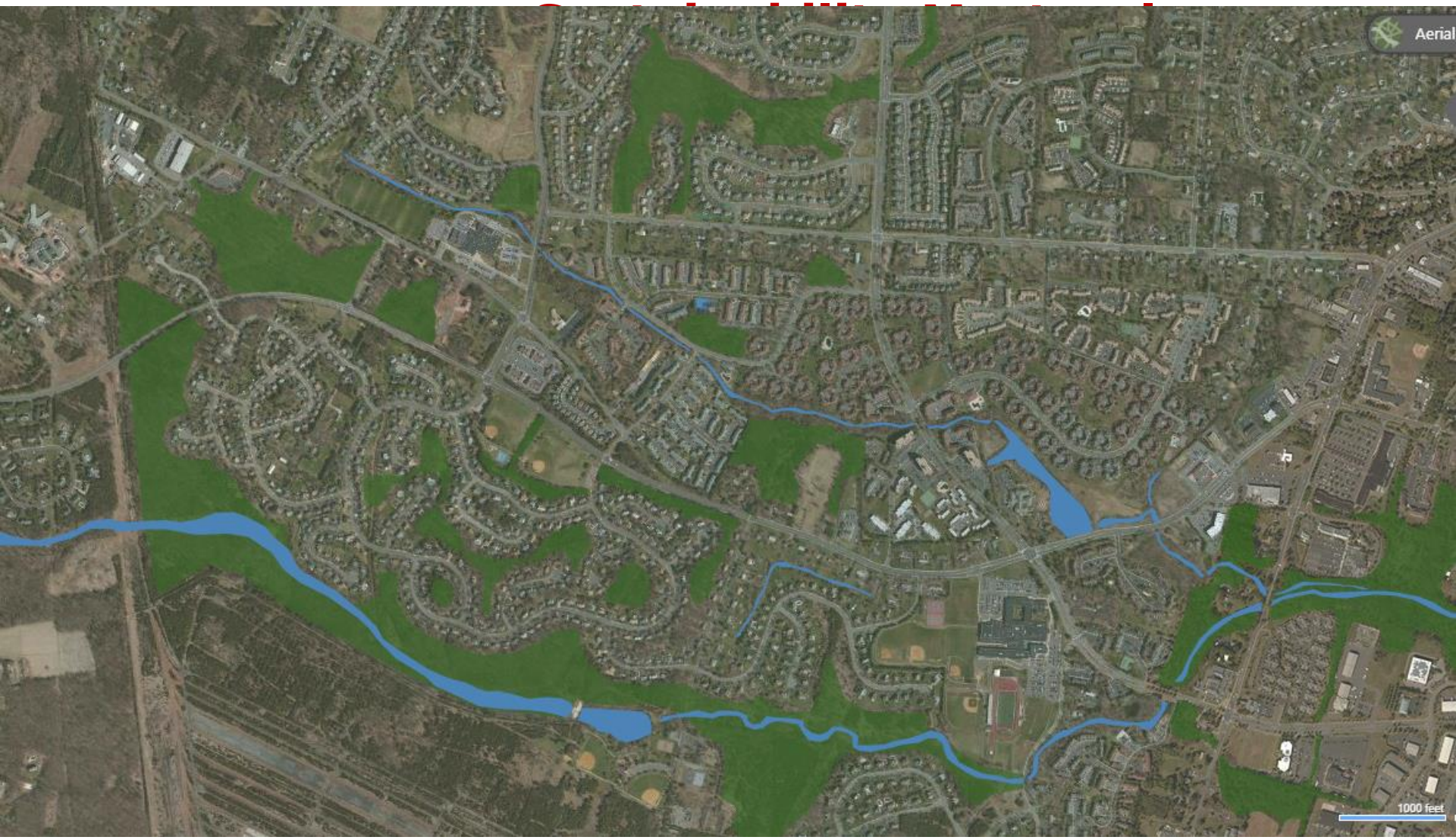


10/12/2018

Dense Tree Cover

RUTGERS
New Jersey Agricultural Experiment Station

Site Sustainability Masterplans to Neighborhood/Township GSI Initiated Green Infrastructure



Streams

RUTGERS
New Jersey Agricultural Experiment Station

Site Sustainability Masterplans to Neighborhood/Township GSI Initiated Green Infrastructure

Floodplains

Detention Basins

Destinations

Destinations and Origins

Bike and Pedestrian Paths

e Sustainability Masterplans to Neighborhood/Townsh
Initiated Green Infrastructure Sustainability Masterp

Neighborhood
Neighborhood
Neighborhood
Library
Neighborhood
Neighborhood
Neighborhood
Recreation
Shopping
Neighborhood
High School
Aerial
1000 feet

RUTGERS
New Jersey Agricultural
Experiment Station

What Would a Neighborhood Look Like?

What Would a Neighborhood Look Like?

