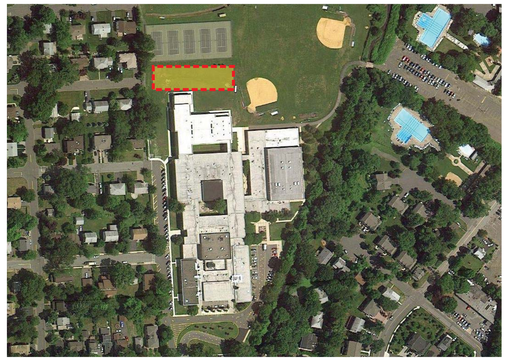
APPENDIX D: ENGINEERING PLANS FOR IMPLEMENTATION PROJECTS TO ADDRESS KNOWN WATER QUALITY IMPAIRMENTS IN THE TENAKILL BROOK WATERSHED

TENAKILL BROOK WATERSHED RESTORATION & PROTECTION PLAN

Tenafly High School Concept Design

Municipality: Borough of Tenafly
Subwatershed: Tenakill Brook TB6
Location: Tenafly High School

PROJECT LOCATION



BIORETENTION RETROFIT (1)
Bioretention areas, or rain gardens, are landscaping features adapted to provide on-site treatment of stormwater runoff. They are commonly located in parking lot islands or within small pockets of residential land uses. Surface runoff is directed into shallow, landscaped depressions. These depressions are designed to incorporate many of the pollutant removal mechanisms that operate in forested ecosystems. Runoff from larger storms is generally diverted past the facility to the storm drain system. The remaining runoff filters through the mulch and prepared soil mix. The filtered runoff can be collected in a perforated underdrain and returned to the storm drain system.

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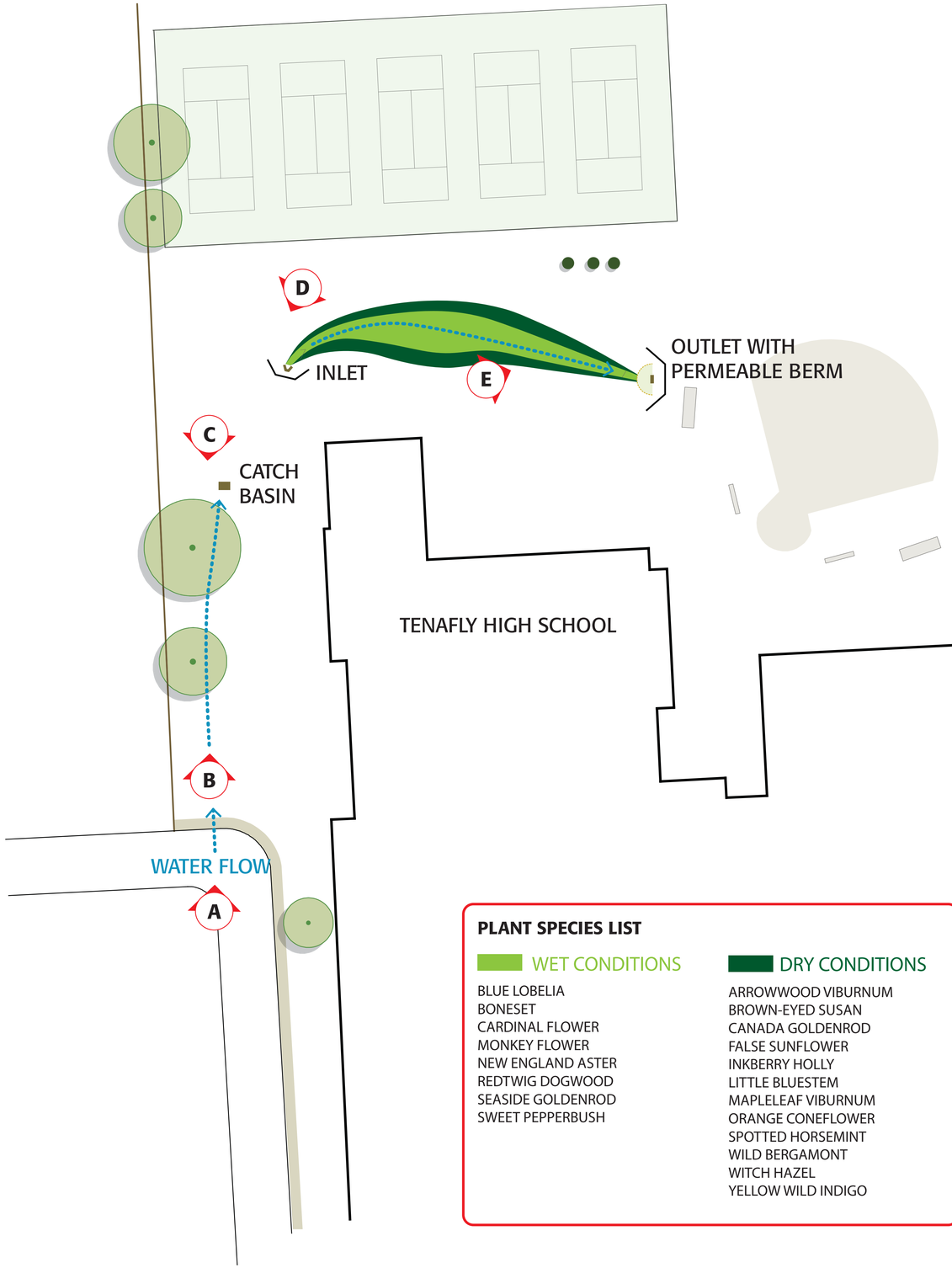
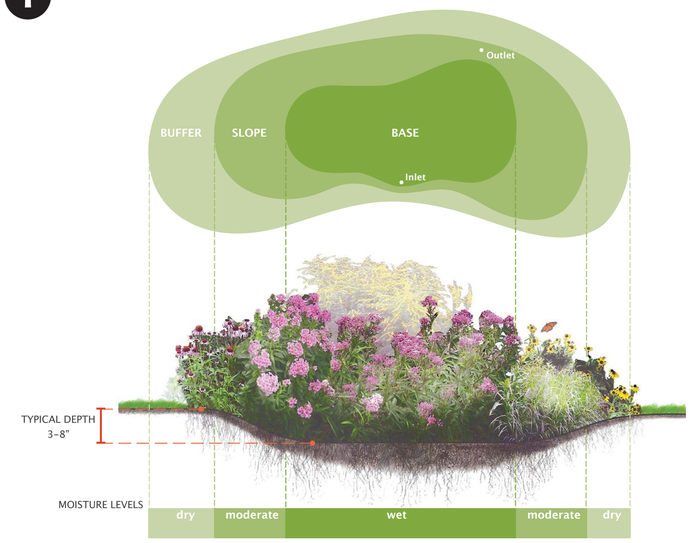


