



Flood Plain Reclamation Where do we start?

Rutgers Cooperative Extension Water Resources Program

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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 community water resources issues using sustainable and practical science-based solutions.

The Water Resources Program serves all of New Jersey, working closely with the County Extension Offices.





What is a Flood Plain?

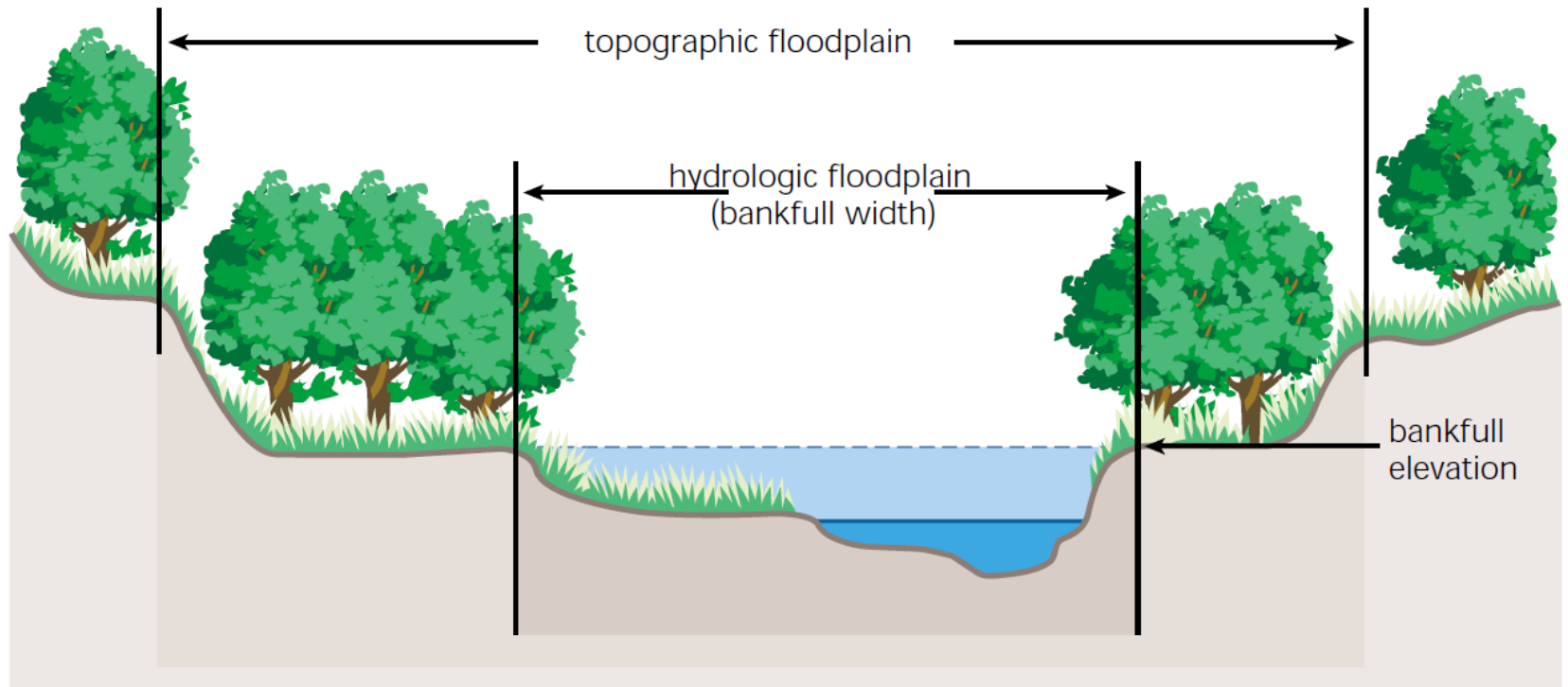


Figure 1.20: Hydrologic and topographic floodplains. The hydrologic floodplain is defined by bankfull elevation. The topographic floodplain includes the hydrologic floodplain and other lands up to a defined elevation.





Functions of Flood Plain

- Provides storage during large storm events
- Reduces stream velocities during large storm events
- Buffers development from flooding
- Provides wildlife habitat
- Cleans the water





Building in Flood Plains



- Increases overall flooding by displacing water into other areas
- Greater financial losses through property damage
- Increases risks to human safety





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Altering the Flood Plain

- Streams meander causing natural alterations in the flood plain
- Filling of flood plains for farming, building, and roadways
- As flood plains are reduced stream velocity increase causing back erosion



Pompton Dam and Ramapo River





Streams Meander!



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Houses in the Flood Plain



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Paving Paradise....

- More pavement, more stormwater runoff, more flooding
- NJ has 12.1% impervious cover or 1,055 square miles or 675,200 acres
- 1 inches of rainfall = 18.3 billion gallons of runoff



Where in New Jersey are we?





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Rescuing Flood Plain Properties





Now What?...What do you do with a rescued flood plain property?



- Remove the homes
- Stabilize the site
- Create a restoration plan that includes:
 - Flood Storage
 - Water Quality Treatment
 - Passive Recreation
 - Wildlife Habitat
 - Open Space



Denville, New Jersey





WE NEED A PLAN!