RUTGERS
New Jersey Agricultural
Experiment Station

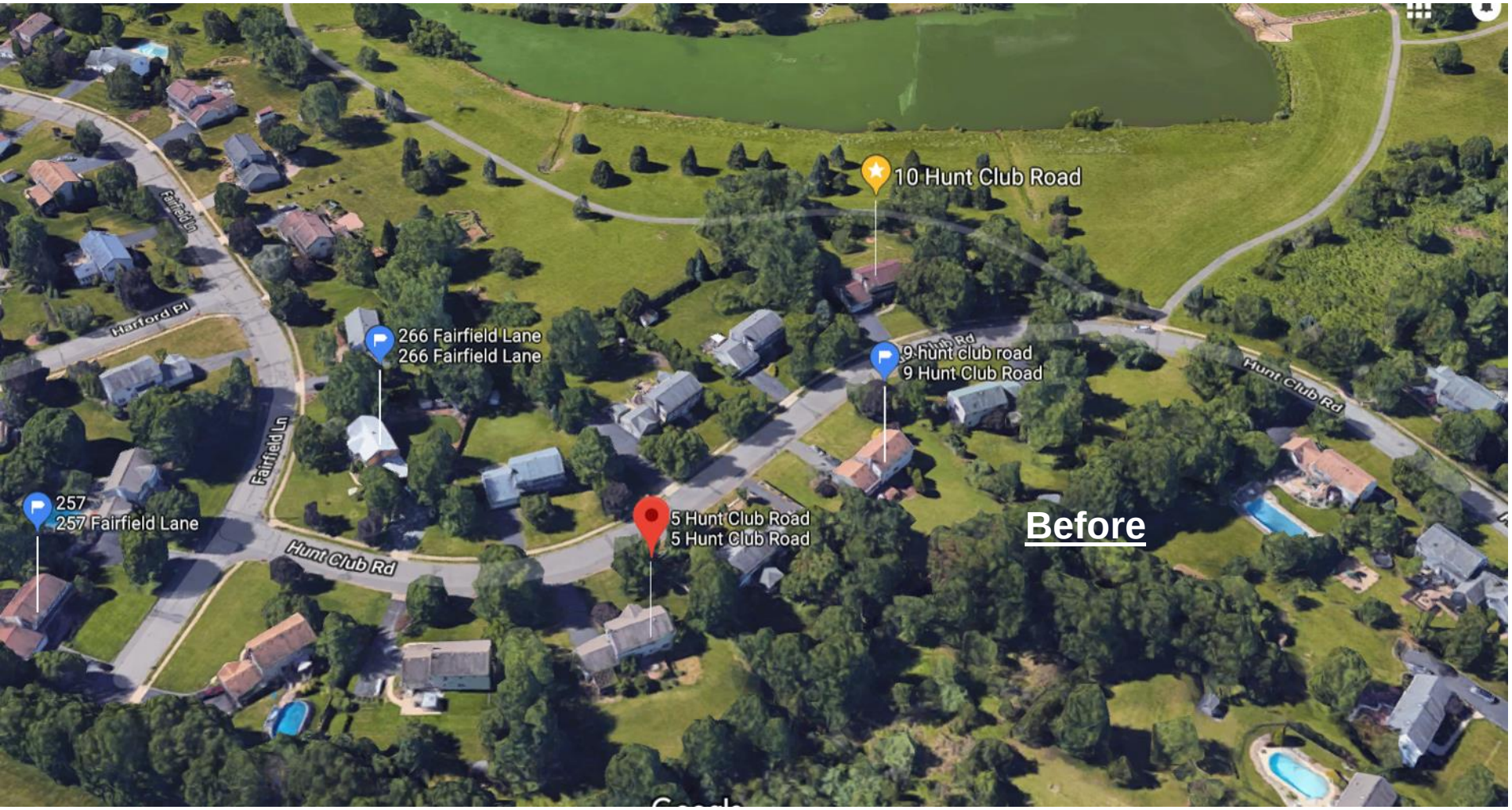
What Would a Neighborhood Look Like?

What Would a Neighborhood Look Like?

What Would a Neighborhood Look Like?

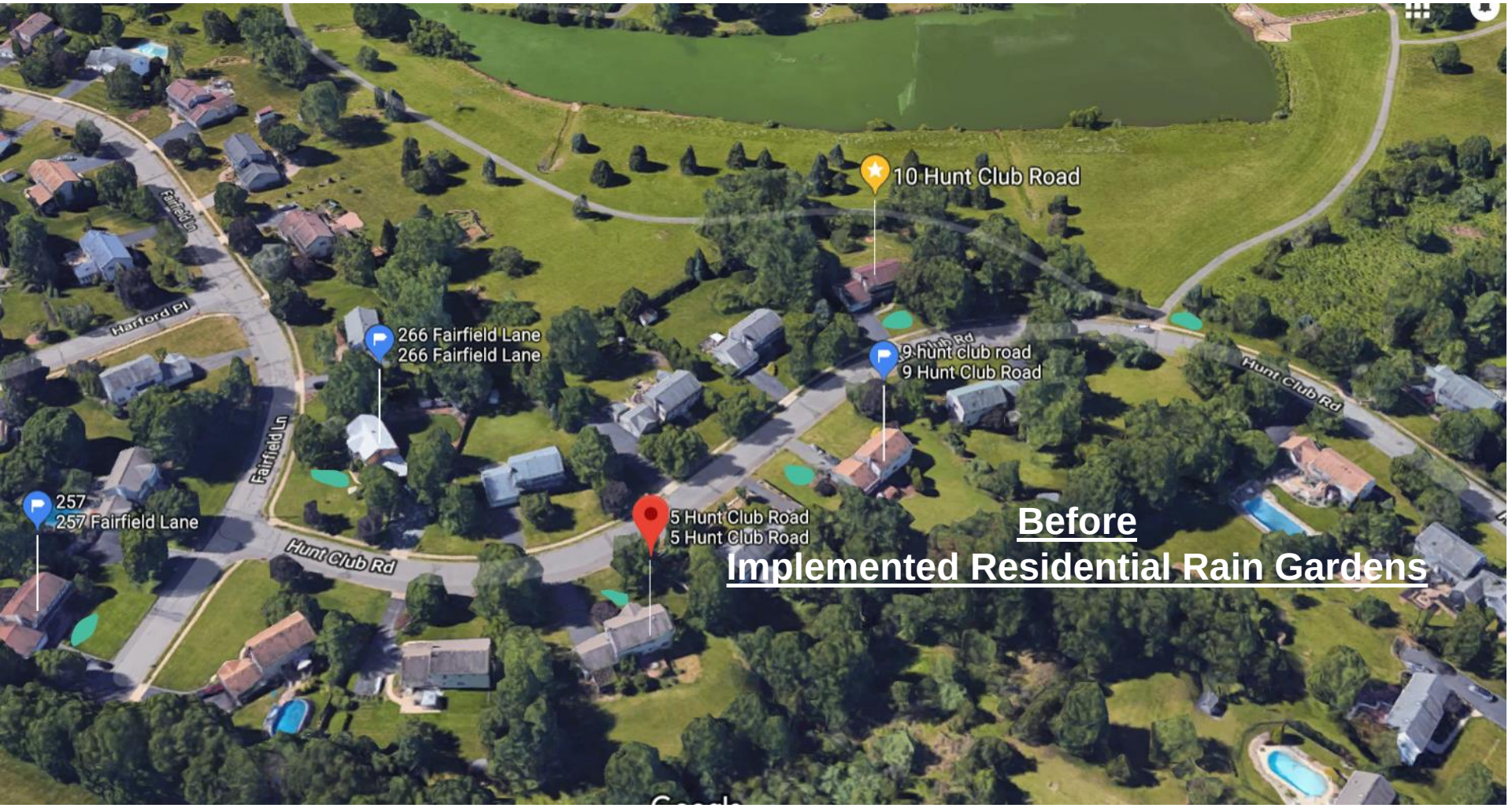
RUTGERS
New Jersey Agricultural Experiment Station

What Would a Neighborhood Look Like?