SITE PHOTOS

1 BIORETENTION RETROFIT (RAIN GARDEN)



PLANT SPECIES LIST

WET CONDITIONS

BLUE LOBELIA
BONESET
CARDINAL FLOWER
MONKEY FLOWER
NEW ENGLAND ASTER
REDTWIG DOGWOOD
SEASIDE GOLDENROD
SWEET PEPPERBUSH

DRY CONDITIONS

ARROWWOOD VIBURNUM
BROWN-EYED SUSAN
CANADA GOLDENROD
FALSE SUNFLOWER
INKBERRY HOLLY
LITTLE BLUESTEM
MAPLELEAF VIBURNUM
ORANGE CONEFLOWER
SPOTTED HORSEMINT
WILD BERGAMONT
WITCH HAZEL
YELLOW WILD INDIGO

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TENAKILL BROOK WATERSHED RESTORATION & PROTECTION PLAN

Cresskill Brook Concept Design

Project ID: CB1_Cr_a
Municipality: Borough of Demarest
Subwatershed: Cresskill Brook Watershed
Location: Cresskill Brook and surrounding neighborhood

PHOTOS OF SURROUNDING AREA

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Water Resources Program

PROJECT LOCATION

SITE PLAN

LOCATION: Academy Lane, Demarest, NJ

Site Plan depicts a neighborhood of the Tenakill Brook Watershed that should implement a Streamside Living Program to help mitigate the harmful development impacts to the Tenakill Brook. This could be implemented throughout many of the neighborhoods in the Tenakill Brook Watershed.

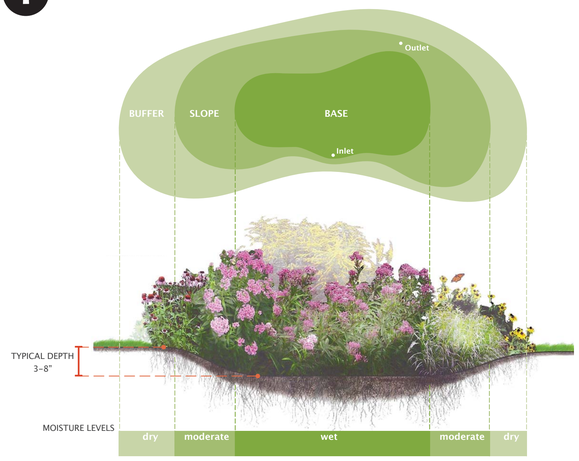
WHAT IS A RAIN GARDEN? (1)
A rain garden is a landscaped, shallow depression that captures, filters, and infiltrates stormwater runoff. The rain garden removes nonpoint source pollutants from stormwater runoff while recharging groundwater. A rain garden has two main goals. The first goal is to serve as a functional system to capture, filter, and infiltrate stormwater runoff at the source, and the second goal is to be an aesthetically pleasing garden. Rain gardens are an important tool for communities and neighborhoods to create diverse, attractive landscapes while protecting the health of the natural environment.