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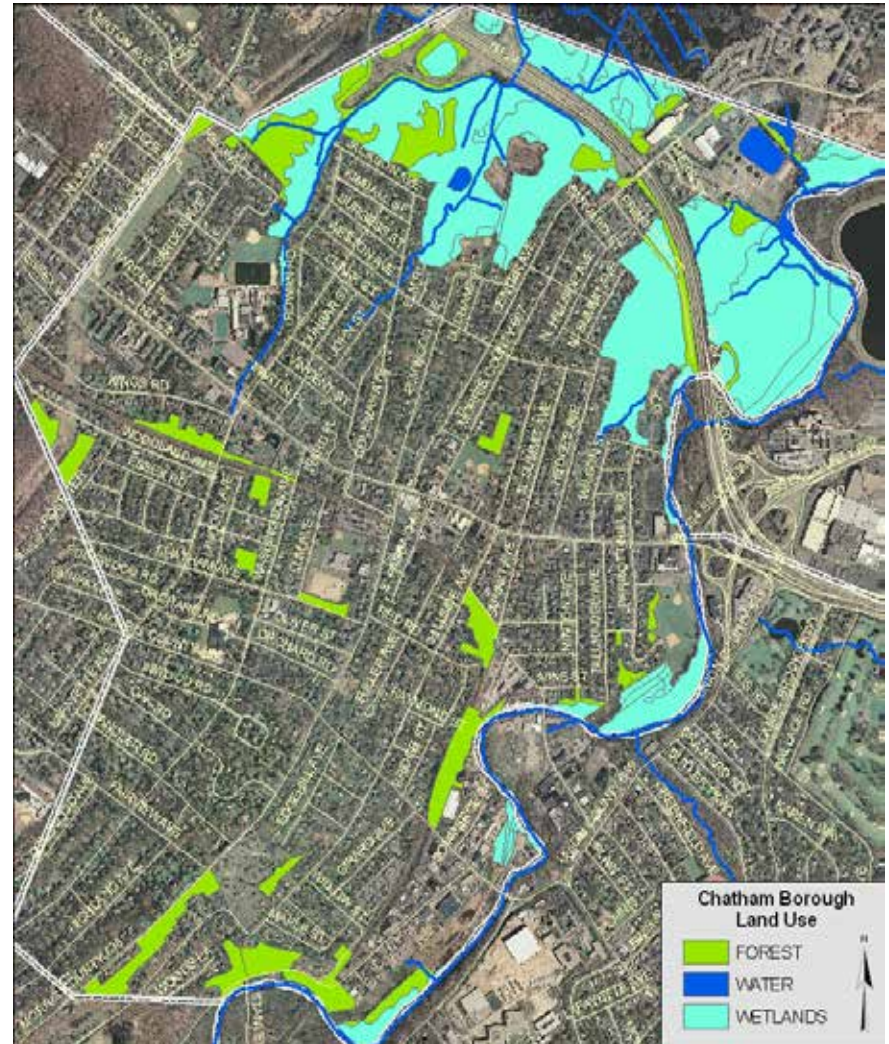




Map Flood Plain Areas



- § Valuable assets for habitat corridors and recreation
 - § 78% Urban
 - § 6% Forest (~92 acres)
 - § 1% Water
 - § 15% Wetland (~230 acres)
- § Water quality protection
 - § Passaic River is northeastern New Jersey's largest source of drinking water
- § Remaining sites are continually threatened by encroachment, over-use, concentrated wildlife populations, and invasive exotics





Make Connections!

- Identify regional open space resources
- Piece together fragmented habitats
- Take advantage of previously underutilized and disturbed sites
- Link to the larger community
- Explore green building, stormwater management and sustainable landscape design
- Create a desire for community awareness and participation





Partner Up!

- Environmental planning and regulatory compliance
- Open space preservation and habitat restoration
- Passive recreation and wildlife observation opportunities by way of trails and interpretive areas
- Restoration and enhancement of wetlands, creeks and river corridors
- Community education and stewardship





Get Community Support!





It's all about partners



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It's all about relationships





It's all about future generations



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RAHWAY RIVER FLOOD PLAIN RESTORATION MASTER PLAN



BOARDWALK OVERLOOK



TRAIL ENTRANCE





Get Funding

- Sell it to FEMA or NJ Blue Acres – flood protection, getting people out of harms way
- Sell it to NJ Green Acres – preserving open space
- Sell it to the Wetlands Mitigation Council – restoring wetlands
- Sell it to NOAA – community based restoration project (habitat)
- Sell it to NJDEP – stormwater mitigation project
- Sell it to local businesses – a feel good way to contribute to their community
- Sell it to Bergen County!!!





Build It!

Use your funding for materials and ...

- Get municipality and county to help
- Get the parks department to help
- Get community groups involved
- Get volunteers to help (especially the kids)





Maintain It!

- Everything needs maintenance
- Volunteers can help but someone needs to be responsible for keeping on top of it





FLOOD PLAIN RESTORATION STRATEGIES





Restoring Ecological Function



- § Soil erosion control
- § Wetland mitigation and restoration
- § Streambank and shoreline stabilization
- § Stream restoration
- § Habitat enhancement
- § Greenway and riparian plantings
- § Stormwater Best Management Practices (BMPs)
- § Watershed restoration





Creating Open Space & Greenways



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Developing Passive Recreation Opportunities



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Rahway River Flood Plain Restoration
Teaneck Creek Flood Plain Restoration
Hamilton Township Water Resources Plan
Thomas Jefferson Middle School
Rockaway River Flood Plain Reclamation in Denville

CASE STUDIES





Rahway River Urban Flood Plain Restoration Project



- Rahway River Watershed is highly urbanized and subject to frequent flooding.
- FEMA and NJ Green Acres purchased 4 ½ acres of developed flood plain and turned over to City.
- City relocated residents and razed existing buildings.
- Goal was to restore site to natural flood plain, integrate into existing Union County Parks greenway along the river, provide wildlife habitat, and public education/passive recreation.





