PLANNING AND IMPLEMENTING GREEN STORMWATER INFRASTRUCTURE

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APA-PA Conference (Allentown, PA)
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MELIORA DESIGN
Civil, Water Resources, and Structural Engineering

BRANDYWINE CONSERVANCY

OUTLINE

- Water Cycle
- CSOs
- Philadelphia
  - Green City, Clean Waters
  - Planning process
  - GSI Examples
- What's happening in other cities
- New Municipal Stormwater Regulations
- Regulatory Tools for GSI
- GSI Implementation in Small Municipalities
- Incentive Program for GSI

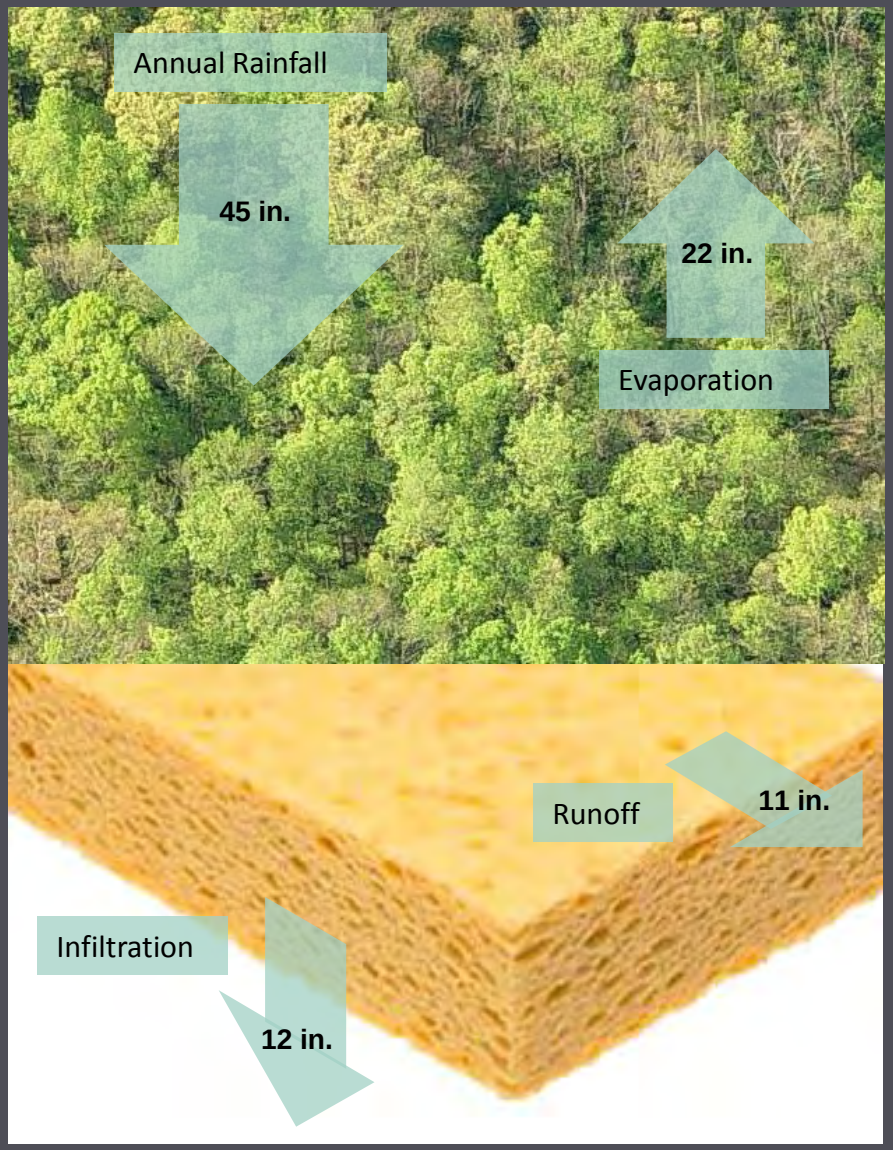
Meliora Design

WHO WE ARE

- Civil engineering
- Specialize in Sustainable Site Design and Stormwater Management
- Planning
- Advocacy
- Certified Women-owned Business Enterprise (WBE)

Natural Water Balance

Philadelphia, PA



BRANDYWINE CONSERVANCY

MELIORA DESIGN
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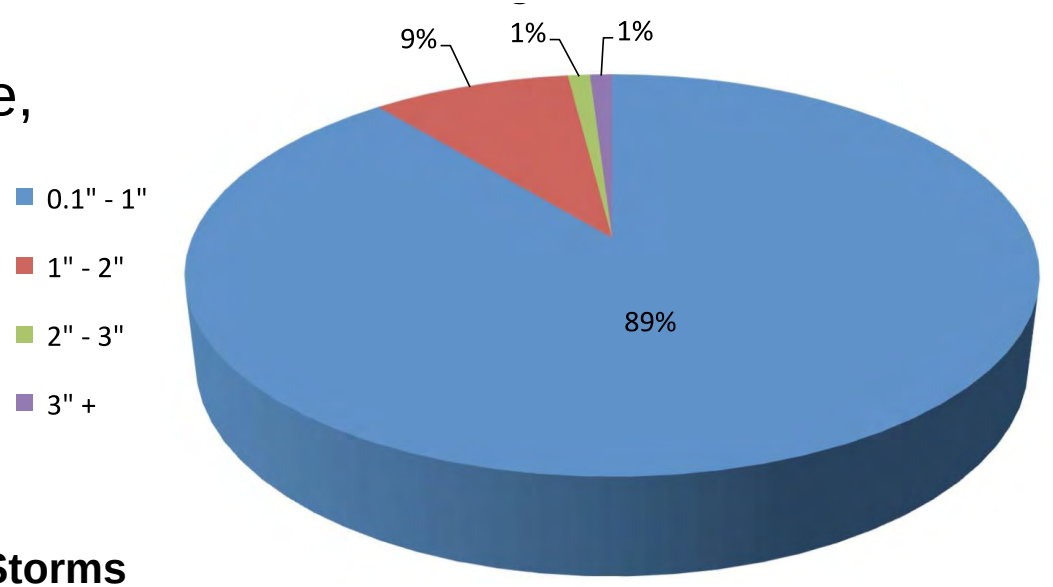
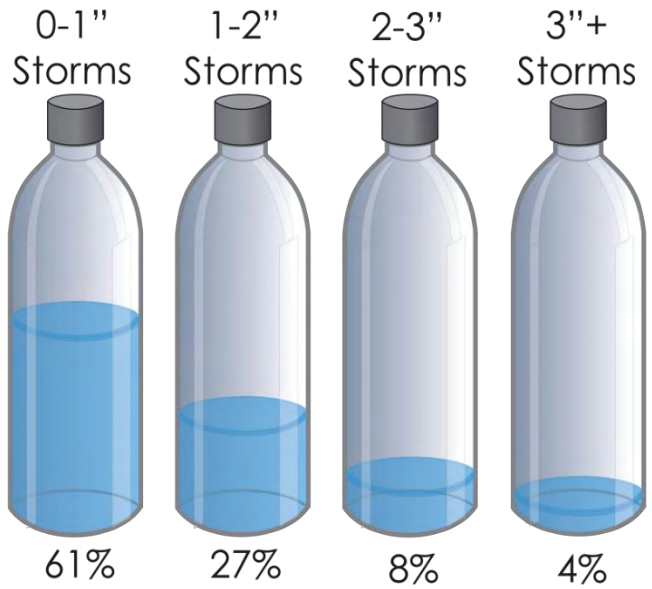
RAINFALL: 45” per year on average