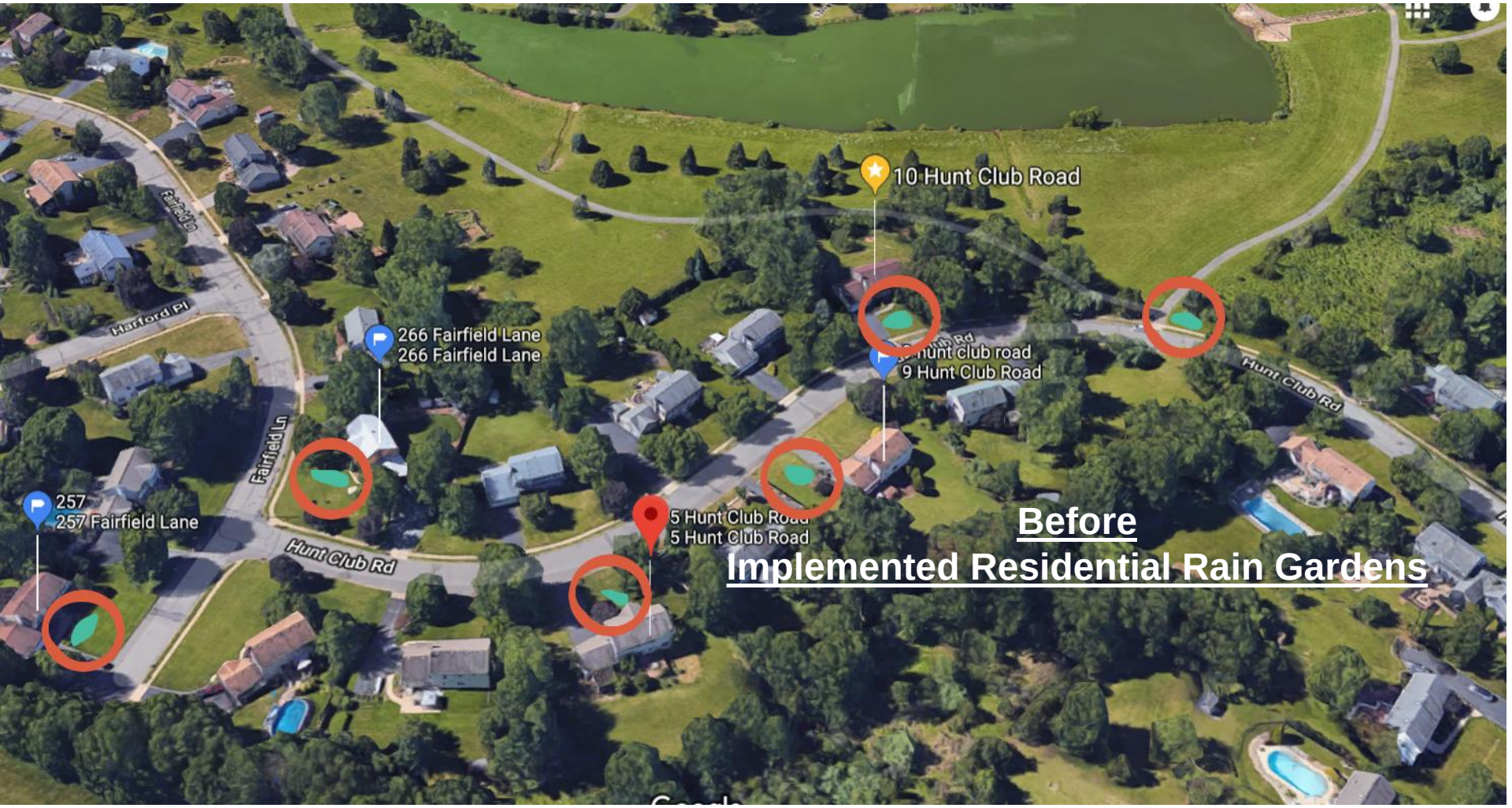
RUTGERS
New Jersey Agricultural
Experiment Station

What Would a Neighborhood Look Like?



RUTGERS
New Jersey Agricultural Experiment Station

What Would a Neighborhood Look Like?



RUTGERS
New Jersey Agricultural Experiment Station

What Would a Neighborhood Look Like?

RUTGERS
New Jersey Agricultural Experiment Station

What Would a Neighborhood Look Like?

RUTGERS
New Jersey Agricultural Experiment Station

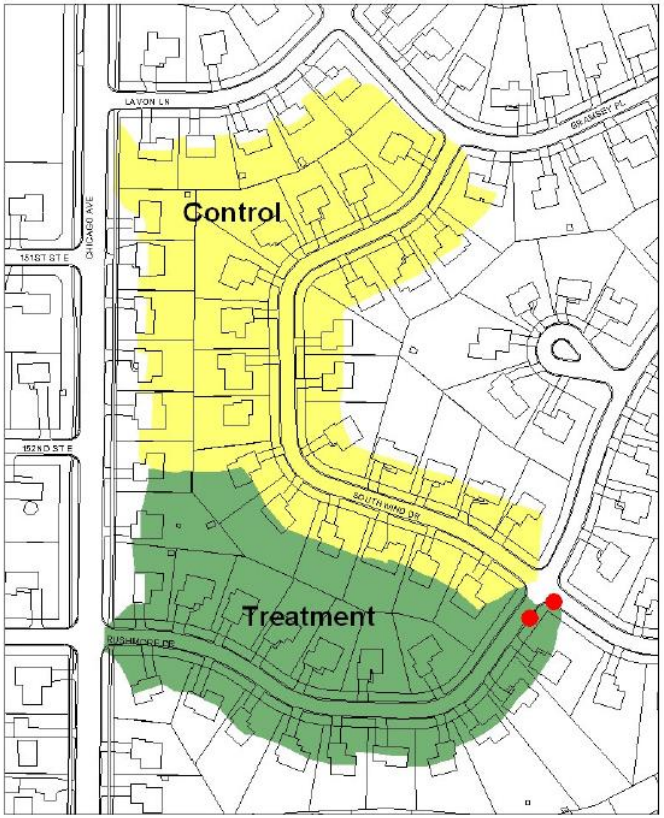
What Would a Neighborhood Look Like?