Project Site



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Primary Partners



- City of Rahway - Current Property Owner
 - Grant administration
 - Significant in-kind construction contribution
- Union County Parks - Future Property Owner
 - Grant administration
 - Significant in-kind construction contribution
 - Coordinate volunteers
- NY/NJ Baykeeper - Grant Administration, Habitat Restoration, Coordinate Volunteers,
- Rahway River Association - Recruit Volunteers, Long-Term Monitoring
- TRC Omni Environmental Corp. - Design, Grant Writing, Permitting, Construction Mgt., Training and Supervising Volunteers





Additional Contributors

- Wetlands Mitigation Council - Funding for design and construction
- NOAA - Funding construction
- NJDEP - Funding construction
- Fish America Foundation - Funding construction
- Merck Foundation - Funding for construction





Riparian Flood Plain Wetlands

- Provide flood buffering and storage.
- Provide wildlife habitat.
- Natural filtering of overland runoff.
- Hydrology:
 - Overland, near surface flow, groundwater
 - Inundation from river
- Soils typically stratified alluvial drift with layers of sand, silt or clay.

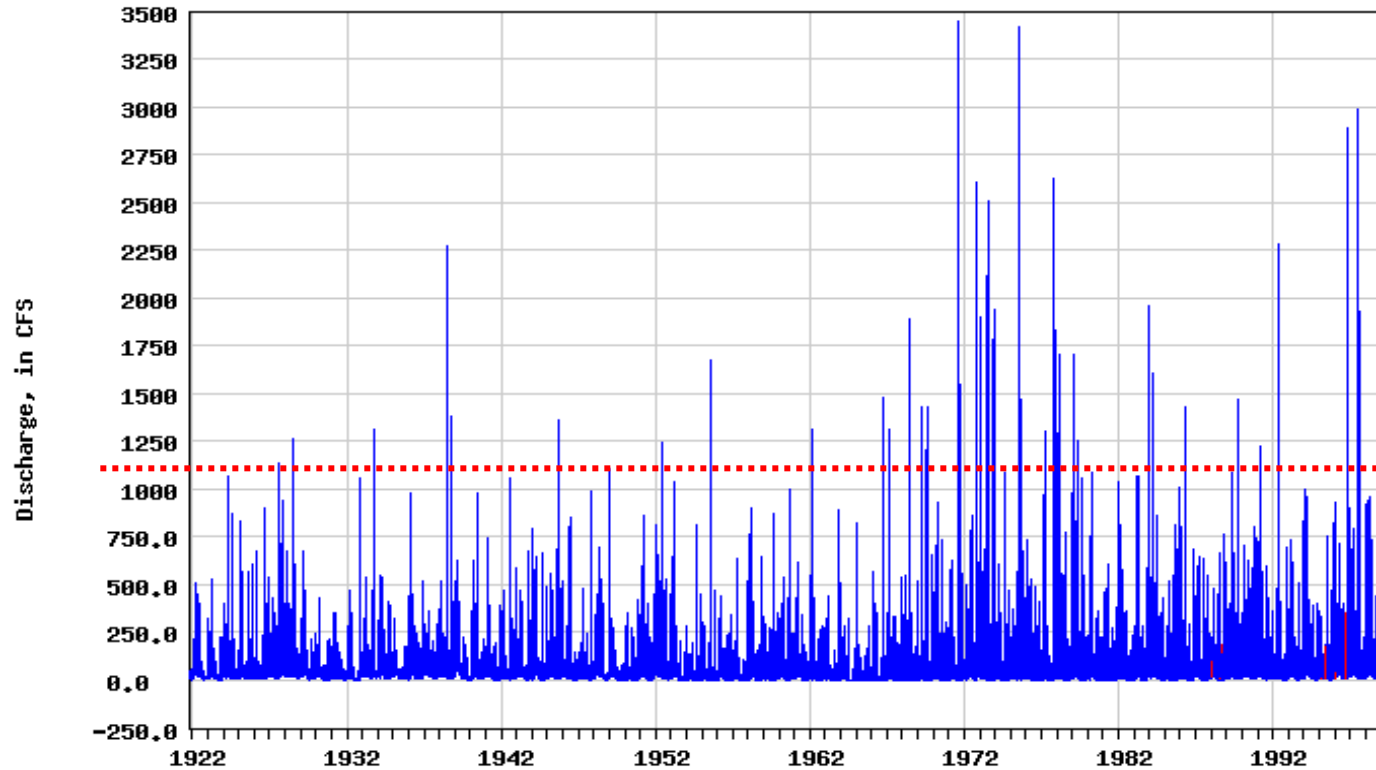




Historic River Flows



Rahway R At Rahway Nj
Station Number: 01395000

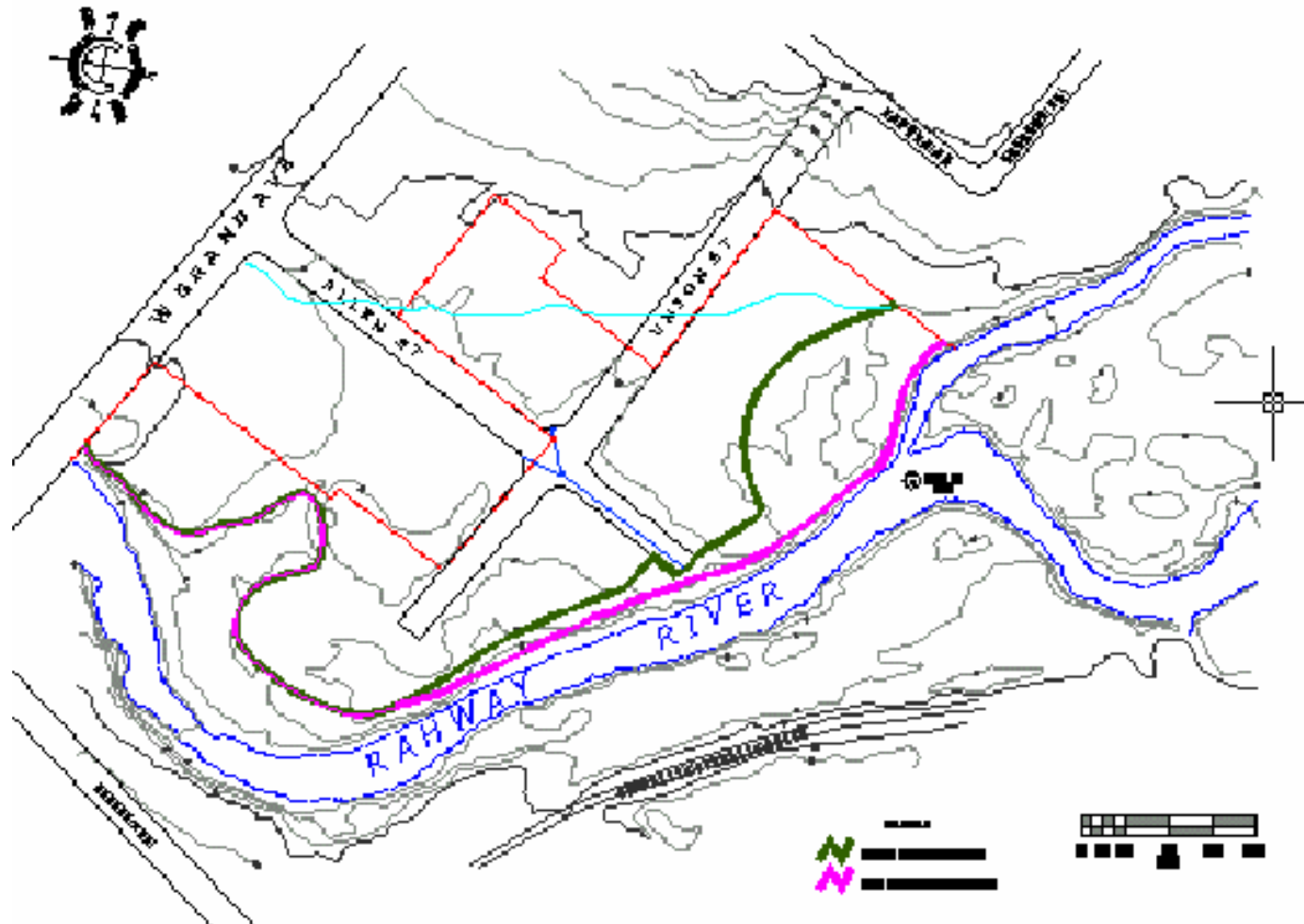


Legend: — Discharge, in CFS
— Estimated Discharge, in CFS





Altered Geology





Timeline

- 1996 Decision to pursue buyout
- 1997 Green Acres FEMA Application
- 1998 Purchase, develop vision
- 1999 Build support, begin demolition
- 2000 Write grants, remove houses
- 2001 Design, permits, more grants
- 2002 Initial construction, planting
- 2003 Complete construction, planting
- 2004 Begin Long-term monitoring







10.23.2002





10.11.2002





10.18.2002









Conclusions

- A successful flood plain reclamation project is a long, complex process
- Requires a strong partnership with “can do” attitude and strong vision
- Must be willing to be flexible and pursue diverse funding opportunities
- Doesn’t happen by itself - takes a lot of hard work