Frequency: Most of the time, it rains 1 inch or less



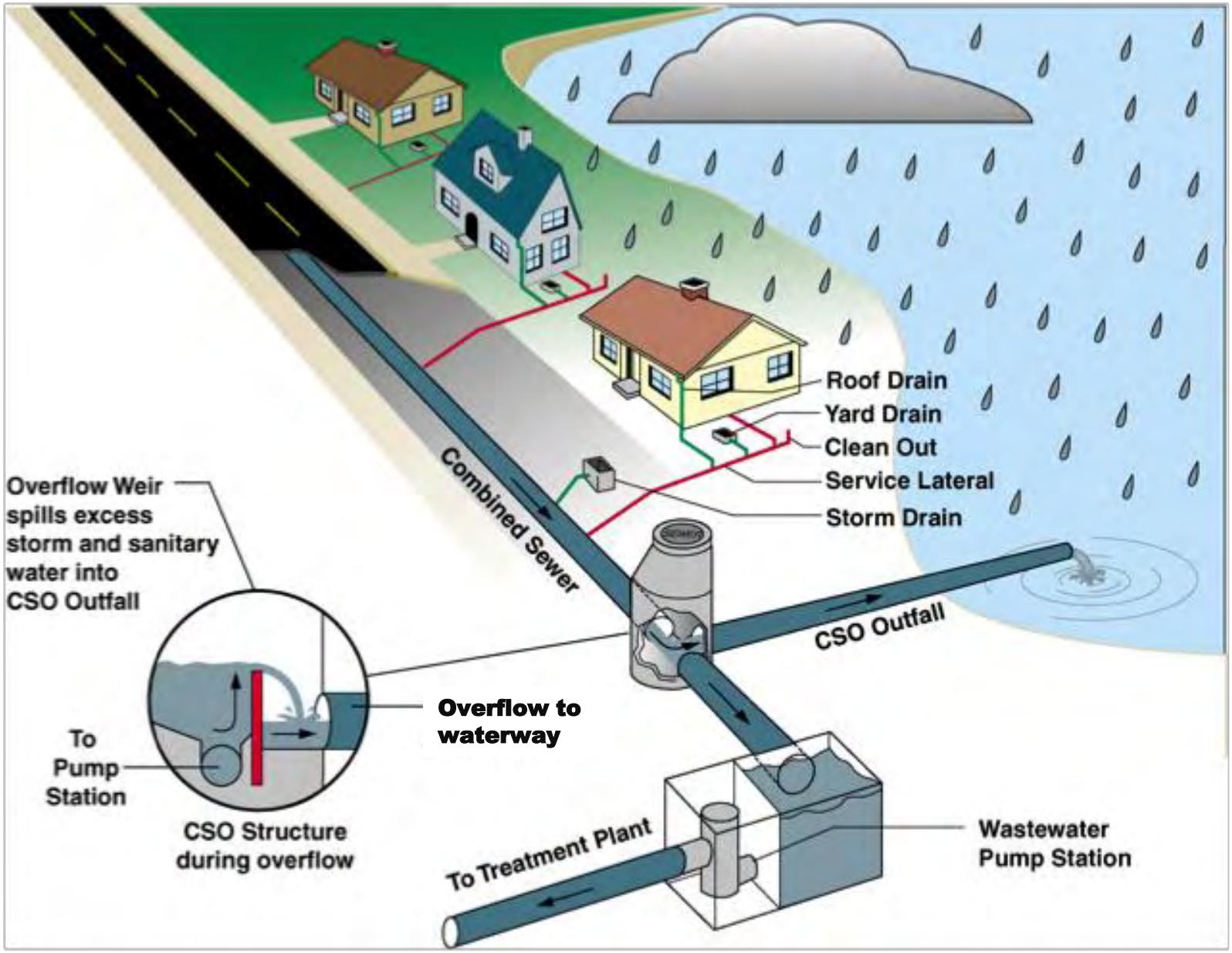
Annual Percentages of Volume from Storms



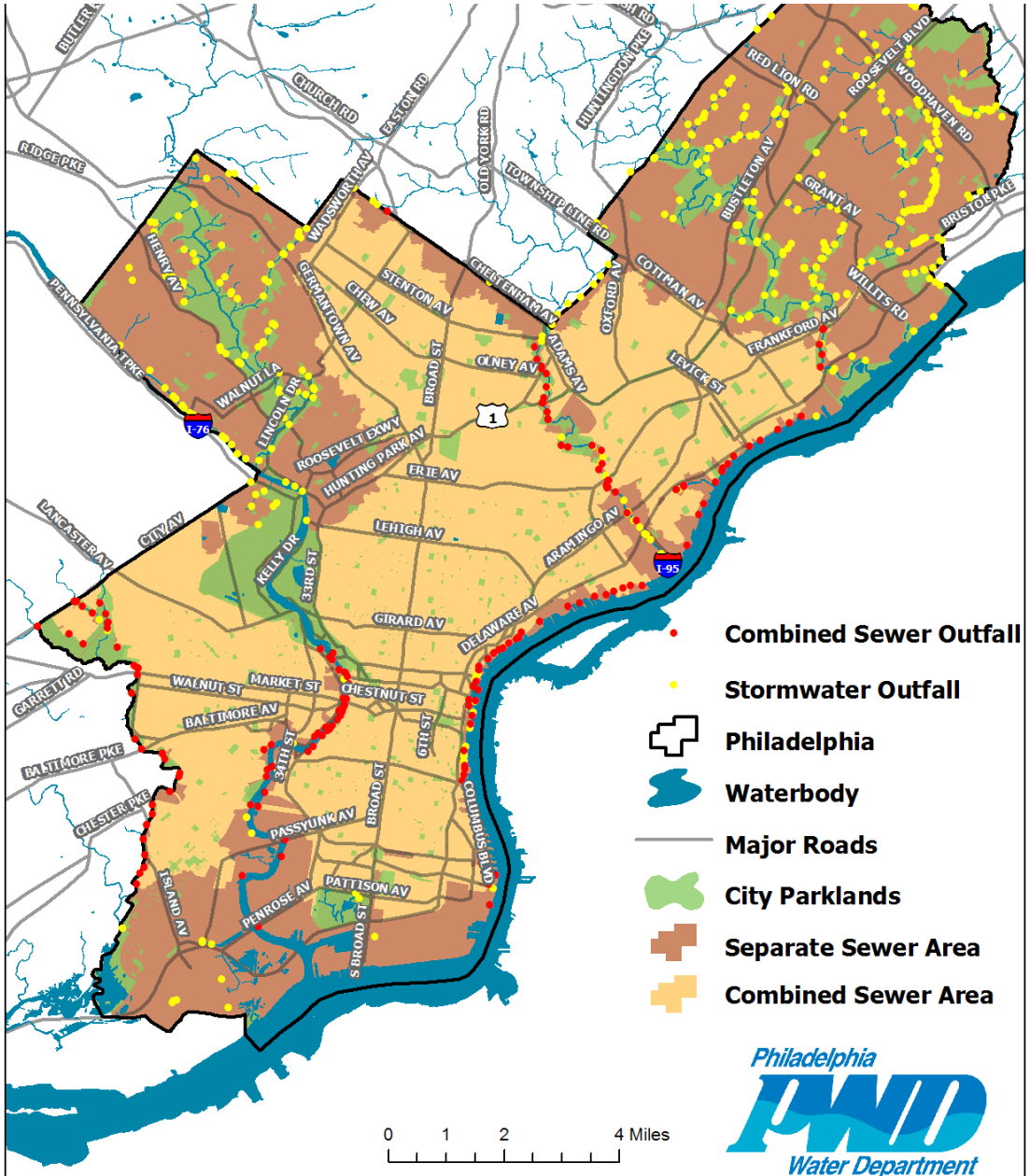
Small storms comprise most of the annual *Volume* of rainfall.

