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Identifying Green Infrastructure Opportunities and Constraints

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Where does green infrastructure need to go?

Everywhere!

ASSESSING THE FEASIBILITY OF GI PRACTICES

Example of the Process

1. Know your system
2. Compile a GIS database
3. Identify site that meet GI criteria
4. Hydrologic and hydraulic modeling
5. Apply a site scoring system to prioritize projects

1. Knowing your system (see System Characterization section of the Long-Term Control Plan (LTCP))

- Extent of Combined Sewer System (CSS)
- Number of Combined Sewer Outfalls (CSO)
- Sewershed for each CSO outfall
- Response of CSS to rainfall

2. Compile a Geographic Information System (GIS) database

- Topography
- Impervious coverage
- Depth to bedrock and groundwater
- Sewer infrastructure
- Sewershed boundaries
- CSO locations
- Utilities
- Parcel data

2. Compile a Geographic Information System (GIS) database (cont'd)

- Soil infiltration potential
- Flood prone areas
- Existing stormwater BMP (best management practices) locations
- Municipal facilities, parks and right-of-ways
- Vacant parcels
- Contaminated properties
- Location of planned municipal upgrades

Preparation of a GIS database is a requirement of the NJPDES permit

3. Identify sites meeting green infrastructure practice "technical" criteria

- Depth to groundwater or bedrock ≥ 2 feet for infiltration practices
- Depth to groundwater or bedrock ≥ 1 foot for system with underdrains or water quality systems
- Drawdown time must be ≤ 72 hours
- Green roofs have a maximum slope of 20%
- Maximum surface ponding is 12 inches for bioretention systems

3. Identify sites meeting green infrastructure practice "other" criteria

- Must have access to the property access to build GI practices (a.k.a. a willing property owner)
- Must have a realistic means of maintaining the green infrastructure practice
- Must have local "buy-in" if practice is in the public right-of-way or other public space

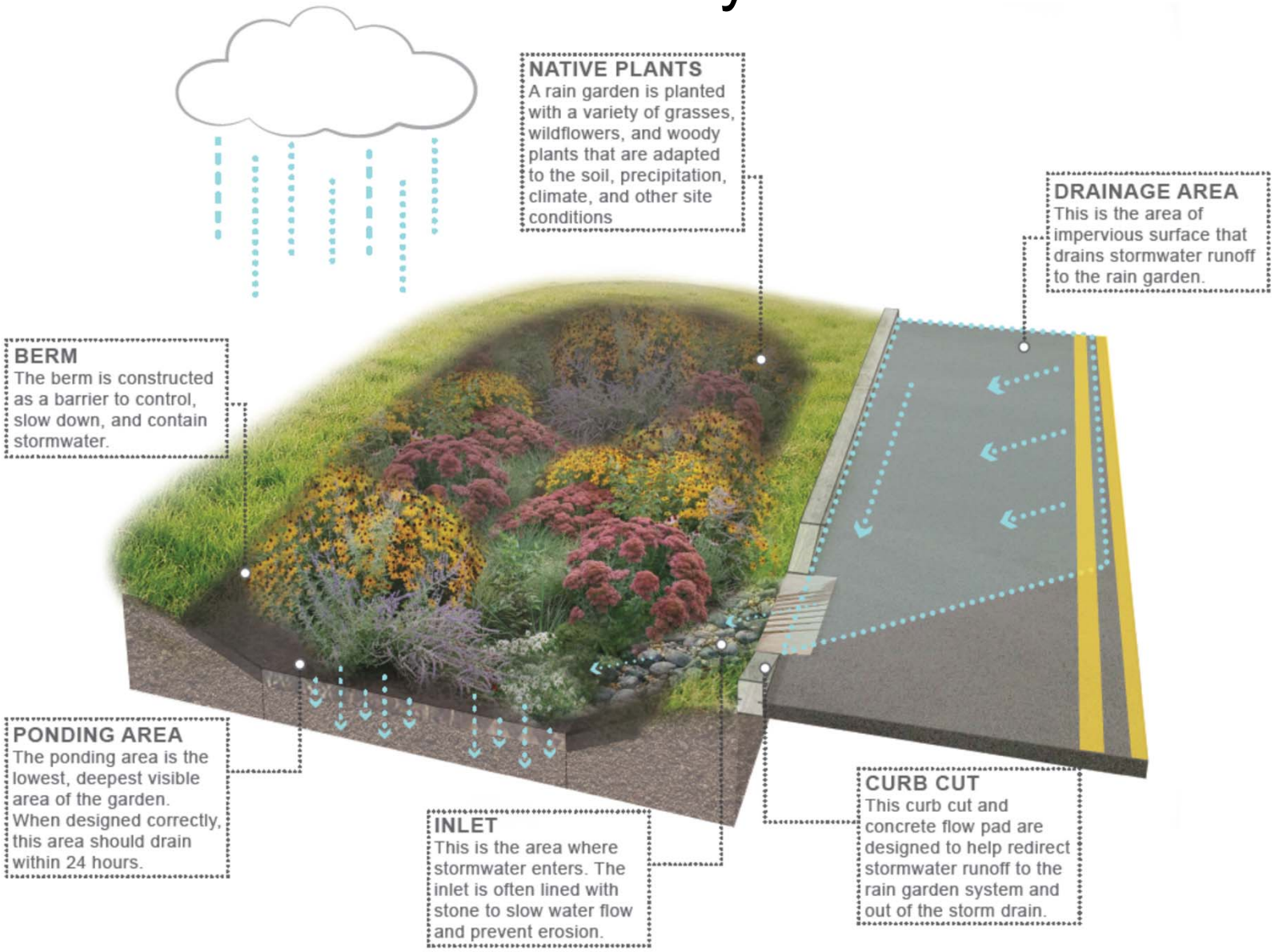
Types of practices

- Bioretention systems
- Bioretention basins
- Small scale bioretention
  - Rain gardens
  - Downspout planter boxes
  - Stormwater planters
  - Bioswales
  - Enhanced and continuous tree pits
- Vegetated filter strips
- Green roofs
- Cisterns

Types of practices (cont'd)

- Pervious paving systems
  - Porous asphalt
  - Pervious concrete
  - Permeable pavers
  - Grass pavers
- Tree plantings
- Grass swales
- Infiltration basins
- Sand filters designed to infiltrate into the subsoil
- Dry wells