Teaneck Creek Flood Plain Wetland Restoration

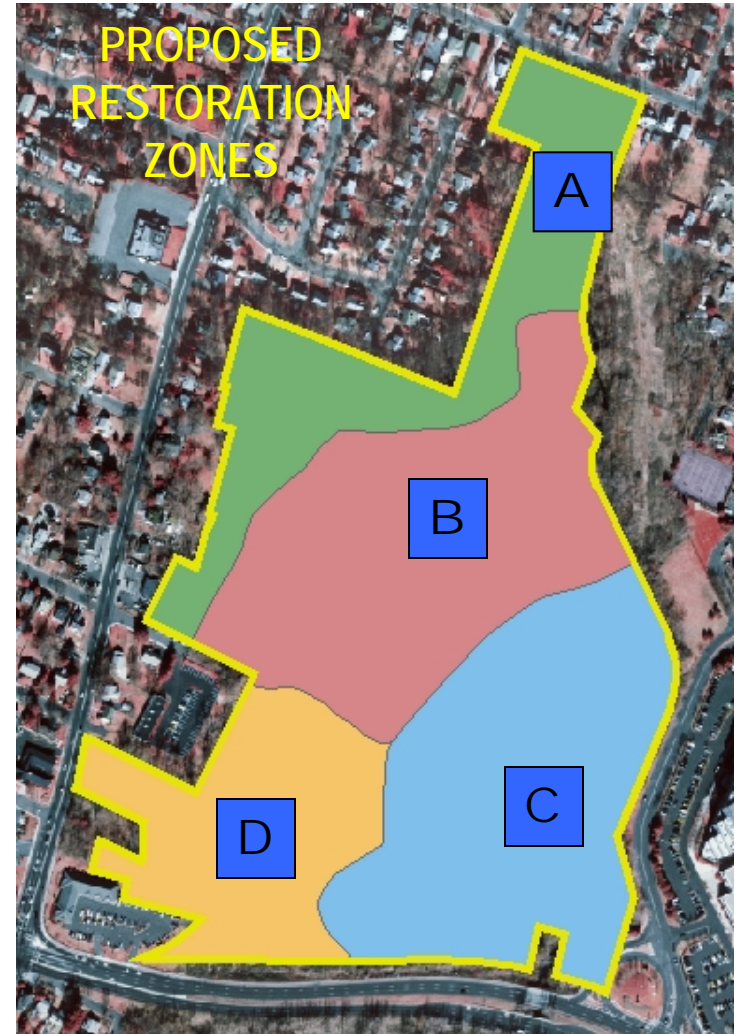


- § Partnership between Teaneck Creek Conservancy, Rutgers University Water Resources Program, and Bergen County to prepare a flood plain wetland restoration project including passive recreation, flood storage, and habitat enhancement
- § Partnered with US Fish and Wildlife Services for invasive species (*Phragmites australis* & *Polygonum cuspidatum*) management
- § Reconnected stream channel to existing flood plain wetlands
- § Managed stormwater runoff to minimize flooding

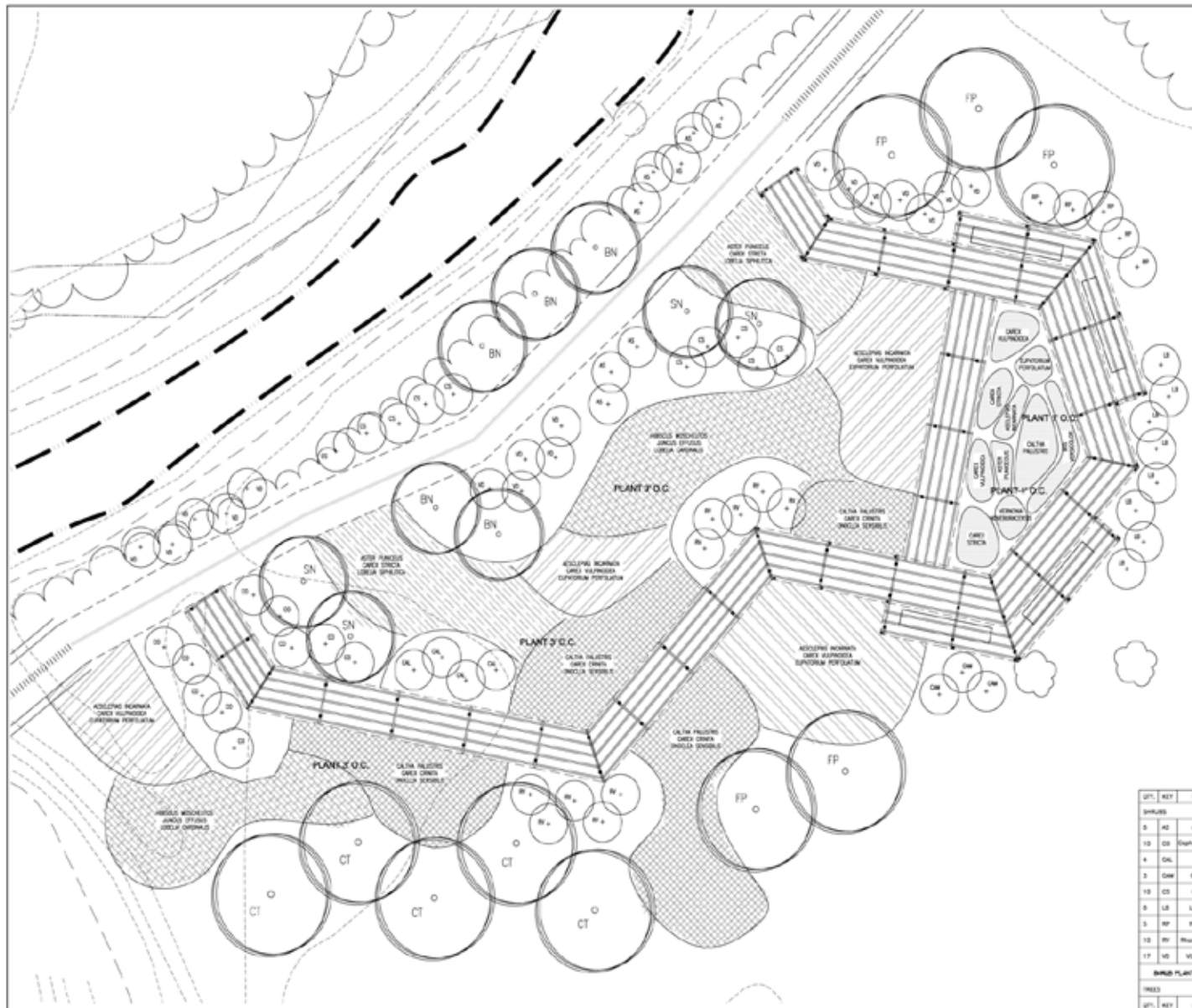




Wetlands Research & Restoration Design



1. OVERALL SCALE: 1/8" = 1' NORTH ARROW: NORTH
 2. DETAIL SCALE: 1/4" = 1' NORTH ARROW: NORTH
 3. OVERALL SCALE: 1/8" = 1' NORTH ARROW: NORTH