Philadelphia

Combined Sewer Systems (CSS)



Combined Sewer Overflows (CSO)



Green City Clean Waters

The City of Philadelphia's Program for Combined Sewer Overflow Control

A Long Term Control Plan Update

- Public Green Stormwater Infrastructure Projects
- Incentivized Stormwater Infrastructure Projects
- (Re)Development Green Stormwater Infrastructure

5 Down, 20 to Go: Celebrating 5 Years Neighborhoods

As of June 1, 2016 the Green City, Clean Waters program has established 837.7 Greened Acres, exceeding the five-year regulatory target and reducing pollution from stormwater runoff and combined sewer overflows by more than 1.5 billion gallons annually.

LiveSlides web content

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Start the presentation.

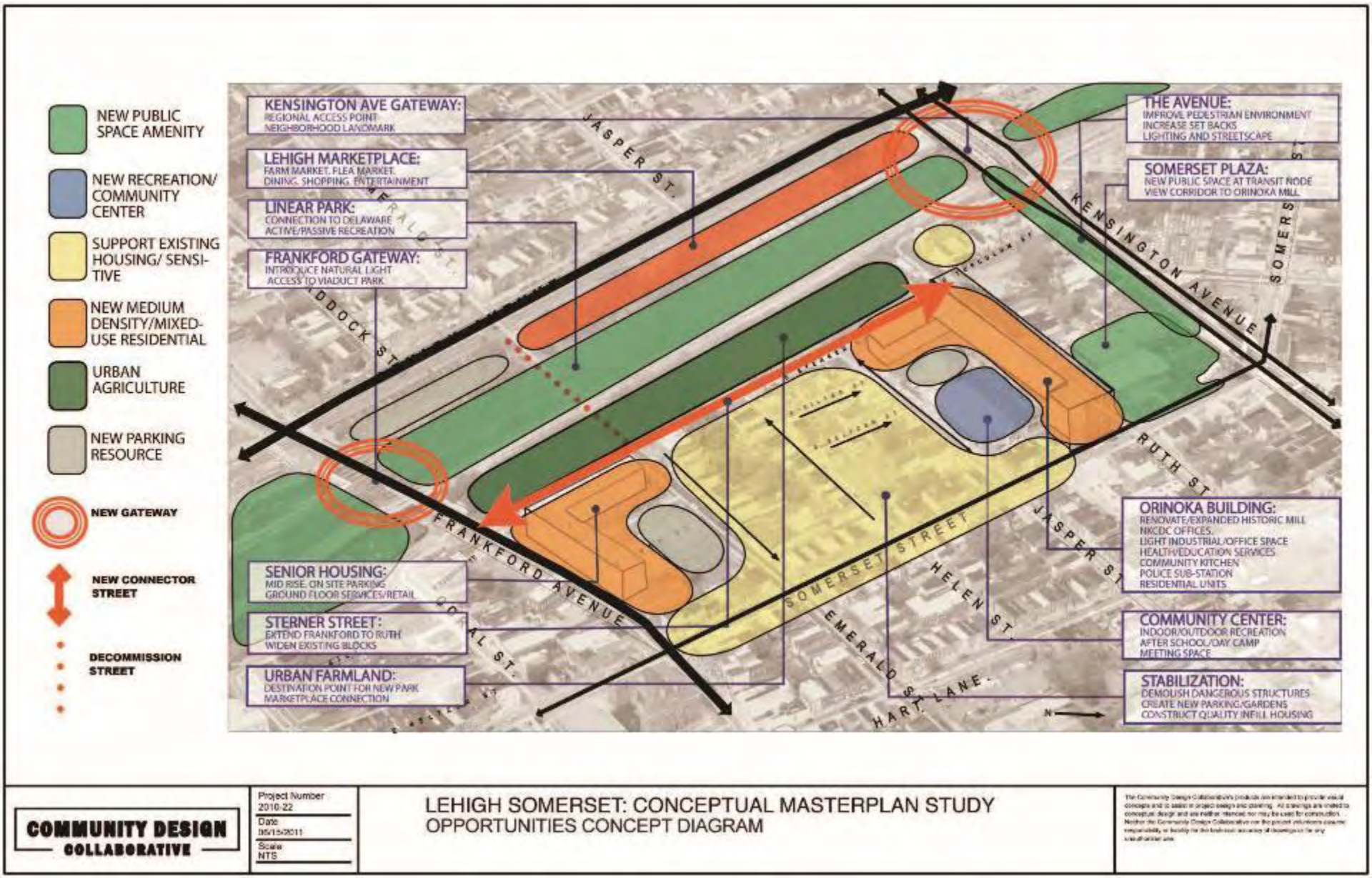
Planning for Success

- Mapping
- Site Analysis
- Capital Projects are an opportunity for GI:
  - Sidewalk improvements
  - Intersection improvements
  - Water and sewer line work
- All municipal and public projects maximize GI (schools, parks, streets, etc.) are opportunities
- Public involvement early on
- Project tracking
- Maintenance Plans & Training