Landscape Sustainability Masterplan

From Design/Build Installation to Larger Vision to Next Installation

RUTGERS
New Jersey Agricultural Experiment Station

The Blue House



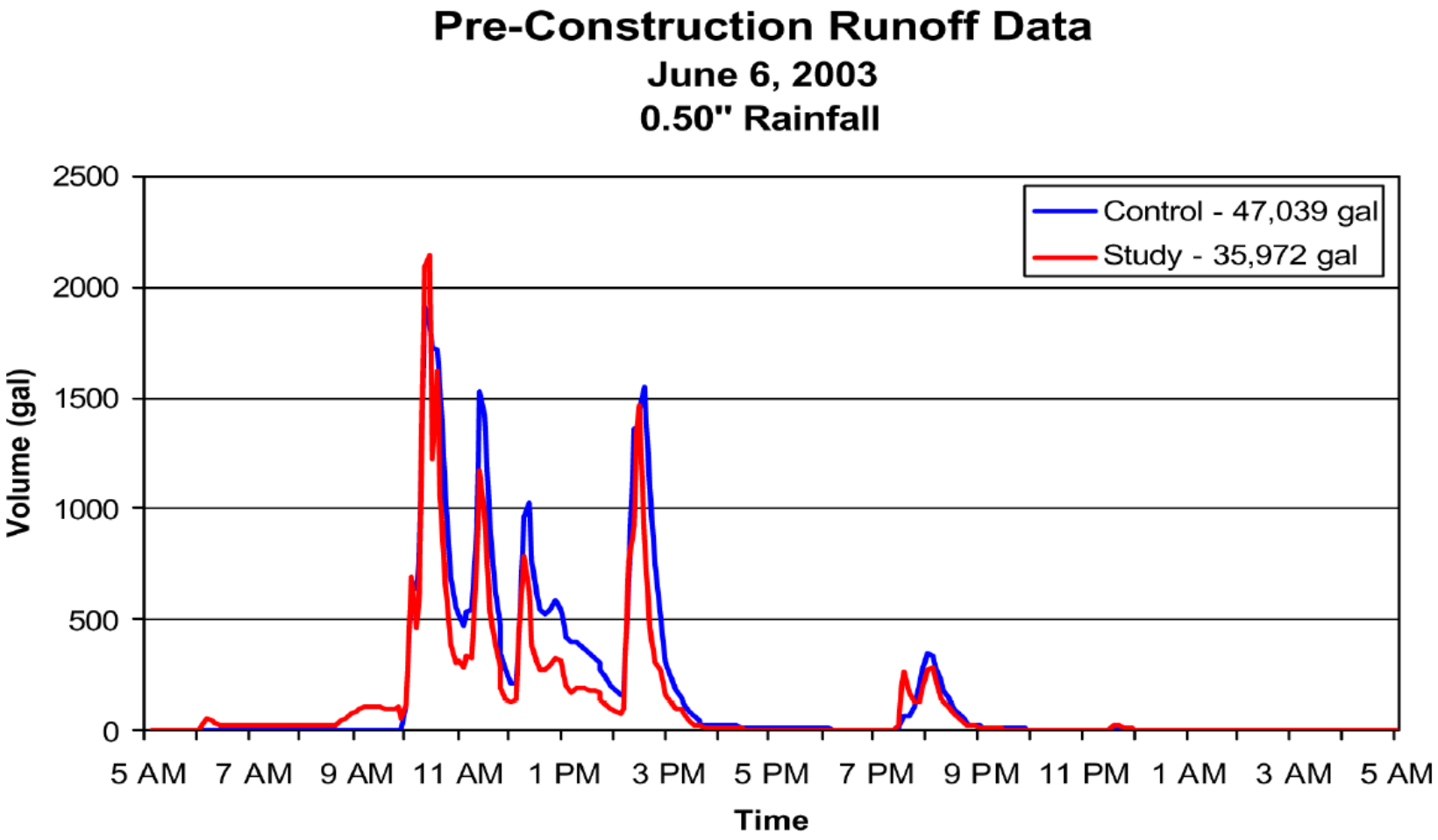
Barr Engineering Company, Burnsville Stormwater Retrofit Study prepared for City of Burnsville June 2006
This and next 4 slides.

RUTGERS
New Jersey Agricultural Experiment Station

How Many?