STREAMSIDE LIVING (2)
A large majority of the Tenakill Brook travels through the properties of homeowners. Many of these residents may not fully understand or adhere to their responsibilities of being a streamside owner. These properties may not have any significant riparian buffers next to the stream, allowing pollutants to enter the stream and for erosion to occur. Nonpoint source pollution from these residents may be a substantial contribution to the high concentrations of bacteria in the watershed.

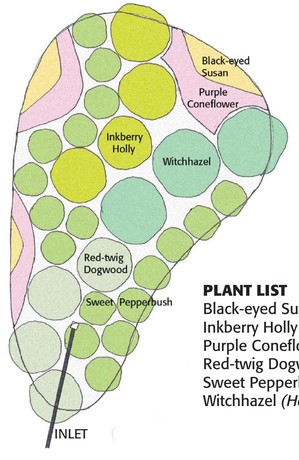
The municipalities should each have a streamside living program. This program should include a public education/outreach portion. The education should include teaching residents to: limit the use of pesticides and herbicides; establish a no-mow zone along banks; protect storm drains from debris; plant native trees, shrubs, perennials and grasses; identify and remove invasive plants; leave woody debris and rocks; avoid applying fertilizer near streams; never dump chemicals down storm drains; and avoid storing waste or loose soil near a stream. It should also include the state and local regulations. The Water Resources Program also recommends that the municipalities inspect the properties of streamside owners periodically.

The Water Resources Program believes that nonpoint source pollution from streamside properties may have a significant impact on the high concentrations of bacteria found in the watershed. If this pollution is eliminated, then there may be a large decrease in bacteria concentrations. It would also teach the residents to be aware of their impact on the watershed, and avoid other harmful activities.

1 RAIN GARDEN



1a PLANTING PLAN - SHRUB RAIN GARDEN



PLANT LIST
Black-eyed Susan *(Rudbeckia laciniata)*
Inkberry Holly *(Ilex glabra)*
Purple Coneflower *(Echinacea purpurea)*
Red-twig Dogwood *(Cornus sericea)*
Sweet Pepperbush *(Clethera alnifolia)*
Witchhazel *(Hamamelis virginiana)*

2 STREAMSIDE LIVING - RAIN BARRELS + EDUCATION

TENAKILL BROOK WATERSHED RESTORATION & PROTECTION PLAN

Demarest Pond Park Buffer Restoration

PROJECT LOCATION

Municipality: Demarest Borough
Subwatershed: TB2
Location: Demarest Pond Park
Hardenburgh Avenue and County Road

RIPARIAN/FORESTED BUFFER (1)
A riparian or forested buffer is an area along a shoreline, wetland, or stream where development is restricted or prohibited. The primary function of aquatic buffers is to physically protect and separate a stream, lake, or wetland from future disturbance or encroachment. If properly designed, a buffer can provide stormwater management, and can act as a right-of-way during floods, sustaining the integrity of stream ecosystems and habitats. As conservation areas, aquatic buffers are part aquatic ecosystem and part urban forest.

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STREAMBANK STABILIZATION (2)
Streambank stabilization consists of using vegetation or structural materials to stabilize and protect banks of streams, brooks, rivers, or excavated channels against scour and erosion from flowing water. Streambank vegetation that is sufficiently developed contributes large woody material to streams and creates critical structural elements of habitats for many different species. Streambanks stabilized with shrub and tree vegetation provides excellent habitat for fish and wildlife species.