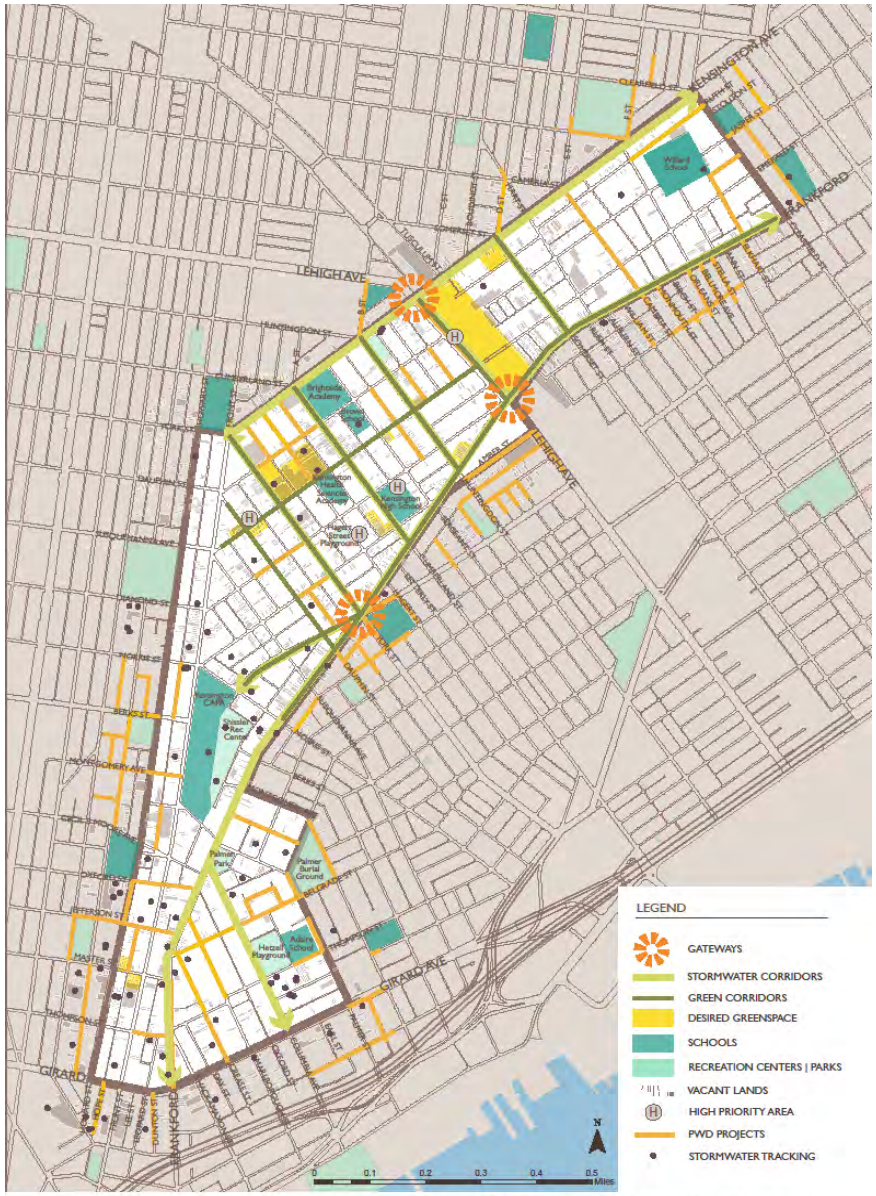
GIS BASEMAP LAYERS

- **Conceptual Work**
  - **GSI SMP Footprint Concept**
  - **GSI Drainage Area Concept**
- Planning Group Layers
  - Project Opportunity Parcels in CSO
  - Planning Study Areas
- Existing Projects
  - CAPIT Projects
  - SW Permit Tracking
  - GSI Project Areas
    - Green Stormwater Infrastructure
    - Green Stormwater Infrastructure Drainage Area
- PWD Infrastructure
  - Sewer
    - Combined System (CSO)
      - Inlet
      - Manhole
      - Sewer Inlet Pipe
      - Sewer
      - Waste Water Vent Pipes
    - Separate & Green System (SS)
      - Stormwater Manholes
      - Stormwater Inlets
      - Stormwater
      - Stormwater Inlet Pipes
      - Stormwater Vent Pipes
  - Water
    - Fire Hydrant
    - Water Valves
    - Water
    - Water Service Line Pipes
    - Water Hydrant Line Pipes
- Environmental
  - Flow Network
    - Ridges
    - Nodes
    - Valleys
    - Streets
  - Impervious and Sewersheds
  - Philadelphia Major Watersheds
  - Sewersheds
  - Modelsheds
- Reference
  - Neighborhoods
  - Council Districts 2016
  - Land Use
  - Philadelphia Planning Districts
  - Philadelphia Parks & Recreation
  - Philadelphia City Limits
- Base Layers
  - Streets
  - PWD Parcels
  - Topographic 2' Contours
  - Curbs
  - Hydrology Centerline
  - Hydrology Polygon
  - Aerial Imagery 2012