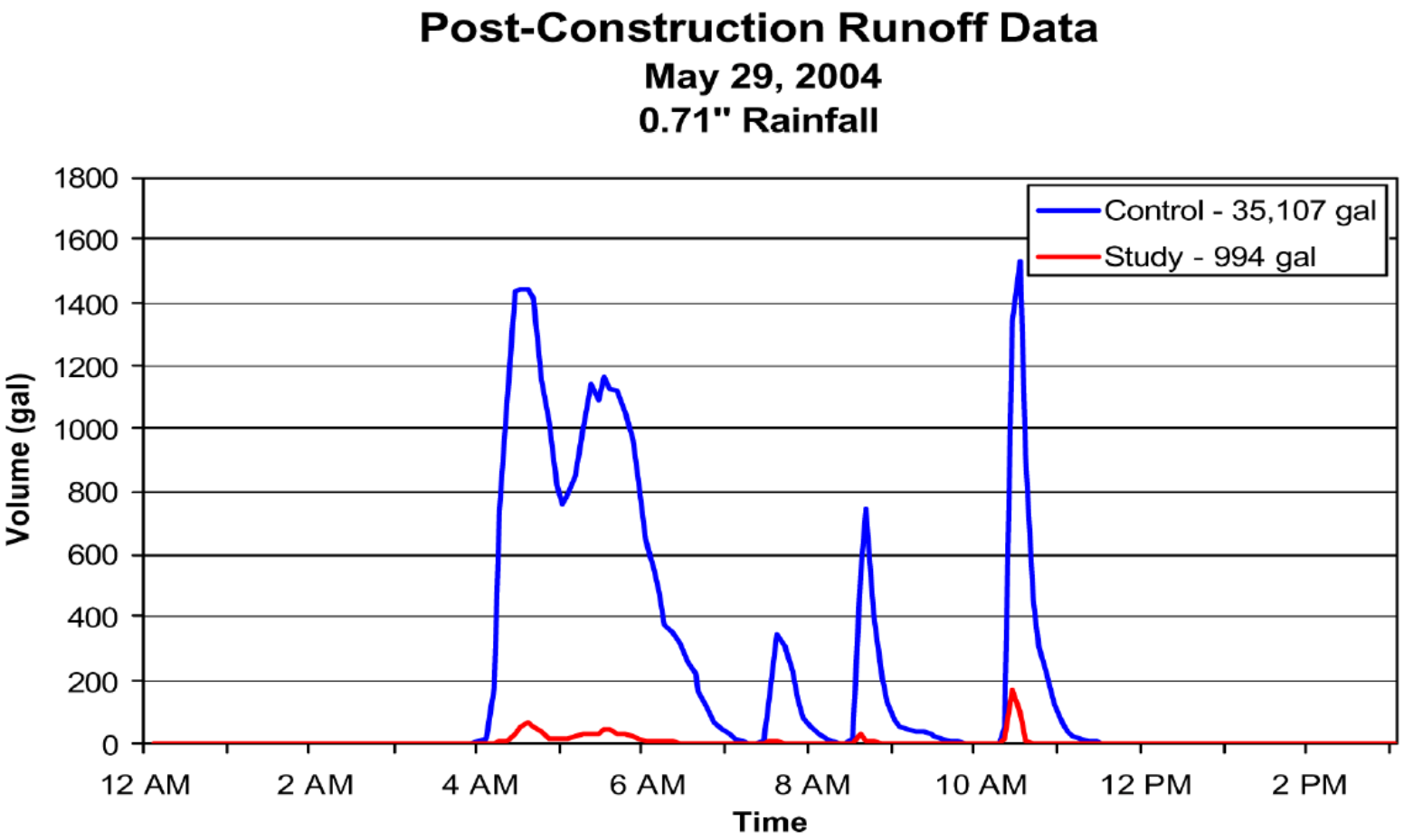
RUTGERS
New Jersey Agricultural Experiment Station

Calibration



RUTGERS
New Jersey Agricultural Experiment Station

Post Installation



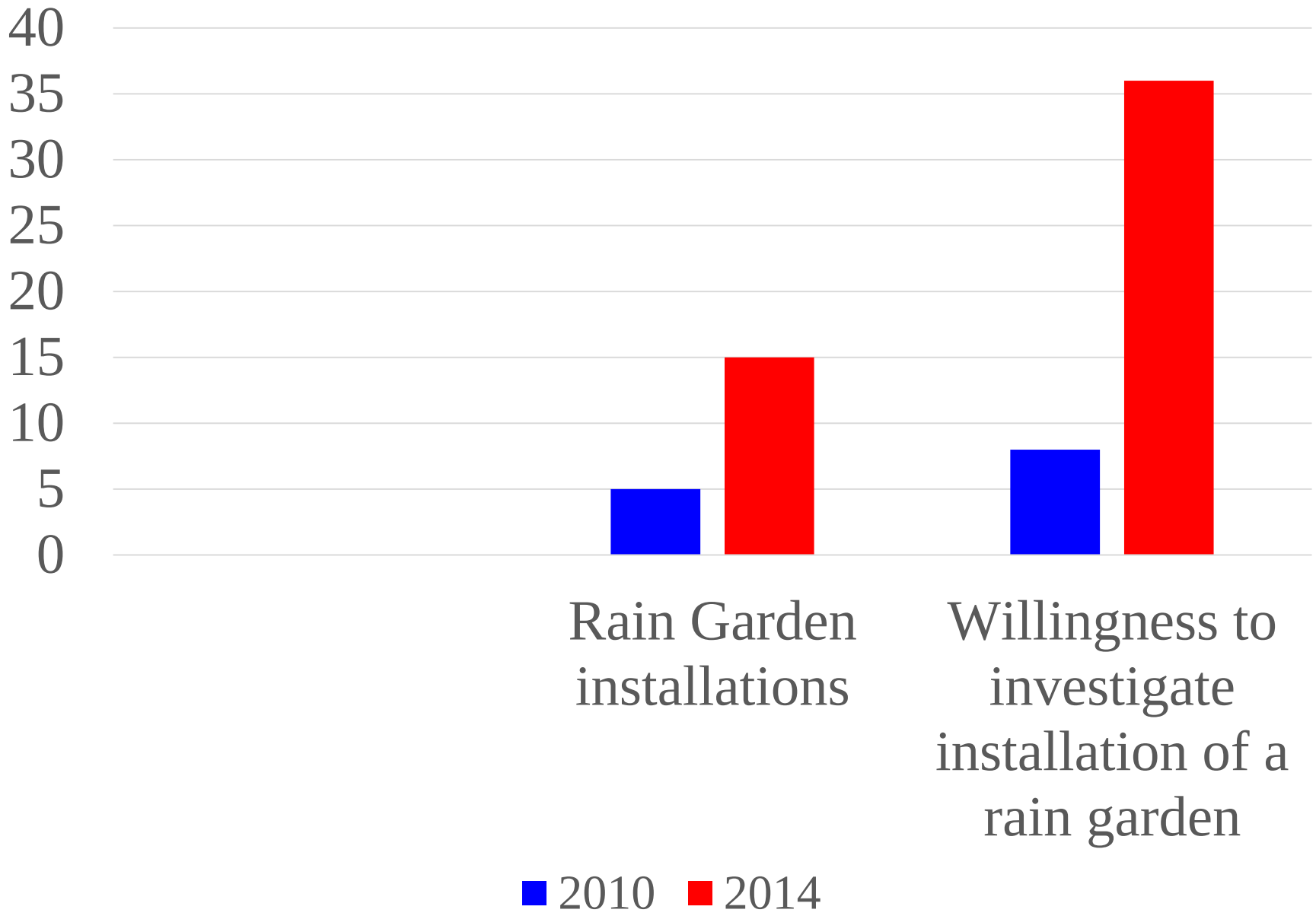
RUTGERS
New Jersey Agricultural Experiment Station