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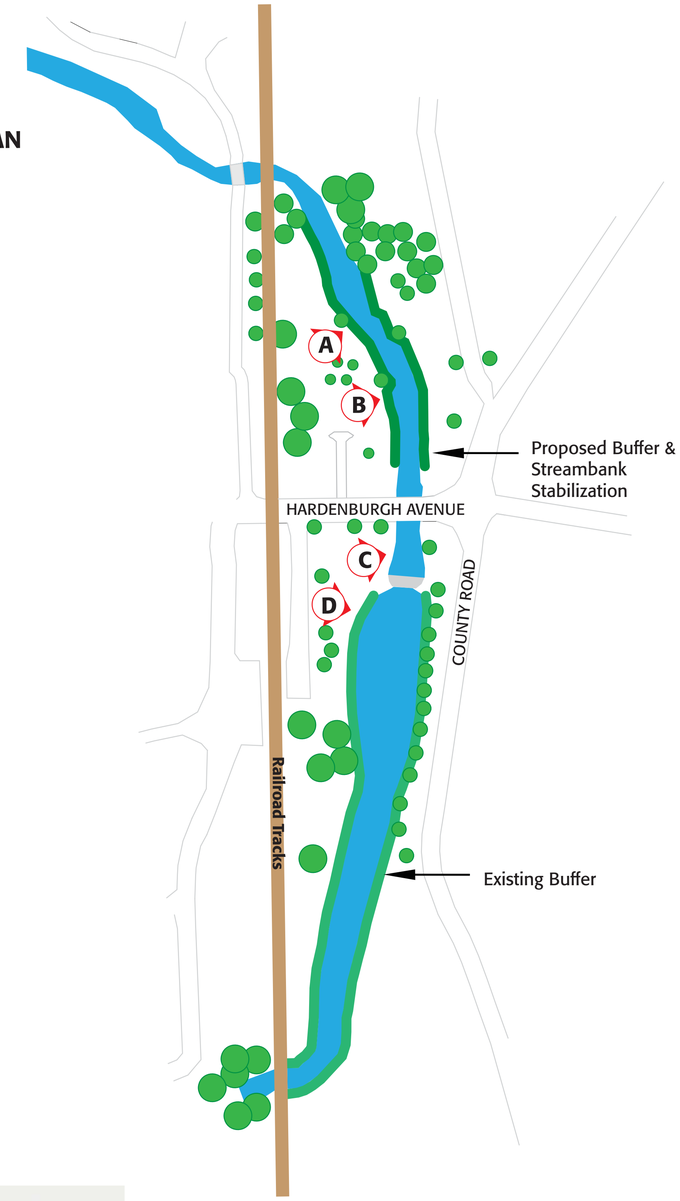
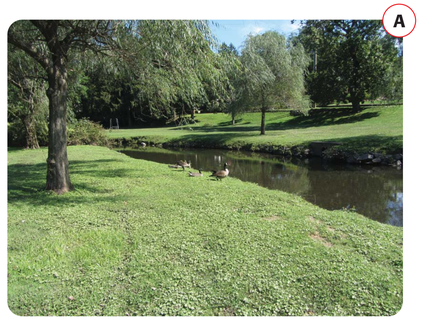
SITE PLAN



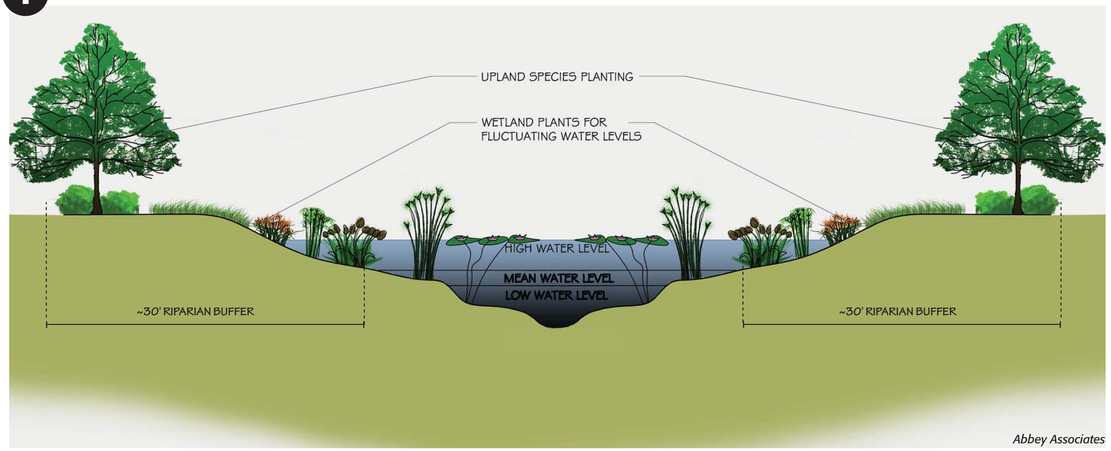
SITE PHOTOS



Proposed Buffer Location

Existing Buffer with Signage

1 RIPARIAN BUFFER RESTORATION



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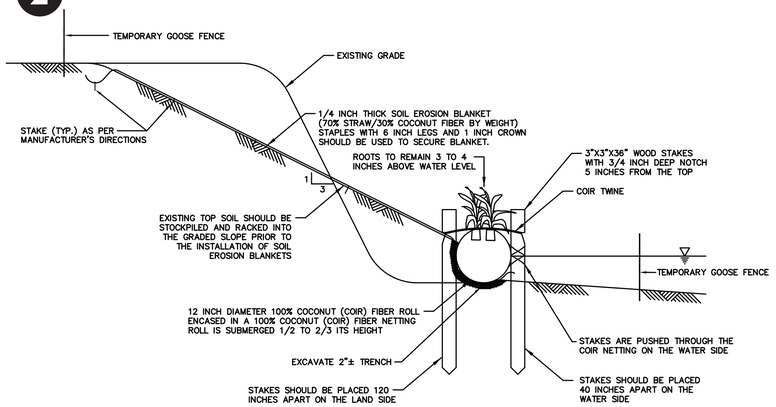
2 STREAMBANK STABILIZATION