PREVIOUS STUDIES



PREVIOUS STUDIES



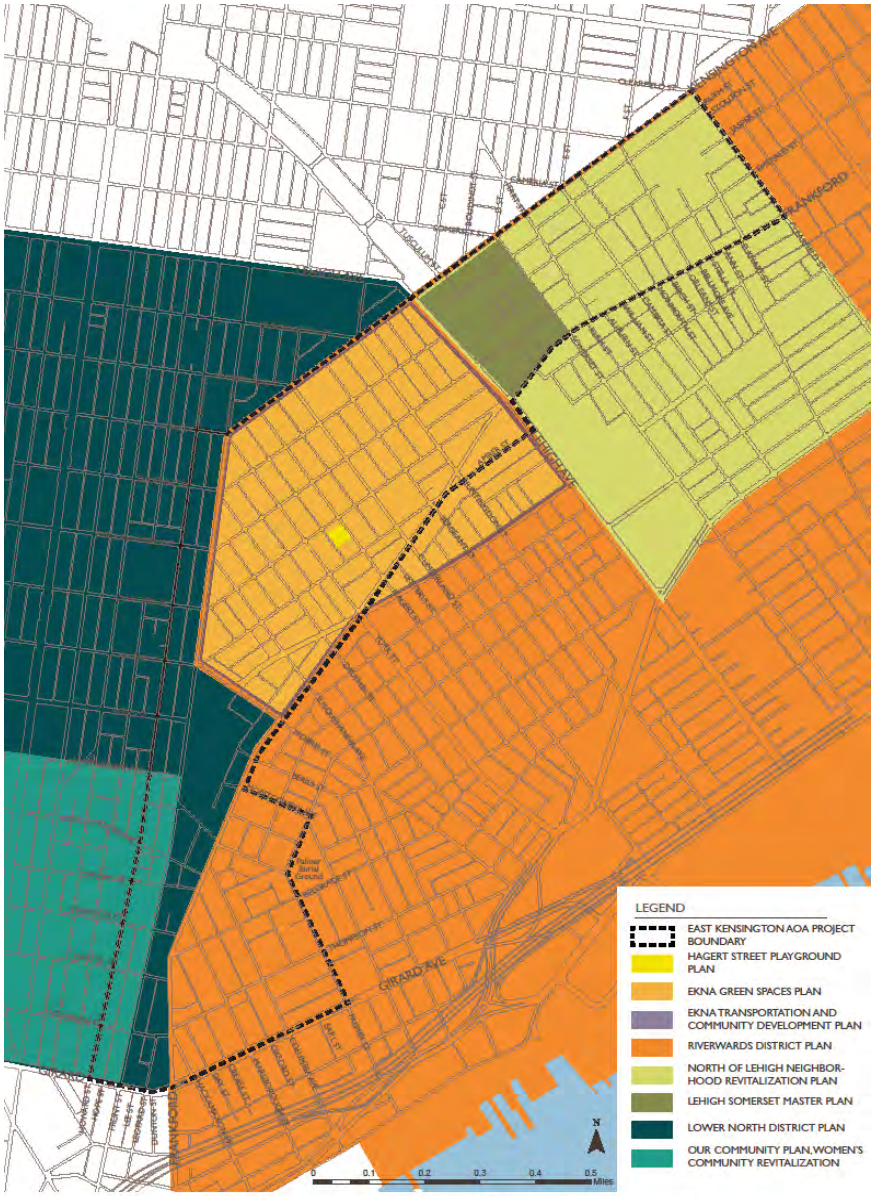
PHILADELPHIA WATER

EAST KENSINGTON | STORMWATER AREA OF OPPORTUNITY ANALYSIS

TASK 1.1 NEIGHBORHOOD PLANNING INITIATIVES

PHS Meliora Design

DATE: 07 AUGUST 2015



PHILADELPHIA WATER

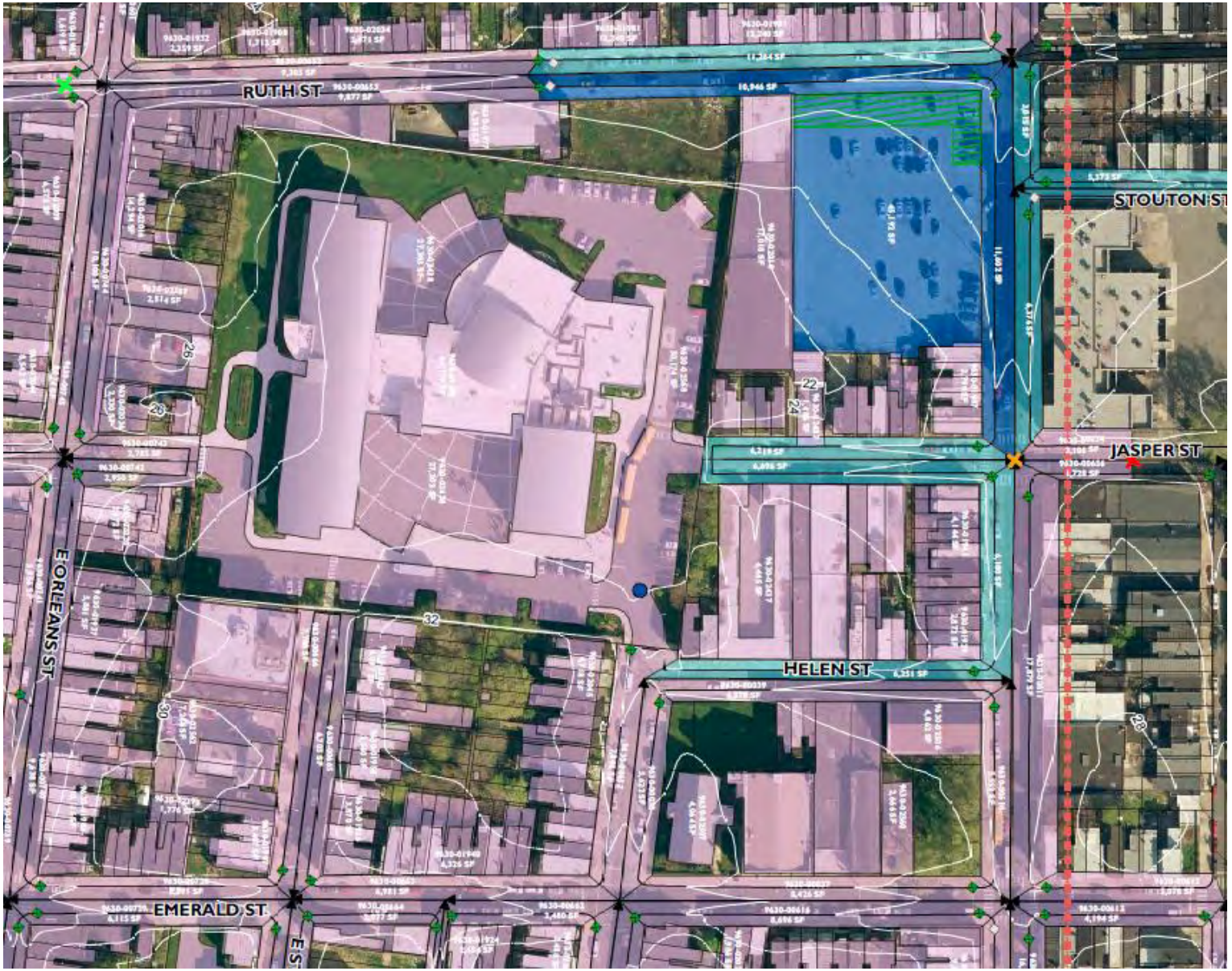
EAST KENSINGTON | STORMWATER AREA OF OPPORTUNITY ANALYSIS