Cluster rain gardens

Clustering rain gardens

- It is hard for a single residential rain garden to have a significant impact on improving water quality or to achieve a reduction of flow on a nearby stream.
- Clustering rain gardens increases the cumulative reductions in pollutant removal and the reduction of flows to the stream during storm events.
- Clustering rain gardens with signage increases the educational reach of the program.

6 Ulysses Drive, Hills of Troy, Parsippany, NJ.


40
35
30
25
20
15
10
5
0
Rain Garden installations
Willingness to investigate installation of a rain garden
2010
2014

RUTGERS
New Jersey Agricultural Experiment Station

Influence of neighbors

A 2010 rain garden

Across the street and 4 houses down in 2014

RUTGERS
New Jersey Agricultural Experiment Station

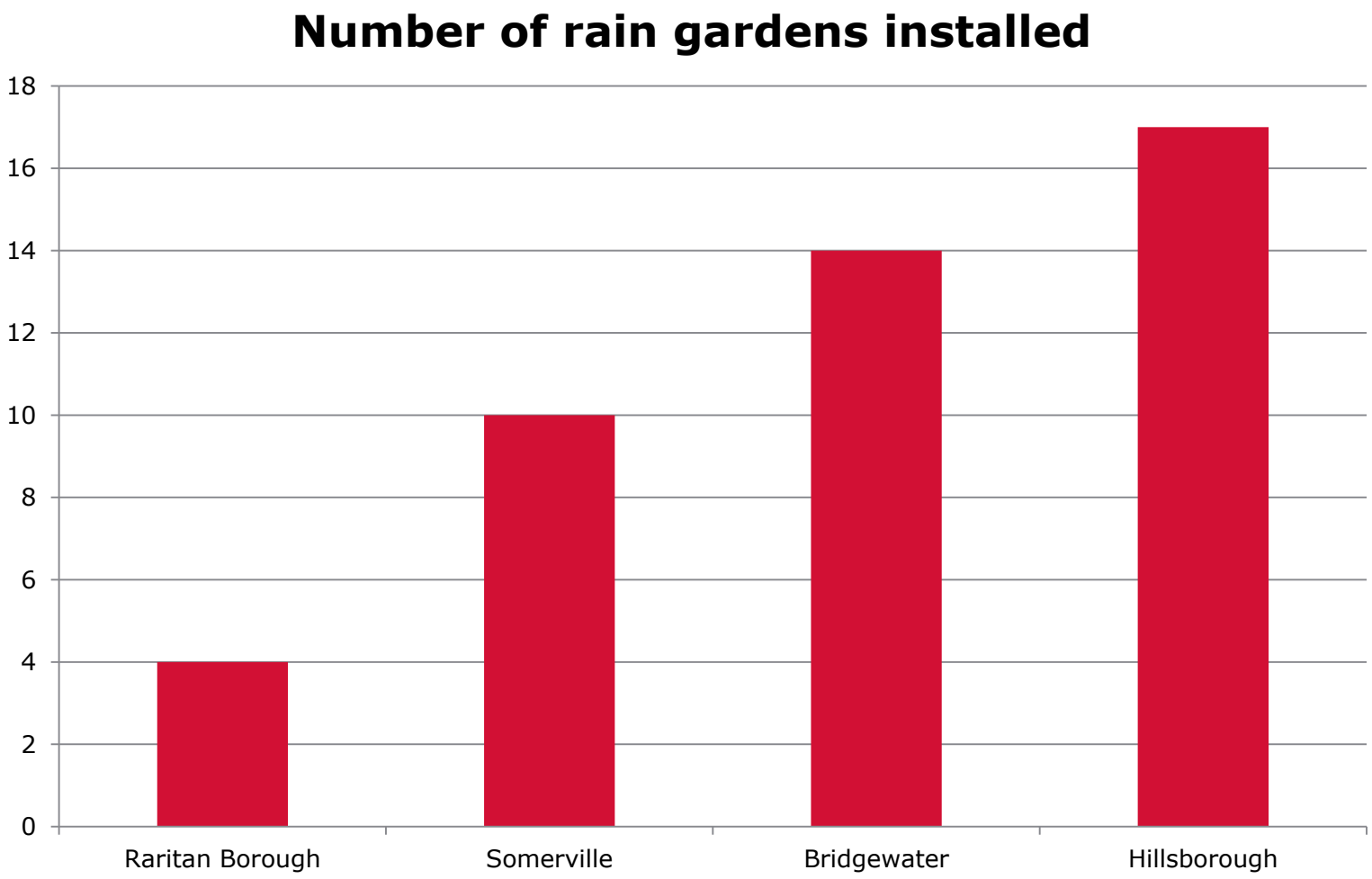
Educational sessions

RUTGERS
New Jersey Agricultural Experiment Station

Design Sessions

RUTGERS
New Jersey Agricultural Experiment Station

Rain Garden Rebate Program



RUTGERS
New Jersey Agricultural Experiment Station

Touches- Hillsborough

- Municipal/Library rain garden
  - Signage
  - Your Guide to Hillsborough 2018
  - Hillsborough "The Good Life" YouTube video, https://www.youtube.com/watch?v=mlmU5xcmoAY&t=415s
- Christmas in the garden
- Rebate informational flyers
- Educational sessions