SHORELINE WITH COCONUT FIBER ROLL AND ECO-NET STABILIZATION

TENAKILL BROOK WATERSHED RESTORATION & PROTECTION PLAN

Marlborough Co-op Apartments Concept Design

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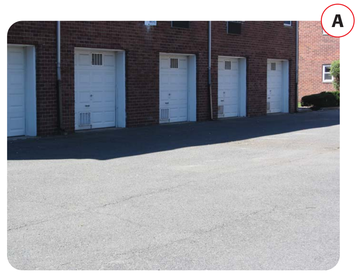
Water Resources Program

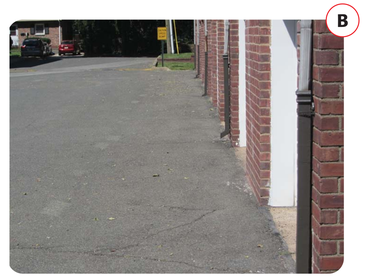
PROJECT LOCATION

Municipality: Tenafly Borough
Subwatershed: TB4
Location: Marlborough Co-op Apartments
68 Franklin Street

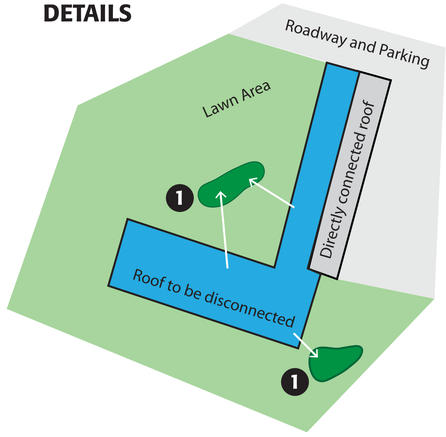
SITE PLAN

SITE PHOTOS





DETAILS



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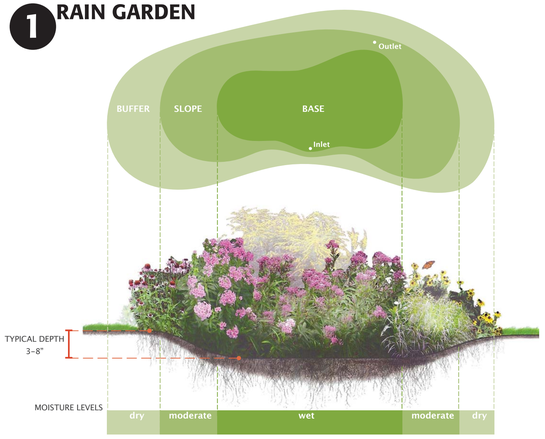
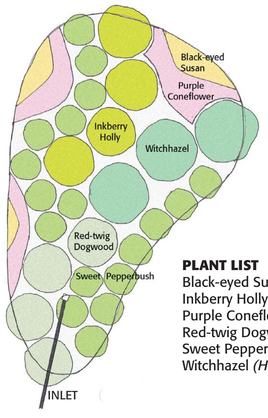
1 RAIN GARDEN

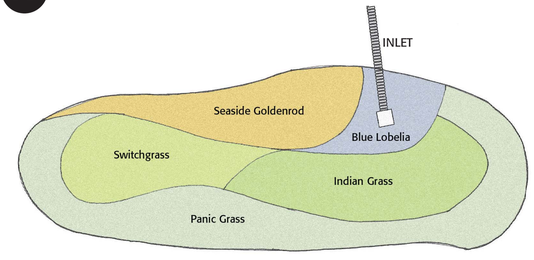


1a PLANTING PLAN - SHRUB RAIN GARDEN



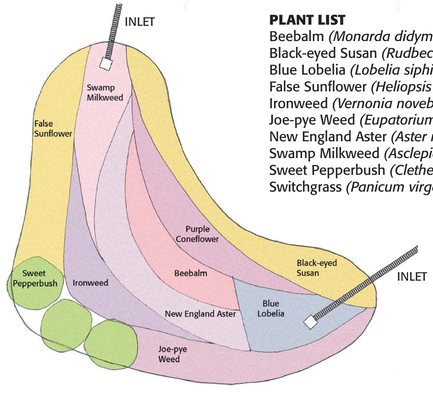
PLANT LIST
Black-eyed Susan *(Rudbeckia laciniata)*
Inkberry Holly *(Ilex glabra)*
Purple Coneflower *(Echinacea purpurea)*
Red-twig Dogwood *(Cornus sericea)*
Sweet Pepperbush *(Clethera alnifolia)*
Witchhazel *(Hamamelis virginiana)*

1b PLANTING PLAN - GRASSES RAIN GARDEN



PLANT LIST
Blue Lobelia *(Lobelia siphilitica)*
Indiangrass *(Sorghastrum nutans)*
Panic Grass *(Panicum virgatum)*
Seaside Goldenrod *(Solidago sempvirens)*
Switchgrass *(Panicum virgatum)*