TASK 1.1 NEIGHBORHOOD PLANNING INITIATIVES BOUNDARIES

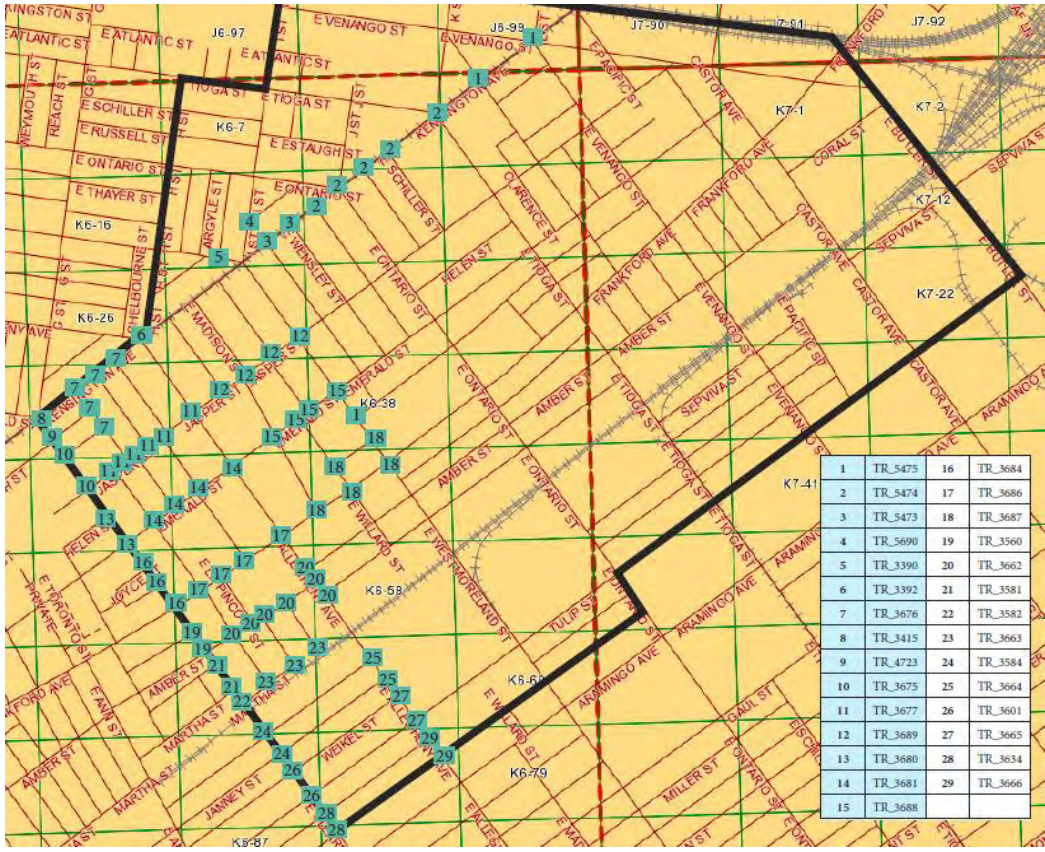
PHS Meliora Design

DATE: 07 AUGUST 2015

DRAINAGE AREA MAPPING



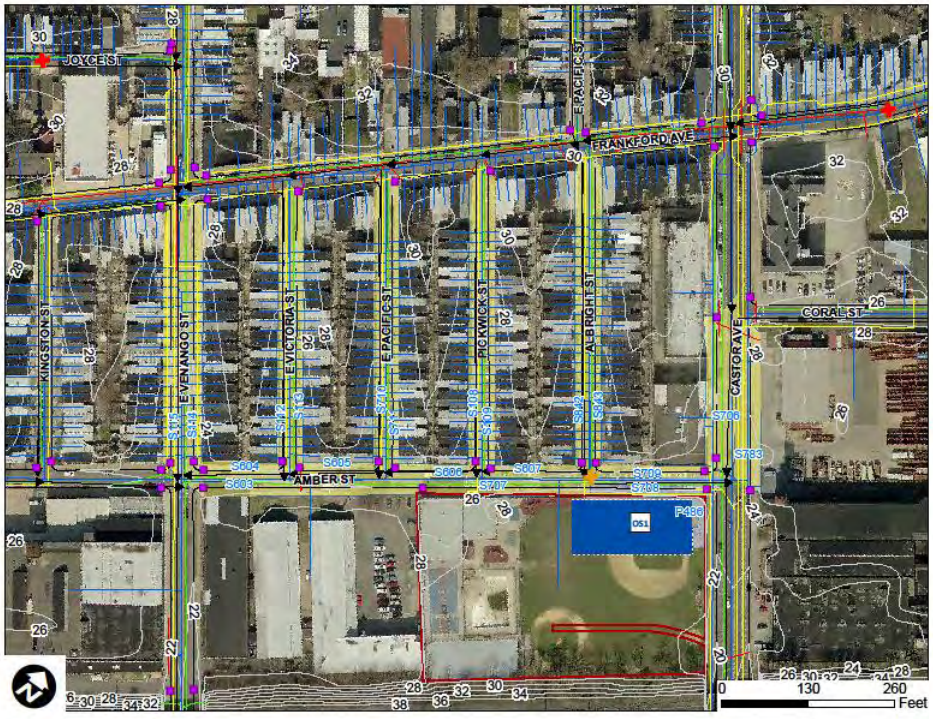
UTILITY MAPPING

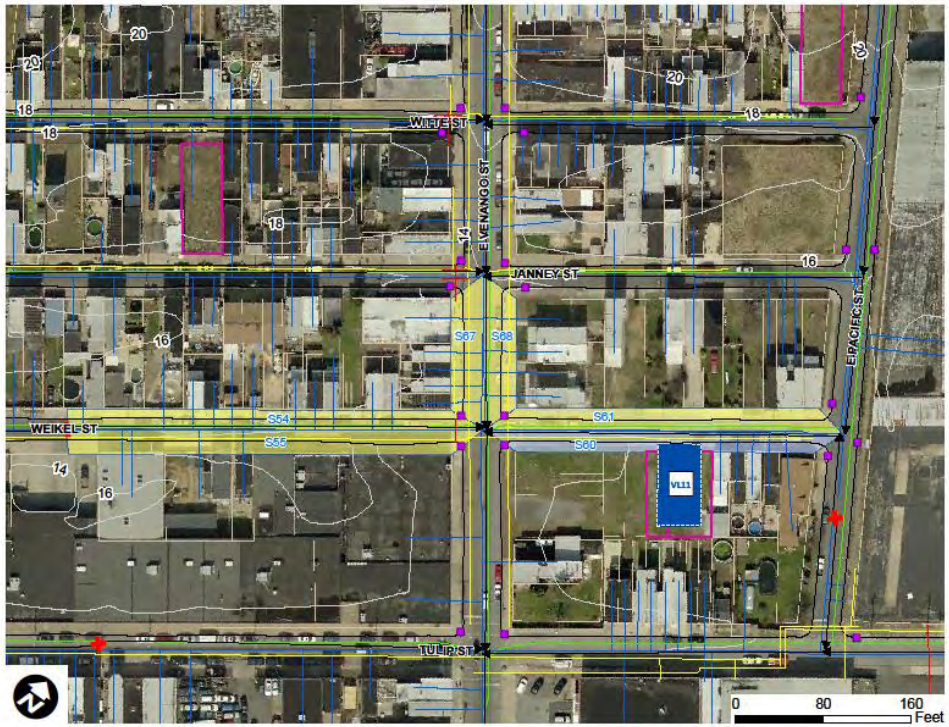


1	TR_5475	16	TR_3684
2	TR_5474	17	TR_3686
3	TR_5473	18	TR_3687
4	TR_5690	19	TR_3560
5	TR_3390	20	TR_3662
6	TR_3392	21	TR_3581
7	TR_3676	22	TR_3582
8	TR_3415	23	TR_3663
9	TR_4723	24	TR_3584
10	TR_3675	25	TR_3664
11	TR_3677	26	TR_3601
12	TR_3689	27	TR_3665
13	TR_3680	28	TR_3634
14	TR_3681	29	TR_3666
15	TR_3688		