RUTGERS
New Jersey Agricultural Experiment Station

Touches

- Letter to residents Hunts Pond re rain garden rebate program
- Open public meetings (2) –Restoration Plan by Chris Obropta
- Chris Obropta and I in neighborhood numerous times
- Rutgers Environmental Stewards did some limited canvassing speaking to residents
- Additional educational sessions specifically focused on Hunts Pond residents
- Have separate educational sessions at a neighbor's house
- Able to see neighbor's having Rutgers Water Resources Program Staff installing rain gardens

RUTGERS
New Jersey Agricultural Experiment Station

Touches

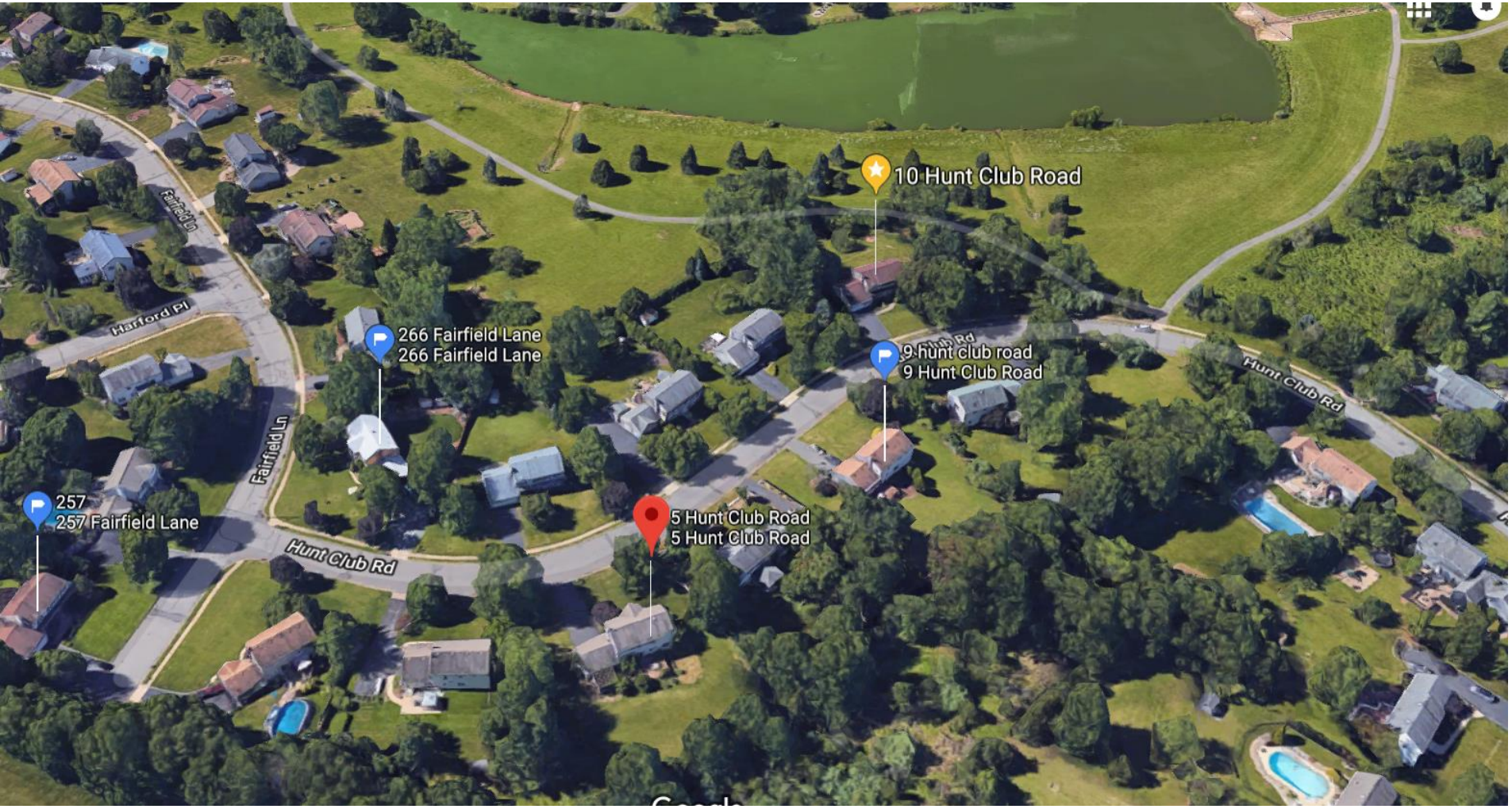
- Residents (196 homes)were visited in 2010 by Rutgers faculty and staff. Flyers were left if not at home. Repeat visits including in evening.
- Rain gardens had signs placed road side (2010).
- Flyers were mailed to each residence (2015).

RUTGERS
New Jersey Agricultural Experiment Station

Early installations

RUTGERS
New Jersey Agricultural Experiment Station

Hunts Pond Installations



RUTGERS
New Jersey Agricultural Experiment Station

How do we find out?

- Waiting for dreaded IRB approval
- Surveys to 4 different groups
  - Hillsborough residents – general
  - Hillsborough residents who attended educational session but not design session
  - Hillsborough residents who attended design session
  - Hunts Pond residents

RUTGERS
New Jersey Agricultural Experiment Station

Questions we hoped are answered-General

- Do they know what a rain garden is? How it functions?
- Did you notice the Municipal rain garden?
- Did you know it was a rain garden?
- How did they learn it was a rain garden?
- Did the Municipal rain garden impact their idea of what a rain garden looked like?
- If they knew about the Municipal rain garden did that lead to any action?
- Did they know about the rain garden rebate program?
- How did they learn about the rebate program?
- Did they partake in the rebate program, education, design, installation? If not, why not?
- Gender, age, how long lived in home?
- Do they know someone who has a rain garden?