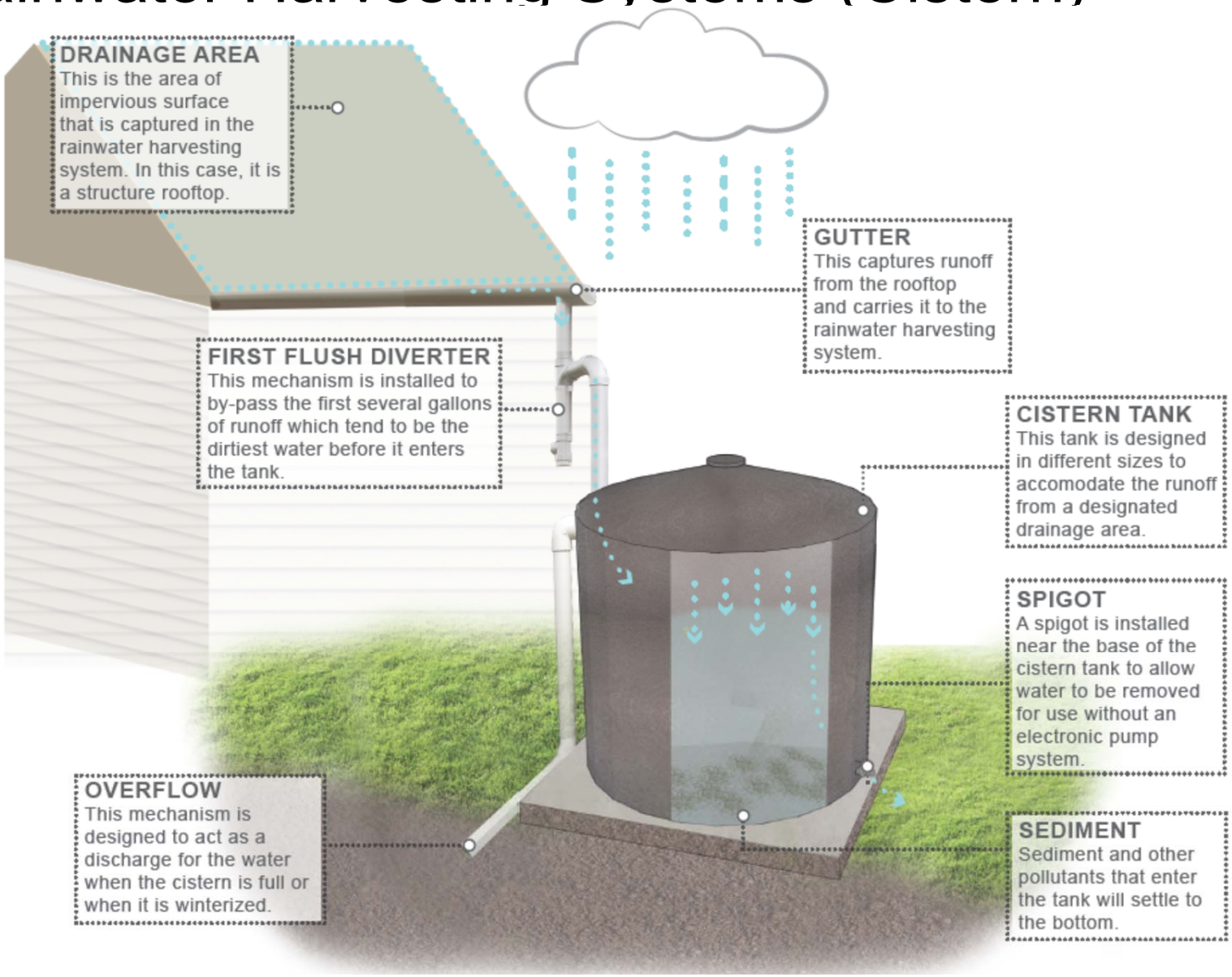
Small Scale Bioretention Systems



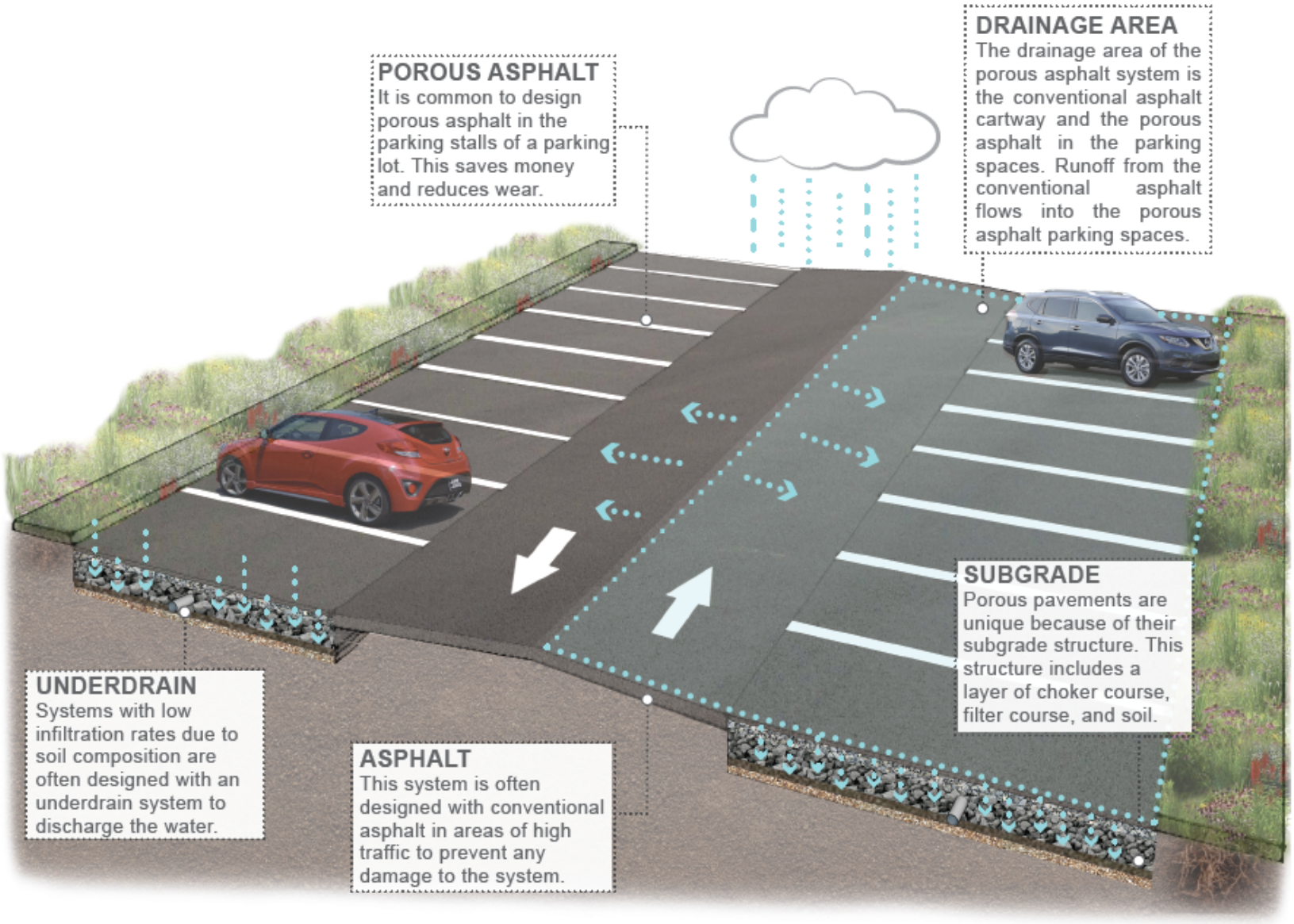
Lots of Rain Gardens!