OUTDOOR CLASSROOM PLANTING PLAN (SCALE: 1"=10')

AFFECT # OF EACH OF USE PER ACRE

PLANT CODE	SCIENTIFIC NAME	COMMON NAME
BN	Betula nana	Dwarf Birch
SN	Salix nemoralis	Willow
FP	Fragaria virginiana	Wild Strawberry
CT	Cornus stricta	Spicebush
UL	Ulmus americana	American Elm
LA	Lonicera caerulea	Blue Honeysuckle
ST	Stachys palustris	Water Thyme
TR	Trifolium pratense	Red Clover
VI	Viburnum dentatum	Blackhaw
RY	Rhus typhina	Cockspur Hawthorn
MS	Morus nigra	Black Mulberry

SEED MIX 1 - WETLAND MEADOW

HERBACEOUS SPECIES PLANT ZONE

PLANT CODE	SCIENTIFIC NAME	COMMON NAME
SN	Salix nemoralis	Willow
CT	Cornus stricta	Spicebush
FP	Fragaria virginiana	Wild Strawberry
UL	Ulmus americana	American Elm
LA	Lonicera caerulea	Blue Honeysuckle
ST	Stachys palustris	Water Thyme
TR	Trifolium pratense	Red Clover
VI	Viburnum dentatum	Blackhaw
RY	Rhus typhina	Cockspur Hawthorn
MS	Morus nigra	Black Mulberry

HERBACEOUS SPECIES

QTY	KEY	BOTANICAL NAME	COMMON NAME	SIZE
10	AC	Nyssa sylvatica	Smooth Alder	10' - 12', p. # 200
10	DB	Daphniphyllum occidentale	Butterbush	10' - 12', p. # 200
4	DL	Calceola uniflora	Small Paperbush	10' - 12', p. # 200
3	DM	Cornus amomum	Silly Spicebush	10' - 12', p. # 200
10	CS	Cornus stricta	Spicebush	10' - 12', p. # 200
5	LB	Ulmus laevis	European Elm	10' - 12', p. # 200
5	RF	Rosa palustris	Swamp Rose	10' - 12', p. # 200
10	RY	Rhus typhina	Cockspur Hawthorn	10' - 12', p. # 200
17	MS	Morus nigra	Black Mulberry	10' - 12', p. # 200

SHRUB PLANTING AREAS TO BE FURNISHED WITH 1" SP. BRONZE HARDWOOD MULCH.

QTY	KEY	BOTANICAL NAME	COMMON NAME	SIZE
4	SR	Salix rigida	Slack Willow	17' - 20' x 8"
5	BN	Betula nigra	Sweet Birch	8' - 10' x 8" x 8"
3	CT	Cornus stricta	Spicebush	8' - 10' x 8" x 8"
5	FP	Fragaria virginiana	Wild Strawberry	17' - 20' x 8"

REVISIONS
 NO. DATE
 1. 06/20/20

DATA PROVIDED BY:
 DESIGN COUNTY DEPARTMENT OF PUBLIC WORKS
 1000 N. 1000 W. ST.
 MADISON, WI 53707

OUTDOOR CLASSROOM PLANTING PLAN

TEANECK CREEK CONSERVANCY

TRC GMM ENVIRONMENTAL CORPORATION
 11111 WALKER DRIVE
 PHOENIX, ARIZONA 85024
 (602) 954-0021
 www.trcinc.com

4/20/20 1. MADISON, WI, USA
 10' x 10' x 10'
 Sheet 28 of 28
 Date: JUN 20, 2020













Hamilton Township (Mercer County)



In June 2011, the Rutgers Cooperative Extension (RCE) Water Resources Program partnered with Hamilton Township (Mercer County) to evaluate watershed and stormwater management issues and to develop recommendations for improving and protecting water resources in the community. The partners are working together to complete a Township-wide evaluation of water resource management needs and to set forth priorities and recommendations for actions needed to address hydrologic issues.





Hamilton Township (Mercer County)



The recommended actions will support a series of goals established for Hamilton Township in its ongoing efforts to address water resources. These goals include:

- Engage the community in water resource protection
- Manage water quality
- Minimize localized flooding
- Implement Phase II stormwater controls
- Improve stormwater facility maintenance



SOURCE: trentonian.com September 2011





Hamilton Township (Mercer County)



- Development of hydrologic model
- Inventory and assessment of stormwater management basins
- Development of comprehensive GIS database of stormwater infrastructure
- Prepare a stormwater mitigation plan
- Complete an impervious cover analysis
- Develop site suitability analysis (for stormwater BMPs)
- Conduct riparian investigations with Environmental Commission
- Develop and implement property owner education program
- Complete a second rain garden demonstration project
- Continue stormwater basin pilot maintenance program
- Implement stormwater basin retrofits and repairs



Teaneck Creek Riparian Restoration

Project Location:

Thomas Jefferson Middle School
Teaneck, NJ
Partner: Teaneck Board of Education





Project Summary



- § Partnered with Teaneck BOE to complete stabilization and restoration along 100 feet of stream at Thomas Jefferson Middle School
- § Completed restoration design plans and permits to reestablish a native “Floodplain Forest” riparian buffer
- § Successfully installed in summer 2008
- § Partnered with US Fish and Wildlife Services for invasive species (*Japanese Knotweed*) management
- § Required a combined engineering and landscape design approach