GSI SIZING

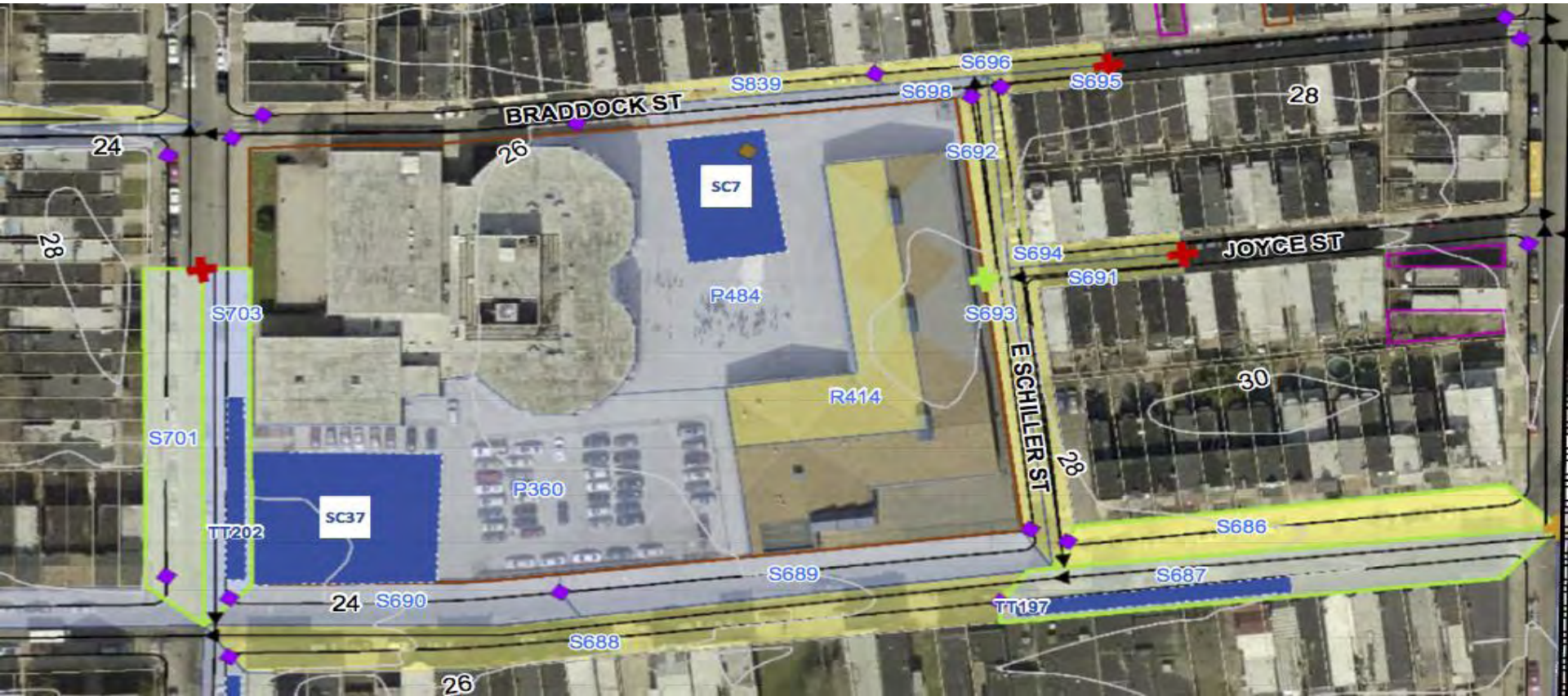
- DRAINAGE AREA > 5,000 SF
- DOWNSTREAM OF EXISTING INLET
- 3’ BUFFER FROM ROW LINE
- 5’ BUFFER FROM ADJACENT PROPOERTY LINE
- 4’ MINIMUM TREE TRENCH WIDTH
- 3’ BUFFER FROM UTILITIES
- 20’ MINIMUM STREET WIDTH FOR BUMPOUTS



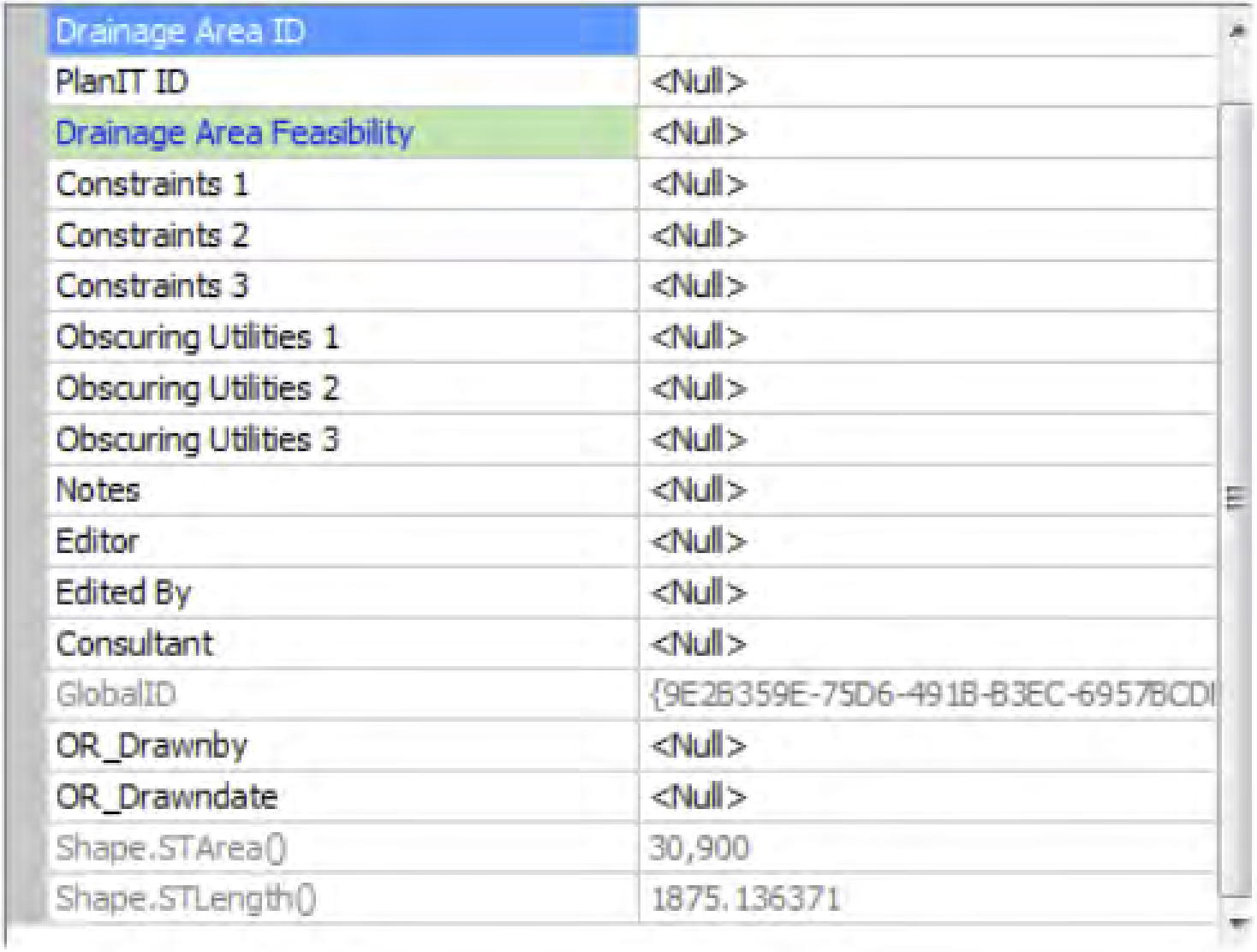


GSI OPPORTUNITIES

- UTILITIES
- SUFFICENT SPACE FOR SMP FOOTPRINT
- MATURE TREES
- STEEP TOPOGRAPHY
- PREFER: SCHOOLS, PARKS, VACANT LOTS, TAX DELINQUENT PARCELS