116

Rainwater Harvesting Systems (Cistern)



Pervious Paving Systems



Porous Asphalt


RESERVED
RES

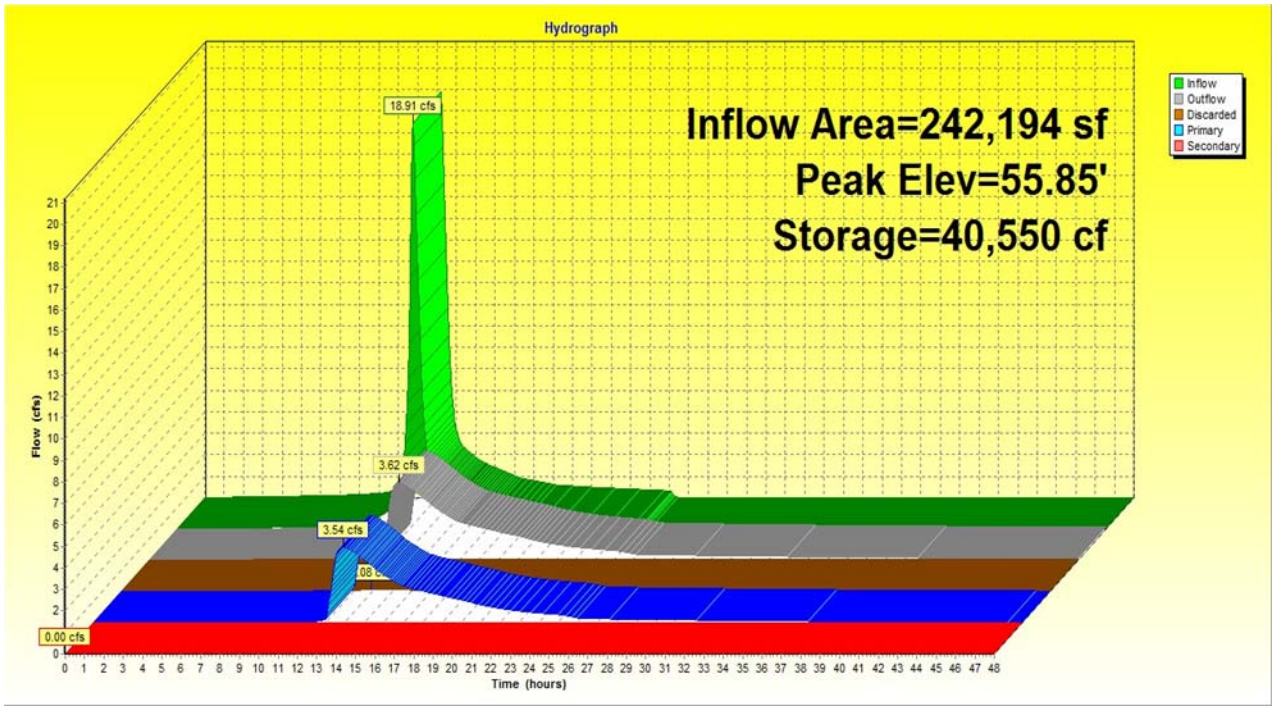
Pervious Concrete

Permeable Pavers

Grass Pavers

4. Hydrologic and hydraulic modeling

- Calculate the individual effects of the proposed green infrastructure practice
- Calculate the combined effects of the proposed practice on the CSS system as a whole



5. Apply a site scoring system that incorporates community considerations

- Cost per runoff volume managed
- CSO reduction potential
- Feedback from public outreach and coordination
- Flood alleviation
- Public visibility
- Public amenity value
- Environmental justice considerations
- Catchment properties

5. Apply a site scoring system that incorporates community considerations (cont'd)

- Available open space for GI construction
- Localized underlying soil data (high infiltration capacity location)
- Proximity to other planned infrastructure and utility projects and cost sharing
- Potential for local triple bottom line benefits (e.g., localized social and economic uplift)

HERE IS HOW WE DO IT

Addressing Impervious Cover

Can we eliminate it?

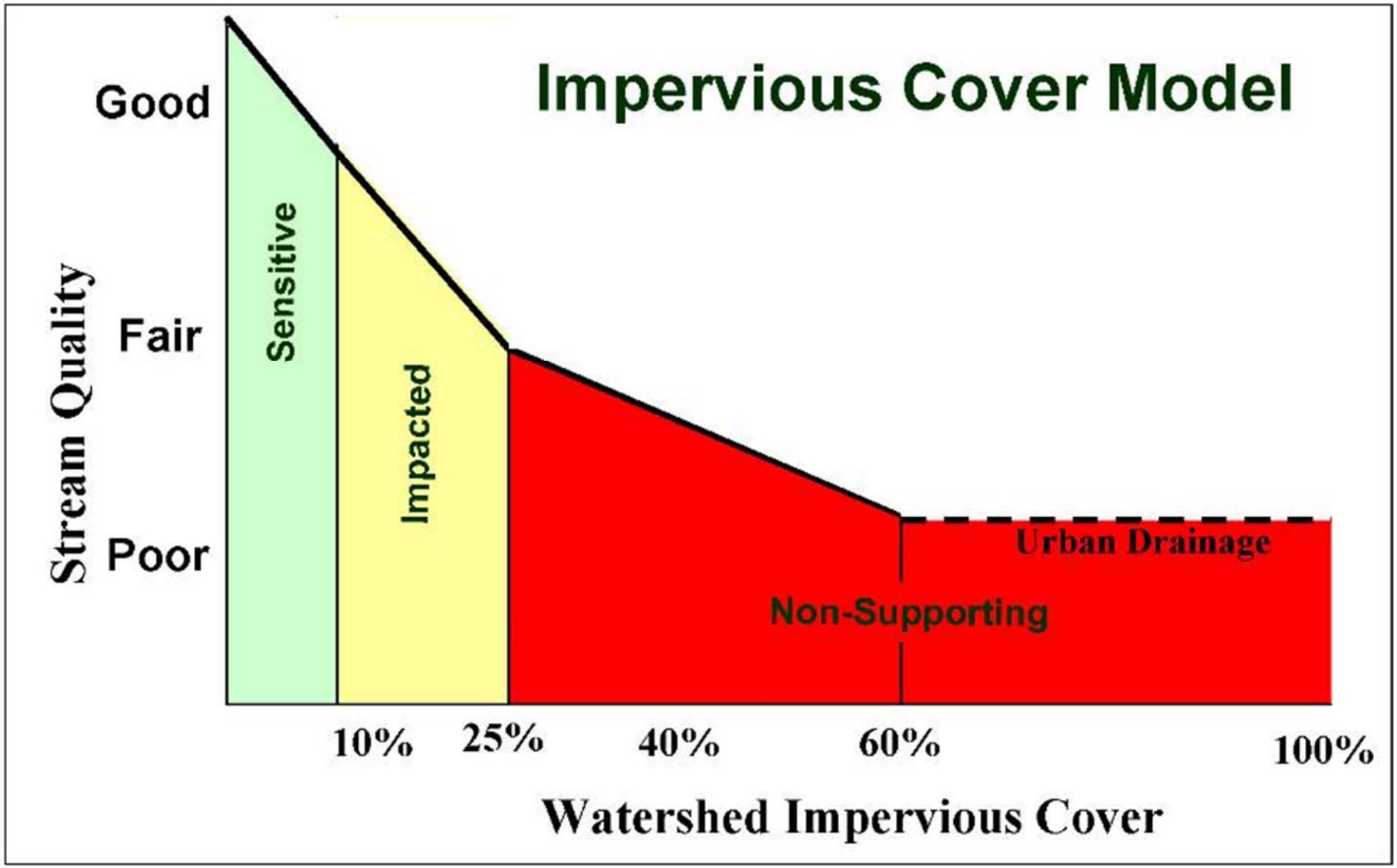
Can we change it?