QTY	SIZE	SCIENTIFIC NAME	COMMON NAME	DBH
SHRUBS				
17	8A	<i>Azalea macrodonum</i>	Black Chokeberry	12" - 18" DBH
12	5A	<i>Cornus alternifolia</i>	Spice Shrub	12" - 18" DBH
10	13A	<i>Cornus amomum</i>	Spice Shrub	12" - 18" DBH
10	13	<i>Cornus sericea</i>	Redstart Dogwood	12" - 18" DBH
10	8B	<i>Ilex verticillata</i>	Winterberry Holly	12" - 18" DBH
12	10	<i>Viburnum prunifolium</i>	Blackberry Viburnum	12" - 18" DBH
11	11	<i>Viburnum trilobum</i>	Downy Woodpecker Viburnum	12" - 18" DBH
17	10	<i>Viburnum acerifolium</i>	Blackberry Viburnum	12" - 18" DBH

QTY	SIZE	SCIENTIFIC NAME	COMMON NAME	DBH
TREES				
17	4C	<i>Amelanchier canadensis</i>	Shadbush	6" - 8" DBH
8	8B	<i>Betula nigra</i>	Black Birch	6" - 8" DBH
10	8B	<i>Betula papyrifera</i>	Gray Birch	6" - 8" DBH
4	10	<i>Celtis occidentalis</i>	Hickory	12" - 18" DBH
2	10	<i>Fragaria virginiana</i>	Strawberry	12" - 18" DBH
6	10	<i>Fraxinus americana</i>	White Ash	12" - 18" DBH
6	10	<i>Quercus bicolor</i>	Swamp White Oak	12" - 18" DBH
2	10	<i>Betula nigra</i>	Black Birch	6" - 8" DBH
4	10	<i>Thuja occidentalis</i>	Eastern White Pine	6" - 8" DBH
4	10	<i>Viburnum acerifolium</i>	Blackberry Viburnum	6" - 8" DBH

PLANTING SCHEDULE

QTY	SIZE	SCIENTIFIC NAME	COMMON NAME
17	8A	<i>Azalea macrodonum</i>	Black Chokeberry
12	5A	<i>Cornus alternifolia</i>	Spice Shrub
10	13A	<i>Cornus amomum</i>	Spice Shrub
10	13	<i>Cornus sericea</i>	Redstart Dogwood
10	8B	<i>Ilex verticillata</i>	Winterberry Holly
12	10	<i>Viburnum prunifolium</i>	Blackberry Viburnum
11	11	<i>Viburnum trilobum</i>	Downy Woodpecker Viburnum
17	10	<i>Viburnum acerifolium</i>	Blackberry Viburnum

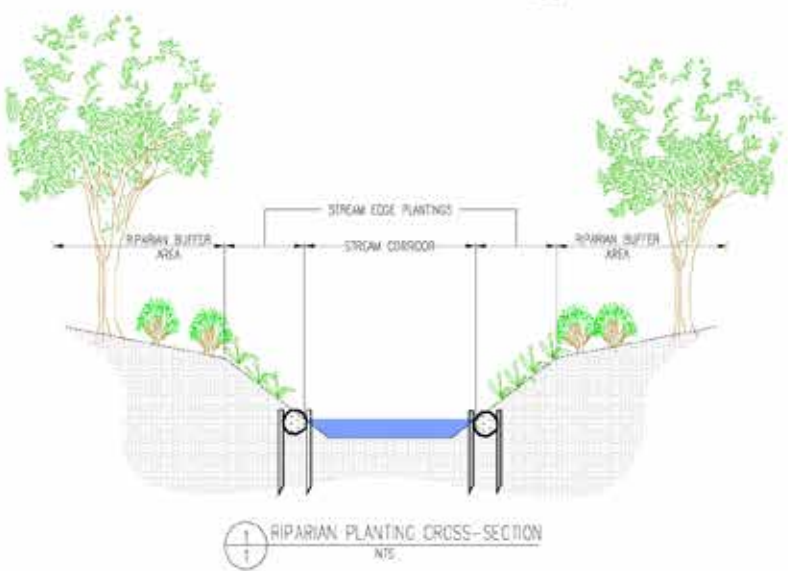
QTY	SCIENTIFIC NAME	COMMON NAME	DBH	DEPTH
400	<i>Solidago canadensis</i>	Blue Wild Yam	2" - 4"	18"
400	<i>Galium aparine</i>	Wormwood	2" - 4"	18"
400	<i>Galium aparine</i>	Wormwood	2" - 4"	18"
400	<i>Galium aparine</i>	Wormwood	2" - 4"	18"
400	<i>Galium aparine</i>	Wormwood	2" - 4"	18"

TOTAL 17' DB WITH 3 FT OF WOODS ONE

QTY	SCIENTIFIC NAME	COMMON NAME
100	<i>Asplenium platyneuron</i>	Rocky Mountain
100	<i>Asplenium platyneuron</i>	Rocky Mountain
100	<i>Asplenium platyneuron</i>	Rocky Mountain
100	<i>Asplenium platyneuron</i>	Rocky Mountain
100	<i>Asplenium platyneuron</i>	Rocky Mountain