RUTGERS
New Jersey Agricultural Experiment Station

Questions we hoped are answered-Education

- Same questions as General
- Change in knowledge
- Because of rebate education I did these things:
- Why they didn’t attend free design session

RUTGERS
New Jersey Agricultural Experiment Station

Questions we hoped are answered-Design

- Same questions as General
- Did you install your rain garden?
- If not, why not?
  - Busy
  - Unsure even with technical assistance
  - Even with rebate more than want to spend
  - Not willing to undertake physical labor
  - Spouse not happy with idea
  - Not really willing to change landscape
  - Don’t really believe it will help nps pollution or flooding
  - Other
- Do you plan to install in the future?
- If you did, are you satisfied, looks, function, rebate?
- Did you receive a physical waiver?

RUTGERS
New Jersey Agricultural Experiment Station

Questions we hoped are answered-Hunts Pond

- Same questions as General
- Did they attend or interact with any of the additional "touches" available to Hunts Pond?
- Especially did they view the digging of the rain gardens by the Rutgers Water Resources staff
- What was the most important factor if they installed a rain garden?

Maintenance

Residential rain garden installed in 2014

Photo courtesy Len Cipkins, October 2018

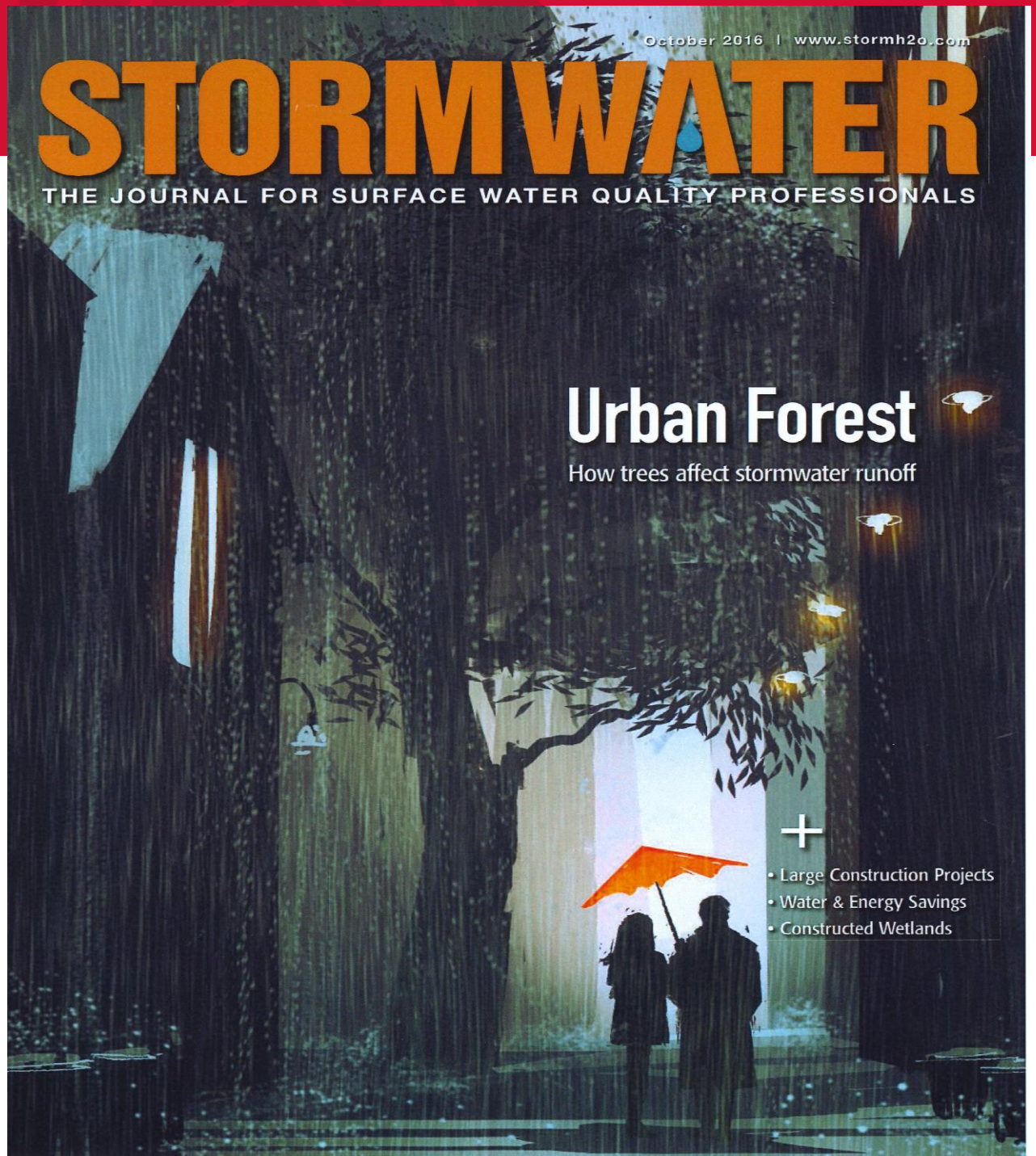
RUTGERS
New Jersey Agricultural Experiment Station

Next steps

Similar to Beatles song “Why don’t we do it in the road?”

Minnesota Burnsville Stormwater rain gardens

One study of forests in US reported that “the nation's forests are worth at least $400 billion in terms of stormwater management alone (American Forests, 1996)



A healthy 100-foot-tall tree has about 200,000 leaves. A tree this size can take 11,000 gallons of water from the soil and release it into the air again, as oxygen and water vapor, in a single growing season.

USDA Water and Forests

RUTGERS
New Jersey Agricultural Experiment Station

Holding water- Stormwater management tree style

Interception of rainfall by leaves and bark.

Stored water in leaves and bark

Evapotranspiration

Throughfall

Spongy leaf litter layer

Root zone holds soil in place and absorb water

Trees can intercept 50-100 gallons of water during large storms. This reduction occurs during the peak flows.

Residents were concerned about naturalized detention basin

- 54 trees were planted at a detention basin
- Trees will reduce runoff to the low flow channels, reduce stormwater through evapotranspiration and infiltration

Hearing all the residents

- Several meetings with residents (some a wee bit heated) regarding "view"
- Design, redesign and final design
- Islands of native plantings and rain garden

Near the Pond

Hunts Pond

- Rain garden at entrance to neighborhood
- Designed and installed by Rutgers Environmental Stewards with great help from Township

Rain Garden at entrance to Pond