Can we disconnect it?

Can we reuse it?

Impervious Cover Assessment (ICA)

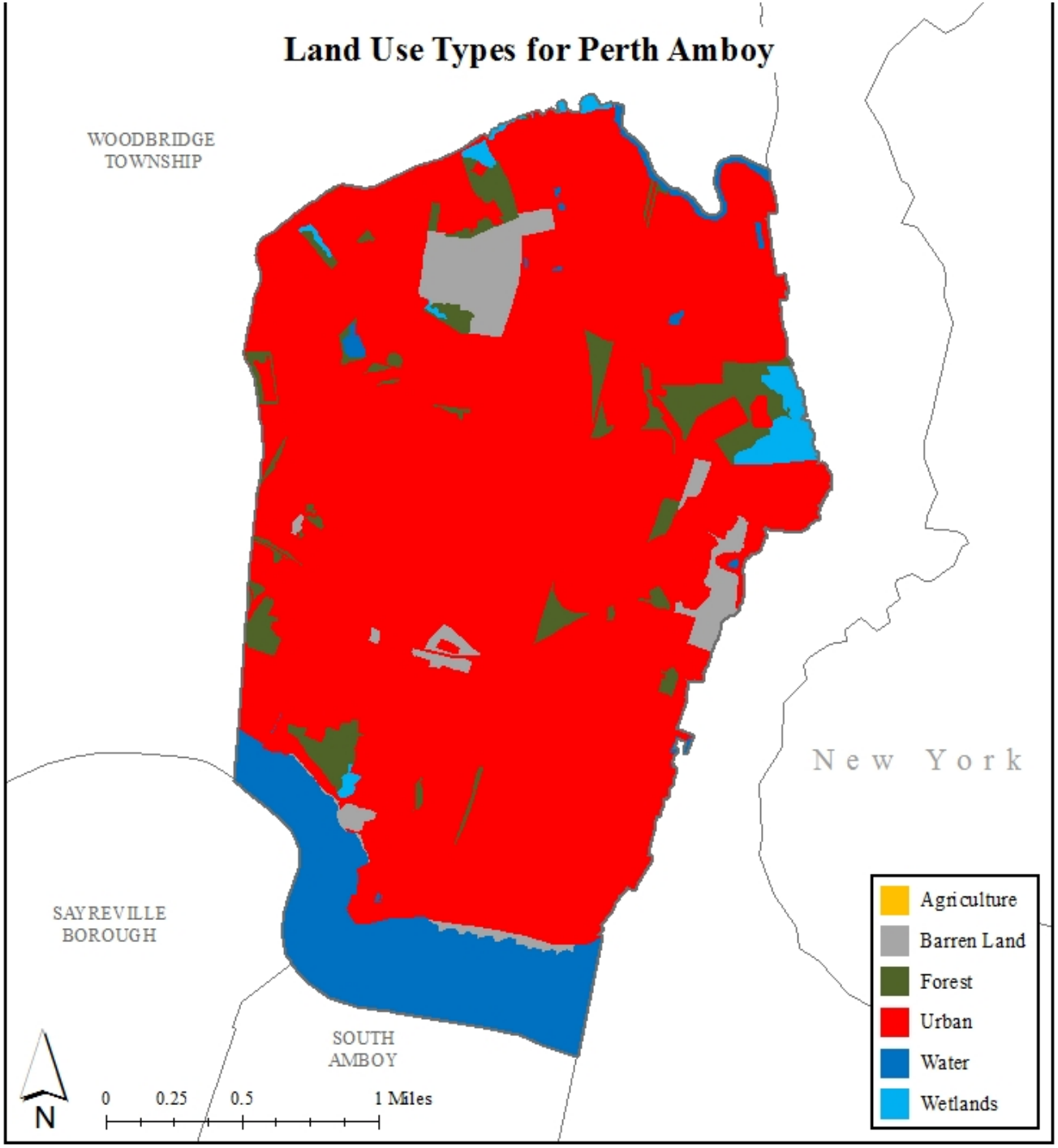
Original ICM developed based on 200+ reports and papers