1c PLANTING PLAN - WILDFLOWER RAIN GARDEN



PLANT LIST
Beebalm *(Monarda didyma)*
Black-eyed Susan *(Rudbeckia laciniata)*
Blue Lobelia *(Lobelia siphilitica)*
False Sunflower *(Heliopsis helianthoides)*
Ironweed *(Vernonia noveboracensis)*
Joe-pye Weed *(Eupatorium spp.)*
New England Aster *(Aster novae-angliae)*
Swamp Milkweed *(Asclepias incarnata)*
Sweet Pepperbush *(Clethera alnifolia)*
Switchgrass *(Panicum virgatum)*

TENAKILL BROOK WATERSHED RESTORATION & PROTECTION PLAN

Memorial Park Buffer Restoration

RUTGERS New Jersey Agricultural Experiment Station

Water Resources Program

PROJECT LOCATION

Municipality: Closter Borough
Subwatershed: TB1
Location: Memorial Park
Harrington Ave and Closter Dock Road

RIPARIAN/FORESTED BUFFER (1)
A riparian or forested buffer is an area along a shoreline, wetland, or stream where development is restricted or prohibited. The primary function of aquatic buffers is to physically protect and separate a stream, lake, or wetland from future disturbance or encroachment. If properly designed, a buffer can provide stormwater management, and can act as a right-of-way during floods, sustaining the integrity of stream ecosystems and habitats. As conservation areas, aquatic buffers are part aquatic ecosystem and part urban forest.

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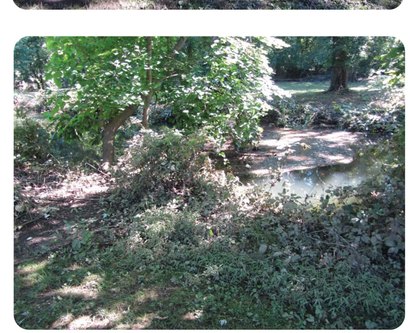
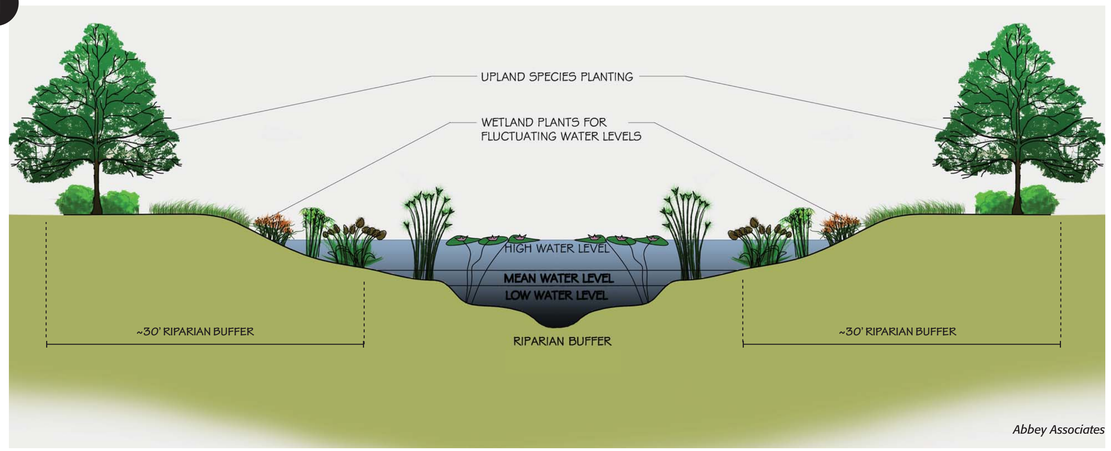
PHOTOS OF SURROUNDING AREA



1 RIPARIAN BUFFER RESTORATION



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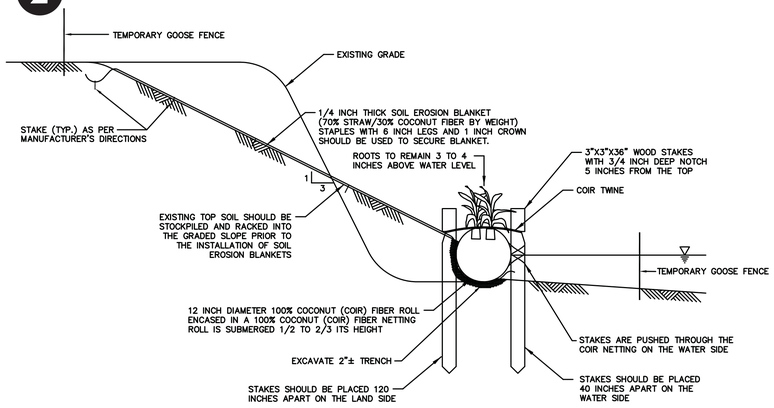
2 STREAMBANK STABILIZATION