1" C STAKES FOR ROCK STABILIZATION WEIR

QTY	SCIENTIFIC NAME	COMMON NAME	DBH
100	<i>Asplenium platyneuron</i>	Rocky Mountain	1" - 2"
100	<i>Asplenium platyneuron</i>	Rocky Mountain	1" - 2"
100	<i>Asplenium platyneuron</i>	Rocky Mountain	1" - 2"
100	<i>Asplenium platyneuron</i>	Rocky Mountain	1" - 2"
100	<i>Asplenium platyneuron</i>	Rocky Mountain	1" - 2"



**TEANECK CREEK RESTORATION
PLANTING PLAN**

THOMAS JEFFERSON MIDDLE SCHOOL
Book 3025, Lot 1
Teaneck Township
Bergen County, New Jersey

TRC Engineers Inc.
CORPORATE OFFICE
171 MILLER STREET TEL: 973-966-6666
MILWAUKEE, WI 53219 FAX: 973-966-6617

DATE: 02/12/2009
SCALE: 1" = 30'
DATE: 02/12/2009
SHEET NO. 1 OF 1



Thomas Jefferson Middle School
Fycke Lane, Teaneck, NJ





Thomas Jefferson Middle School
Fycke Lane, Teaneck, NJ





Thomas Jefferson Middle School
Fycke Lane, Teaneck, NJ





Denville's Rockaway River Flood Plain Restoration



“Owners of 11 homes on Denville’s Riverside Drive have finalized agreements to sell their houses to the township, which will demolish the structures under a program administered by Morris County. The vacant land will be permanently preserved as open space...”



“Township officials have met with members of the Rutgers Cooperative Extension Service, who are helping plan the new community gardens with plants that "absorb the water" and serve as a "buffer" to "mitigate future flooding...”



(nj.com, 2012)



Flood Plain Restoration Project Existing Conditions

Township of Denville, New Jersey



PROJECT AREA



The existing properties currently consist of single-family residential structures with several outbuildings, playsets, and typical suburban landscape vegetation. When these properties are cleared, effort should be given to protect large existing healthy trees (mainly oak and maple) adjacent to the Rockaway River as well as any healthy vegetation along perimeter property lines that will help to buffer the new open space areas from adjacent residential properties.



Flood Plain Restoration Project Proposed Conceptual Plans

Township of Denville, New Jersey



In March, the Morris County freeholders set aside \$16 million from the county's open-space fund to buy flood-prone residential properties as it established its flood mitigation program. The program is now moving forward with the 11 Denville purchases finalized and 66 more approved and in negotiations in Lincoln Park, Parsippany, Pequannock and Riverdale. "It's impressive how responsive the towns have been on behalf of the residents," said Jennifer McCulloch, coordinator of the program. "We've already encumbered half the funding," she said, reporting that \$7.5 million of the \$16 million has been allocated. Meanwhile, the Federal Emergency Management Agency's commitment to home purchases as part of the program presently totals \$51.18 million, according to data provided by McCulloch. "We still have applications coming in," all from Irene, she added.

Township officials have met with members of the Rutgers Cooperative Extension Service, who are helping plan the new community gardens with plants that "absorb the water" and serve as a "buffer" to "mitigate future flooding," Ward said.

Ward said the township will also be seeking input from neighbors on plans for the vacant land, which might also include nature trails.

Ben-Horowitz, The Star-Ledger (December 16, 2012)

PROJECT DESCRIPTION

With the purchase of several flood prone properties located in the floodplain of the Rockaway River, the Township of Denville has the opportunity to enhance open space resources available for its residents and protect the community from future flood damage. The residential properties purchased along Riverside Drive are located within the 100-year flood plain and recently suffered significant damage from flooding. When the Township takes possession of these properties, existing structures will be demolished and removed and the remaining landscape will become part of the open space infrastructure of the Township. This preliminary concept plan for the end uses at each of these properties will enhance the community's ability to appreciate and enjoy the Rockaway River while improving flood storage. Once demolition and clearing of the properties is complete, a series of improvements can be made that will improve access to the River as a recreational resource while improving flood storage. The plan shown here propose several improvements including:

- Canoe/kayak launch access to the Rockaway River
- A series of rain gardens to provide stormwater management & increase flood storage
- A small porous pavement parking area for visitors with canoes and kayaks
- Seating
- Planting of native vegetation

PLANT LIST

Key	Common Name	Botanical Name	Description/Notes
PR	P.J.M. Rhododendron	<i>Rhododendron x WPA</i>	Evergreen foliage, showy pink flowers early spring
BN	River Birch	<i>Betula nigra</i>	Ornamental bark year round
CF	Flowering Dogwood	<i>Cornus florida</i>	Fed fall fruit, white blooms in early spring
IC	Inkberry Holly	<i>Ilex glabra</i>	Evergreen leaves and dark fruit
PS	Creeping Phlox	<i>Phlox stolonifera</i>	Dense-growing groundcover with pink or purple spring blooms
SS	Little Blue Stem	<i>Schizachyrium scoparium</i>	Blue tinted grass blades in spring that turn red in fall
AT	Butterfly Milkweed	<i>Asclepias tuberosa</i>	Yellow/orange blooms early summer through fall, attracts hummingbirds, bees, butterflies & other insects
HV	Witch-hazel	<i>Hemamelis virginiana</i>	Yellow/red flowers in the winter
MV	Sweetbay Magnolia	<i>Magnolia virginiana</i>	Evergreen foliage, fragrant white summer blooms

RIVERSIDE DRIVE & SNYDER AVENUE



ROCKAWAY RIVER





Questions?

Rutgers Cooperative Extension Water Resources Program

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