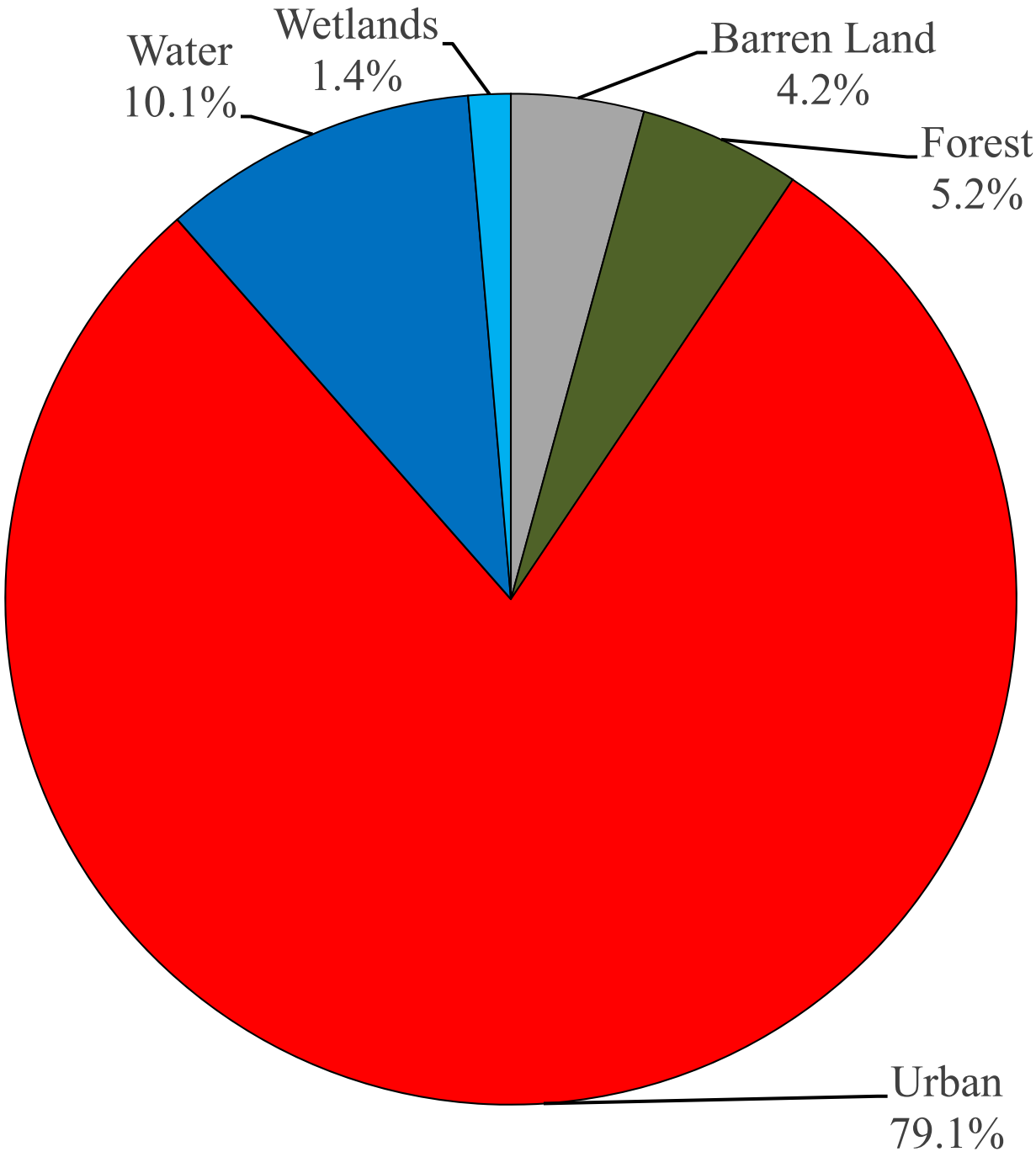


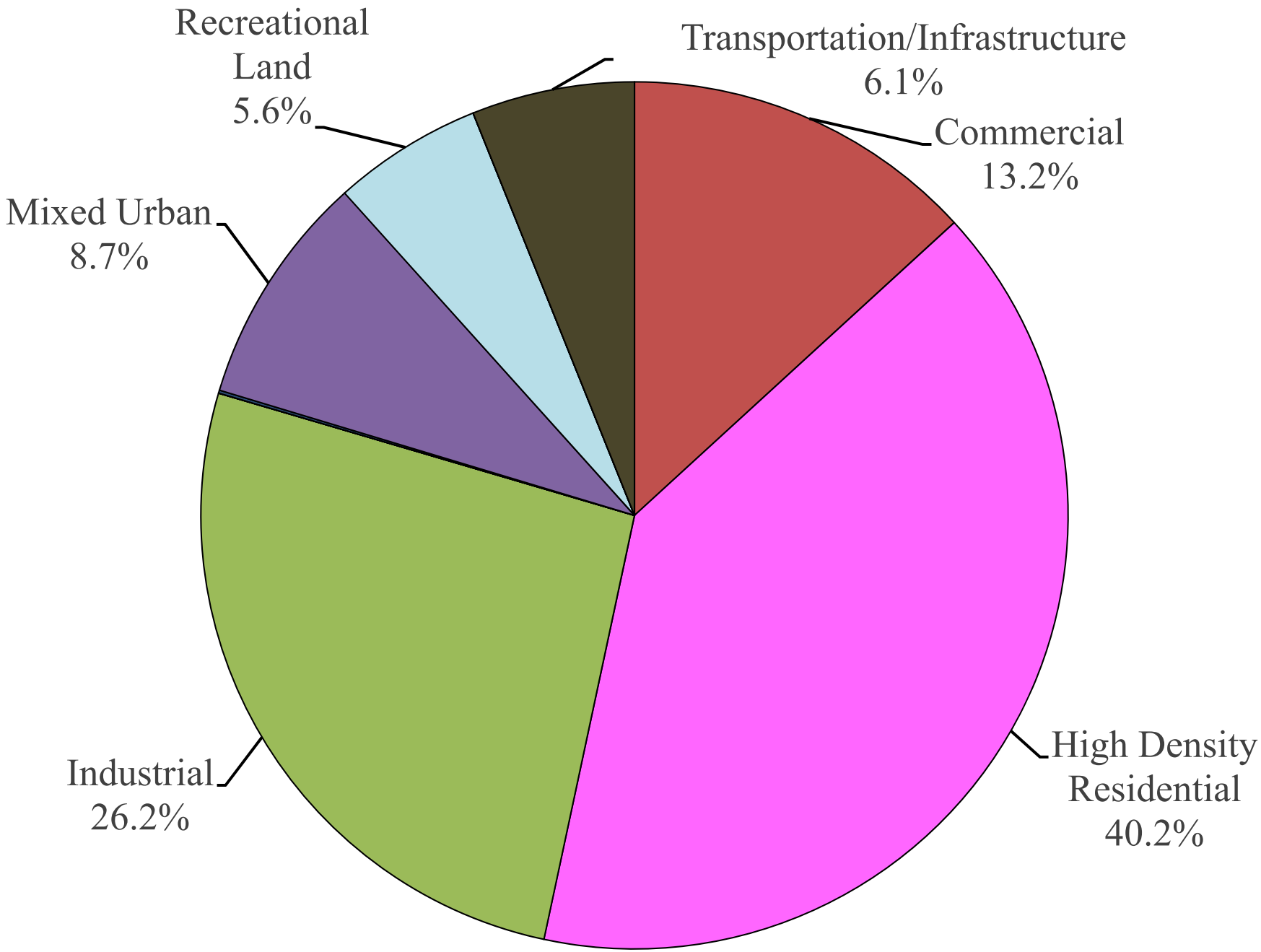
Reference: Tom Schueler and Lisa Fraley-McNeal, Symposium on Urbanization and Stream Ecology, May 23 and 24, 2008