SHORELINE WITH COCONUT FIBER ROLL AND ECO-NET STABILIZATION

TENAKILL BROOK WATERSHED RESTORATION & PROTECTION PLAN

Closter Borough Green Street Concept Design

Project ID: TB1_Cl_d
Municipality: Borough of Closter
Subwatershed: TB1
Location: Roadways in residential neighborhood; Lockwood Lane between Willis Drive & Birch Street

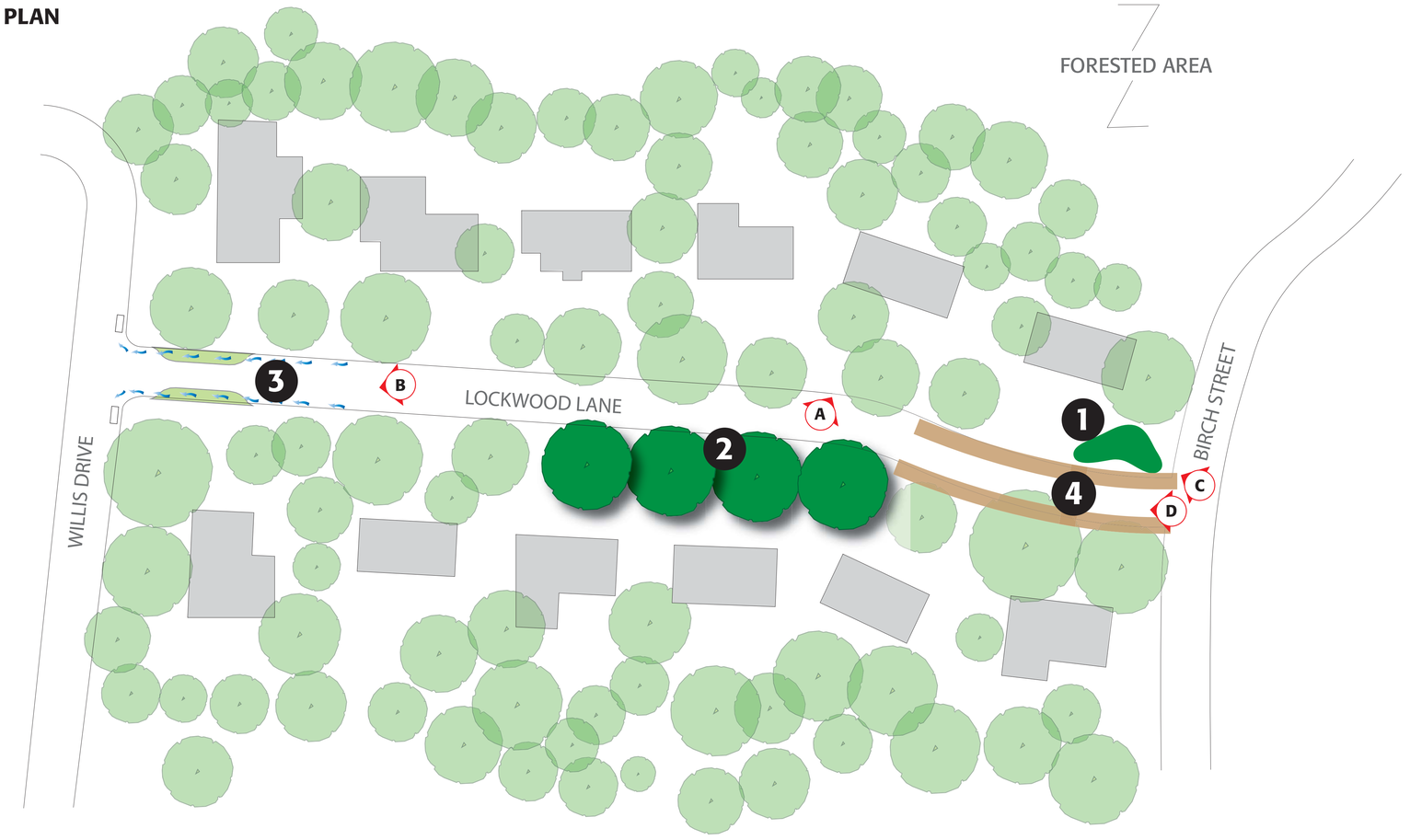
RUTGERS New Jersey Agricultural Experiment Station

Water Resources Program

PROJECT LOCATION

SITE PHOTOS

SITE PLAN



What is a Green Street?
Green streets are an innovative design concept that can transform our streets into appealing landscaped areas while managing stormwater runoff. Designed to be attractive as well as functional, green streets use vegetation and soil to capture, slow, filter, and infiltrate stormwater runoff. They manage stormwater, provide environmental benefits, beautify our streetscapes, add greenery to urban areas, enhance pedestrian and bicycle safety, and provide habitat.

RAIN GARDEN (1)
A rain garden is a landscaped, shallow depression that captures, filters, and infiltrates stormwater runoff. The rain garden removes nonpoint source pollutants from stormwater runoff while recharging groundwater.