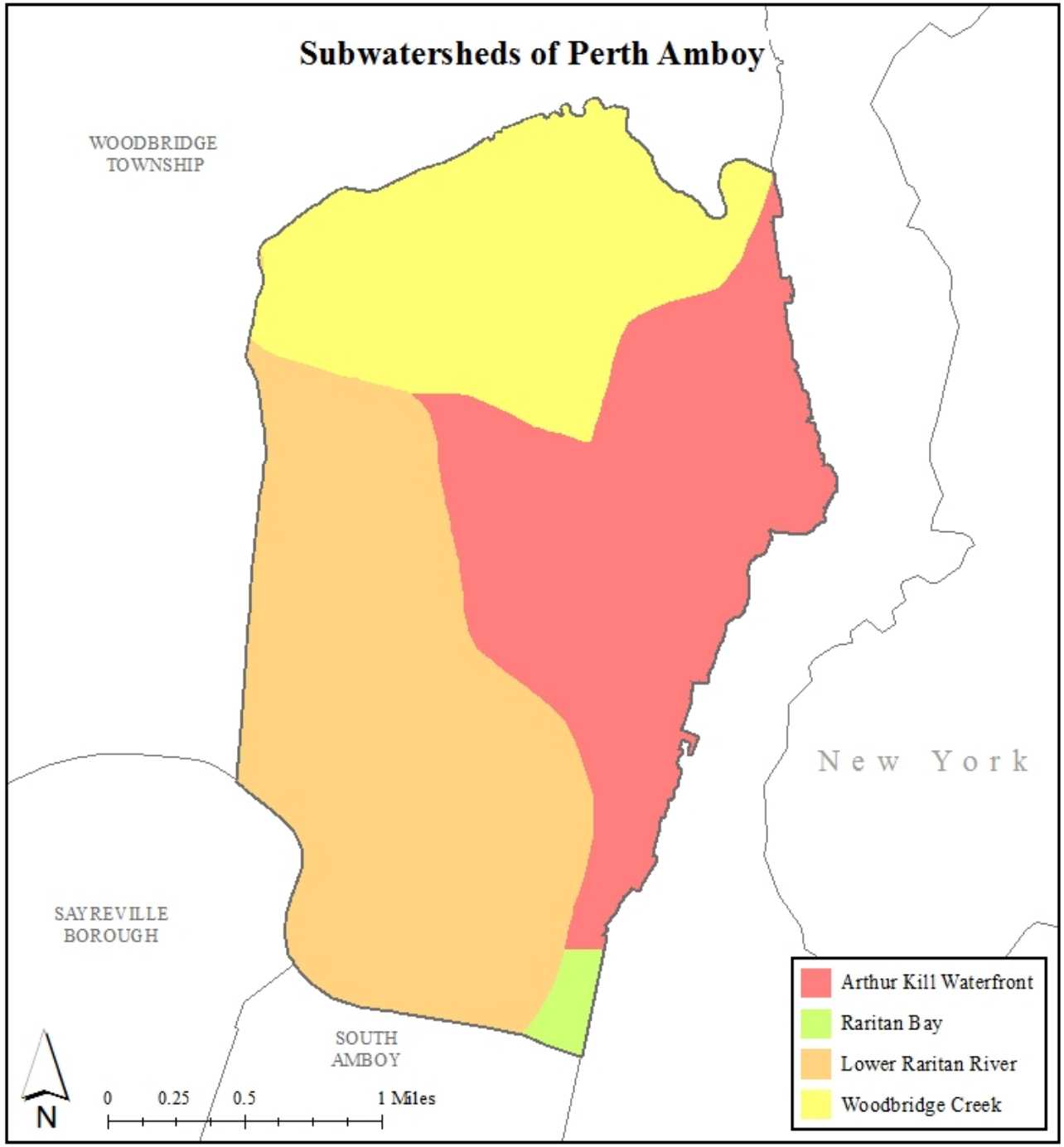
Impervious Cover Assessment (ICA)

- Analysis completed by watershed and by municipality
- Use 2012 Land Use data to determine impervious cover
- Calculate runoff volumes for water quality, 2, 10 and 100 year design storm and annual rainfall
- Contain three concept designs


Land Use Types for Perth Amboy
WOODBRIDGE TOWNSHIP
New York
SAYREVILLE BOROUGH
SOUTH AMBOY
N
0
0.25
0.5
1 Miles
Agriculture
Barren Land
Forest
Urban
Water
Wetlands


Water
10.1%
Wetlands
1.4%
Barren Land
4.2%
Forest
5.2%
Urban
79.1%


Recreational Land 5.6%
Transportation/Infrastructure 6.1%
Commercial 13.2%
Mixed Urban 8.7%
Industrial 26.2%
High Density Residential 40.2%


Subwatersheds of Perth Amboy
WOODBRIDGE TOWNSHIP
New York
SAYREVILLE BOROUGH
SOUTH AMBOY
N
0 0.25 0.5 1 Miles
Arthur Kill Waterfront
Raritan Bay
Lower Raritan River
Woodbridge Creek

Watershed	Total Area (ac)	Impervious Cover (ac)	%
Arthur Kill Waterfront	1,099	568	51.9%
Raritan Bay	38.7	0.00	0.0%
Lower Raritan River	1,336	618	58.3%
Woodbridge Creek	839.0	381	46.3%
Total	3,312	1,567	52.6%

Subwatershed	NJ Water Quality Storm (MGal)	Annual Rainfall of 44" (MGal)	2-Year Design Storm (3.3”) (MGal)	10-Year Design Storm (5.0”) (MGal)	100-Year Design Storm (8.2”) (MGal)
Arthur Kill Waterfront	19.3	678.6	50.9	78.7	132.6
Raritan Bay	0.0	0.0	0.0	0.0	0.0
Lower Raritan River	21.0	738.3	55.4	85.6	144.3
Woodbridge Creek	12.9	455.2	34.1	52.8	89.0
Total	53.2	1,872	140.4	217.0	366

WE LOOK HERE FIRST:

- ✓Schools
- ✓Churches
- ✓Libraries
- ✓Municipal Building
- ✓Public Works
- ✓Firehouses
- ✓Post Offices
- ✓Elks or Moose Lodge
- ✓Parks/ Recreational Fields

- 20 to 40 sites are entered into a powerpoint:
- Site visits are conducted

Perth Amboy City

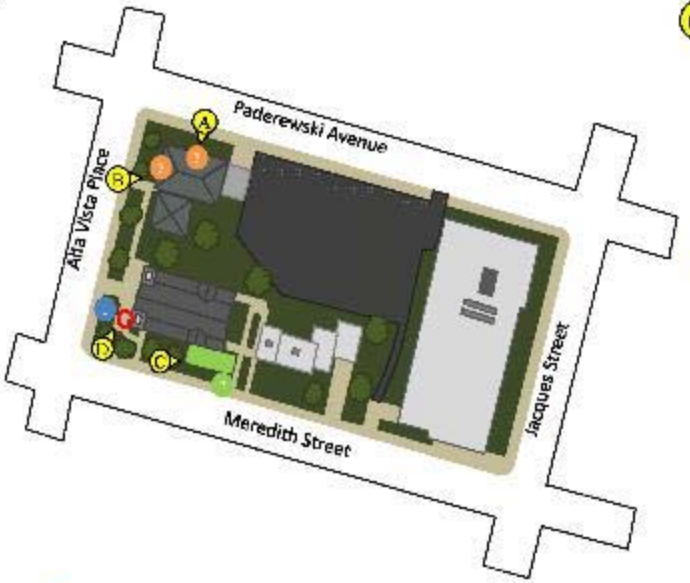
Impervious Cover Assessment

Ukrainian Catholic Church of the Assumption, 684 Alta Vista Place

Assumption Catholic School, Meredith & Jacques Streets

PROJECT LOCATION:

SITE PLAN:



A

B

C

D

1. RAIN BARRELS: Rain barrels will help capture the stormwater that drains from the building's rooftop. Connecting the church's downspouts to rain barrels will allow the stormwater to be collected and used for gardening.

2. BIORETENTION SYSTEM: On this property a rain garden can be used to reduce sediment and nutrient loading to the local waterway and increase groundwater recharge.

3. DISCONNECTED DOWNSPOUTS: Downspouts can be disconnected to allow rainwater to flow into the grassed areas which will help remove pollutants and allow for the stormwater to infiltrate into the ground.

1 RAIN BARREL

2 BIORETENTION SYSTEM

3 DISCONNECTED DOWNSPOUTS

Perth Amboy City
Impervious Cover Assessment
James J. Flynn Elementary School, 850 Chamberlain Avenue

PROJECT LOCATION:

SITE PLAN:

N

1 BIORETENTION SYSTEMS: Trench drains will carry stormwater into bioretention systems or rain gardens. These rain gardens will capture, treat, and infiltrate roadway runoff and runoff from the grass area in front of the school. The existing catch basins will handle any overflow from the gardens. The rain gardens will reduce sediment and nutrient loading to the local waterway while providing beautiful landscaping to the school grounds. The gardens will also provide habitat for birds, butterflies, and pollinators. They also can be incorporated into the elementary school science curriculum.

1 BIORETENTION SYSTEM

2 TRENCH DRAIN

Perth Amboy City

Impervious Cover Assessment

Samuel E. Shull Middle School, 380 Hall Avenue

PROJECT LOCATION:

A

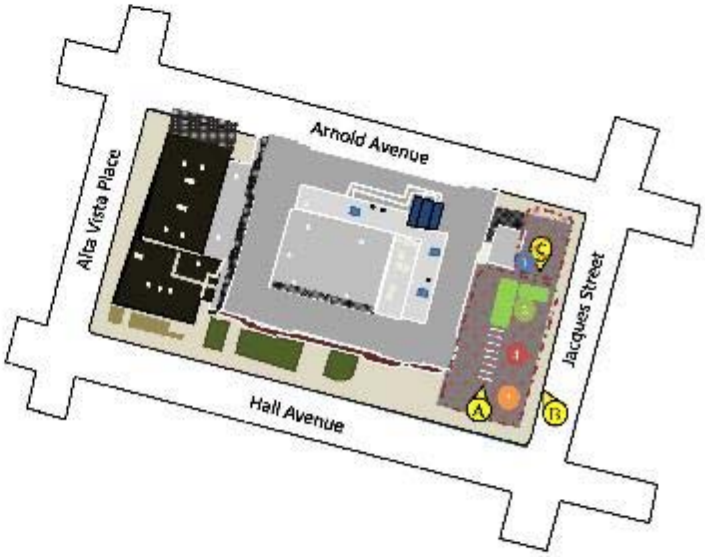
B

C

RUTGERS

SITE PLAN:

N

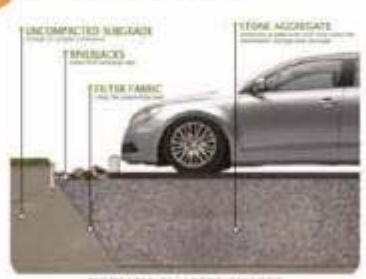


1. RAINWATER HARVESTING: A cistern or a series of rain barrels will help capture the stormwater that drains from the building's loading dock rooftop. Connecting the loading dock downspouts to a rainwater harvesting device will allow the stormwater to be collected and used for landscaping.
2. BIORETENTION SYSTEM: On this property a bioretention system or rain garden can be used to reduce sediment and nutrient loading to the local waterway and increase groundwater recharge.
3. POROUS ASPHALT: Porous asphalt promotes groundwater recharge and filters stormwater.
4. DEPAVING: The parking lot adjacent to the school building will be depaved (i.e., asphalt will be removed). Depaving reduces impervious surfaces, allowing for infiltration, filtration, and treatment of nonpoint source pollution and adds green space.

1 RAINWATER HARVERSTING

2 BIORETENTION SYSTEM

3 POROUS ASPHALT



4 DEPAVING

Impervious Cover Reduction Action Plan (RAP)

PERTH AMBOY: GREEN INFRASTRUCTURE SITES

SITES WITHIN THE ARTHUR KILL WATERFRONT SUBWATERSHED:

1. Anthony V. Ceres School
2. Assumption Catholic School
3. Education Center
4. Ignacio Cruz Early Childhood Center
5. Perth Amboy High School
6. Perth Amboy Vocational School

SITES WITHIN THE LOWER RARITAN RIVER SUBWATERSHED:

7. 587 Fayette Street Plaza
8. Convery Plaza Shopping Center
9. Dr. Herbert N. Richardson 21st Century School
10. Public School No. 7
11. Raritan Bay Medical Center
12. Robert N. Wilentz Elementary
13. Walgreens
14. Washington Park
15. YMCA and Perth Amboy Police Department

SITES WITHIN THE WOODBRIDGE CREEK SUBWATERSHED:

16. 966 Convery Boulevard
17. 1012 Amboy Avenue
18. Edmund Hmieleski Jr. Early Childhood Center
19. James J. Flynn Elementary

ASSUMPTION CATHOLIC SCHOOL

Subwatershed: Arthur Kill

Site Area: 79,150 sq. ft.