TREE BOX FILTER (2)
Tree box filters are in-ground containers used to control runoff water quality and provide some detention capacity. Often premanufactured, tree box filters contain street trees, vegetation, and soil that help filter runoff before it enters a catch basin or is released from the site. Tree box filters can help meet a variety of stormwater management goals, satisfy regulatory requirements for new development, protect and restore streams, control combined sewer overflows (CSOs), retrofit existing urban areas, and protect reservoir watersheds.

STORMWATER CURB EXTENSION (3)
A curb extension or bump out is typically a paved area that extends into the street and is used to help calm traffic and increase pedestrian safety. By altering this design with curb openings that allow runoff to enter and adding a special soil mix and appropriate vegetation, a curb extension can function as an attractive stormwater facility while still providing traffic calming benefits.

PERVIOUS PAVEMENT (4)
Permeable pavement is an alternative to asphalt or concrete surfaces that allows stormwater to drain through the porous surface to a stone reservoir underneath. The reservoir temporarily stores surface runoff before infiltrating it into the subsoil. The appearance of the alternative surface is often similar to asphalt or concrete, but it is manufactured without fine materials and instead incorporates void spaces that allow for storage and infiltration.

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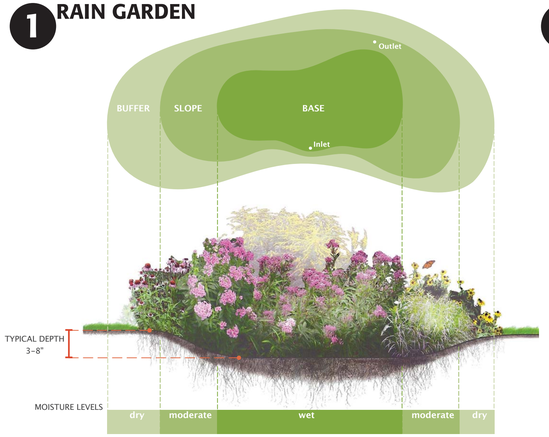
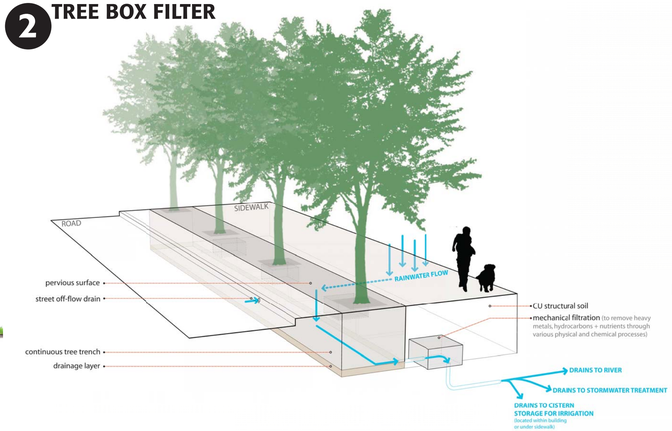
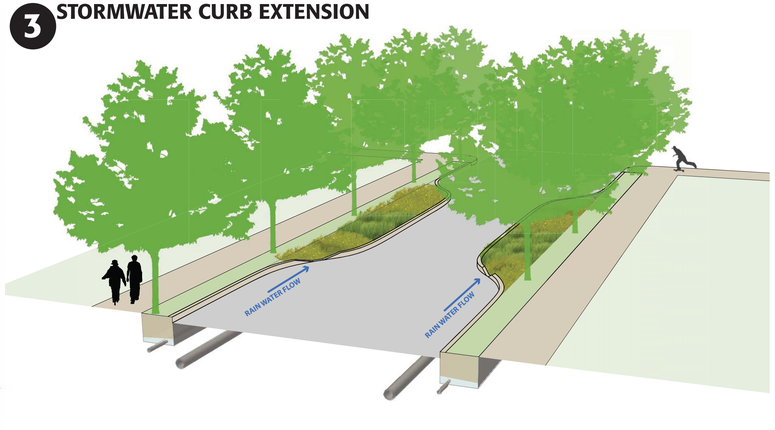
1 RAIN GARDEN



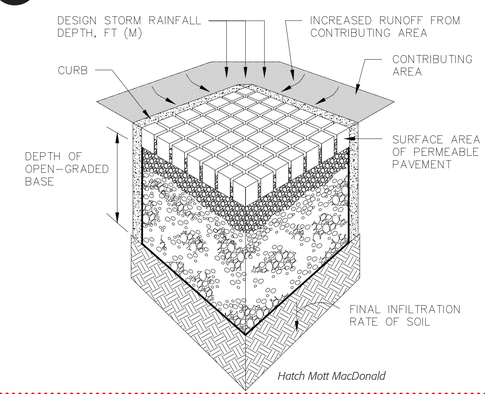
2 TREE BOX FILTER



3 STORMWATER CURB EXTENSION



4 PERVIOUS PAVEMENT



Hatch Mott MacDonald