Address: 376 Meredith Street
Perth Amboy, NJ 08861

Block and Lot: Block 327, Lot 1

Parking spaces can be replaced with pervious pavement to infiltrate stormwater runoff in the north section of the site. A rain garden can be built in the southwest section of the site to capture, treat, and infiltrate roof runoff. A preliminary soil assessment suggests that the soils have suitable drainage characteristics for green infrastructure.

Impervious Cover		Existing Loads from Impervious Cover (lbs/yr)			Runoff Volume from Impervious Cover (Mgal)	
%	sq. ft.	TP	TN	TSS	For the 1.25" Water Quality Storm	For an Annual Rainfall of 44"
80	63,320	3.1	32.0	290.7	0.049	1.74

Recommended Green Infrastructure Practices	Recharge Potential (Mgal/yr)	TSS Removal Potential (lbs/yr)	Maximum Volume Reduction Potential (gal/storm)	Peak Discharge Reduction Potential (cu. ft./second)	Estimated Size (sq. ft.)	Estimated Cost
Bioretention systems	0.055	9	4,039	0.15	1,019	$5,095
Pervious pavements	0.454	76	33,301	1.25	2,916	$72,900

REEN INFRASTRUCTURE RECOMMENDATIONS

Assumption Catholic School

- disconnected downspouts
- pervious pavements
- bioretention / rain gardens
- drainage areas
- property line
- 2012 Aerial: NJOIT, OGIS

0 30' 60'

Perth Amboy

ALL SITES | ARTHUR KILL WATERFRONT | LOWER RARITAN RIVER | WOODBRIDGE CREEK

1 Anthony V. Ceres School

2 Assumption Catholic School

3 Education Center

4 Ignacio Cruz Early Childhood Center

5 Perth Amboy High School

6 Perth Amboy Vocational School

7 687 Fayette St Plaza

8 Convery Plaza Shopping Center

9 Dr. Herbert N. Richardson 21st Century School

10 Public School No. 7

11 Raritan Bay Medical Center

12 Robert N. Wilentz Elementary

13 Walgreens

14 Washington Park

15 YMCA and Perth Amboy Police Department

Perth Amboy

ALL SITES | ARTHUR KILL WATERFRONT | LOWER RARITAN RIVER | WOODBRIDGE CREEK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12 Robert N. Wilentz Elementary


13 Walgreens

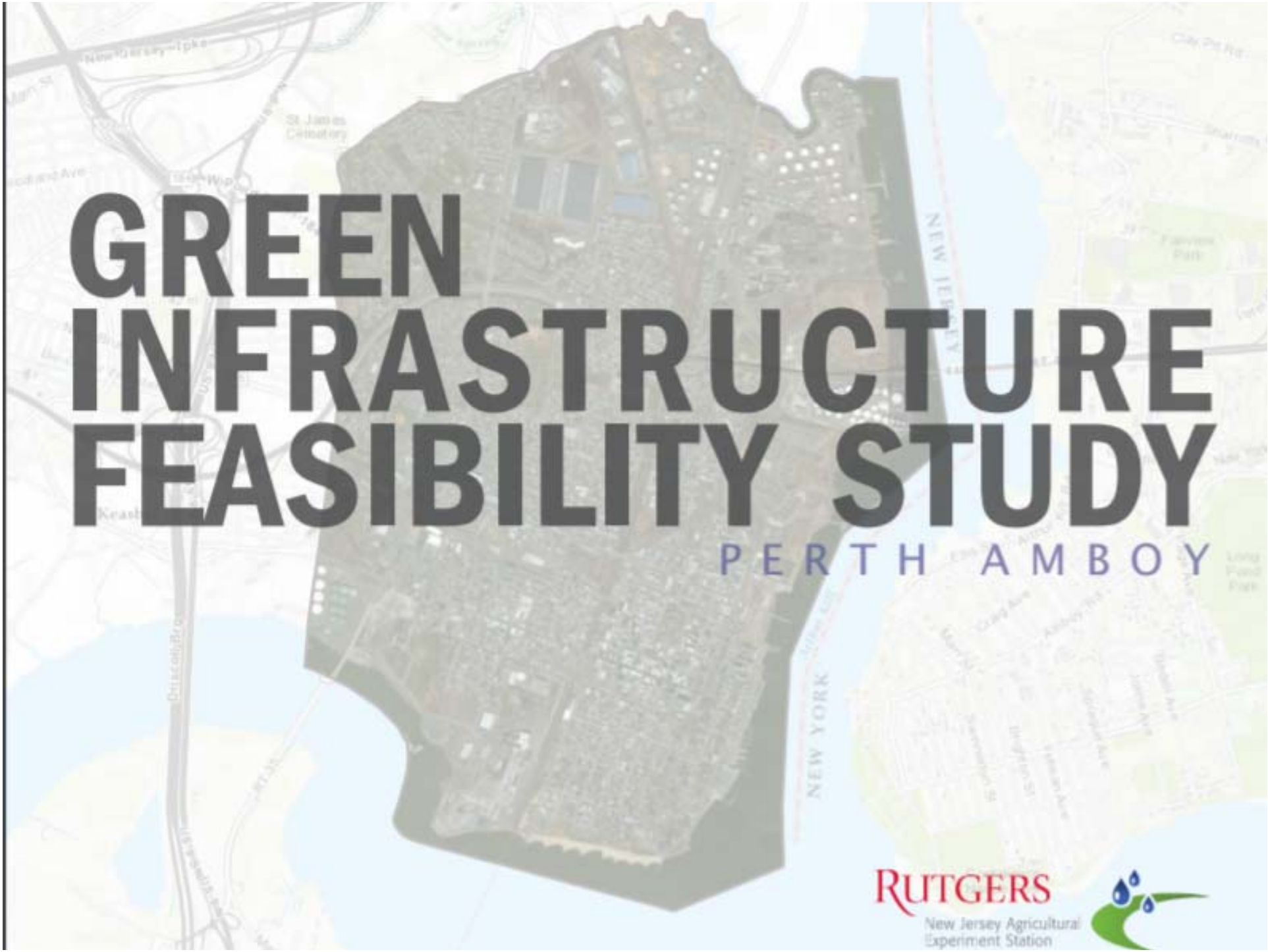

14 Washington Park


15 YMCA and Perth Amboy Police Department

Assumption Catholic School

376 Meredith Street Perth Amboy, NJ 08862

Download Report (PDF)



GREEN INFRASTRUCTURE FEASIBILITY STUDY

PERTH AMBOY

RUTGERS
New Jersey Agricultural Experiment Station

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Rutgers Cooperative Extension Water Resources Program

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