GIS LAYER – CONSTRAINTS



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Drainage Area Feasibility	<Null>
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Constraints 2	<Null>
Constraints 3	<Null>
Obscuring Utilities 1	<Null>
Obscuring Utilities 2	<Null>
Obscuring Utilities 3	<Null>
Notes	<Null>
Editor	<Null>
Edited By	<Null>
Consultant	<Null>
GlobalID	{9E2B359E-75D6-491B-B3EC-6957BCDI
OR_Drawnby	<Null>
OR_Drawndate	<Null>
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Shape.STLength()	1875.136371

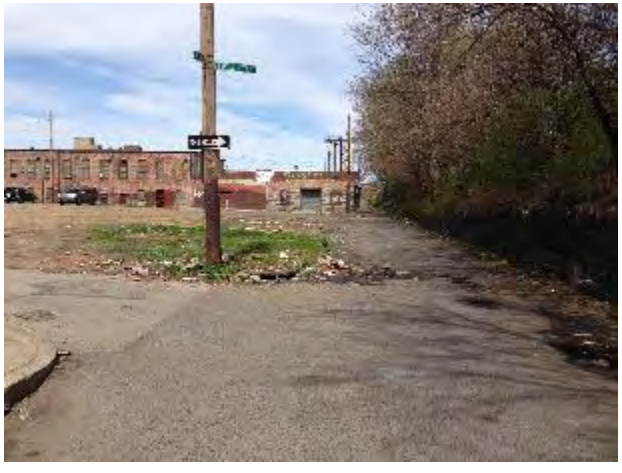
TRACKING DATA

Data Tracking (Recommended): Study Area

GSI Project Number (if recommended or potential)	Segment or Parcel ID (BD # of Street Centerline Layer or PARCELID of Parcel Layer)	Site Name ("Parcel Address" (and Facility Name if applicable) or "X St from Y St to Z St")	Primary Progr	Ownership	Owner Name	Site Evaluation Result	If Recommended or Potential, Drainage Area Map Numbers Managed (S1,P1,R5	Estimated Drainage Area (S	Max Potential Drainage Area (S	Difference Between Max Potential & Estimated (select multiple)	Recent Improvements On Site?	If Yes, Type? (select multiple)	Are There Physical Constraints	Have Utilities Been Evaluated? (select multiple)
FC100	518464	2101 E VENANGO ST	FACILITIES	PRIVATE	NEWELL MARTIN P JR	RECOMMENDED	P405, R912, S707	27,221	47,841	ROOFTOP	NO		NO	GIS, GAS
FC101	357255	3501 JANNEY ST	FACILITIES	PRIVATE	SMAGACH JOHN P	RECOMMENDED	P444, S816	7,911	7,911		NO		NO	GIS, GAS
FC102	357255	3501 JANNEY ST	FACILITIES	PRIVATE	SMAGACH JOHN P	RECOMMENDED	P471	7,212	7,212		NO		YES	GIS, GAS
FC103	282650	2215 E TIOGA ST	FACILITIES	PRIVATE	2215 E TIOGA STREET LLC	RECOMMENDED	P443	9,608	9,608		NO		NO	GIS, GAS
FC104	306330	3515 AMBER ST	FACILITIES	PRIVATE	HOFFMAN RICHARD LLP	RECOMMENDED	P382, S374, S371	25,698	30,043	STREET CROSSING	NO		NO	GIS, GAS
FC105	500001	3737-39 FRANKFORD AVE	FACILITIES	PRIVATE	SZYPER LEN	RECOMMENDED	P86, S323, S324	26,187	26,187		NO		NO	GIS, GAS
FC106	344652	2049-59 E GLENWOOD AVE	FACILITIES	PRIVATE	SFN INC	RECOMMENDED	P101, R877, S817	16,210	22,925	ROOFTOP	NO		NO	GIS, GAS
FC107	248649	2035 E GLENWOOD AVE	FACILITIES	PRIVATE	HUMMEL ANDREW J IV	RECOMMENDED	P190	9,101	9,101		NO		NO	GIS, GAS
FC112	525000	3315 TULIP ST	FACILITIES	PRIVATE	EAST COAST RECYCLING INC	RECOMMENDED	P453, S820	16,093	16,093		NO		NO	GIS, GAS
FC114	262383	2000-10 E ALLEGHENY AVE	FACILITIES	PRIVATE	CNP PROPERTIES LLC	RECOMMENDED	P265, R895, S197, S198	34,509	42,588	ROOFTOP	NO		NO	GIS, GAS
FC115	205349	3340 FRANKFORD AVE	FACILITIES	PRIVATE	WALNUT STREET THEATRE COR	RECOMMENDED	P154, S438, S437	40,692	48,773	STREET CROSSING	NO		NO	GIS, GAS
FC116	530804	2270 E BUTLER ST	FACILITIES	PRIVATE	LIPOFF MARTIN	RECOMMENDED	P81, R60, S774, S776, S785	8,081	34,287	ROOFTOP	NO		NO	GIS, GAS
FC118	453715	3251 EMERALD ST	FACILITIES	PRIVATE	STRAUS MICHAEL S	RECOMMENDED	P355, R788, S299	9,702	20,528	ROOFTOP	NO		NO	GIS, GAS
FC119	97584	3401 COLLINS ST	FACILITIES	PRIVATE	VALUE STORAGE	RECOMMENDED	P248, S829, S828	58,920	58,920		NO		NO	GIS, GAS
FC120	226227	2230 CASTOR AVE	FACILITIES	PRIVATE	CASTOR AVENUE PROPERTIES	RECOMMENDED	P146, S736, S63	35,013	35,013		NO		NO	GIS, GAS
FC122	529590	3359-69 KENSINGTON AVE	FACILITIES	PRIVATE	7-ELEVEN INC	RECOMMENDED	P386, S831	10,617	10,617		NO		NO	GIS, GAS
FC123	535607	3630-32 FRANKFORD AVE	FACILITIES	PRIVATE	HUGHES GREGORY K	RECOMMENDED	P456, S832	12,224	12,224		NO		NO	GIS, GAS
FC125	145972	2001-15 E GLENWOOD AVE	FACILITIES	PRIVATE	HUMMEL ANDREW J IV	RECOMMENDED	P49, S852, S318	40,907	40,907		NO		NO	GIS, GAS
FC128	127229	2231-43 E ONTARIO ST	FACILITIES	PRIVATE	H-D AQUISTION CORP INC	RECOMMENDED	P469, R228	8,646	41,196	ROOFTOP	NO		NO	GIS, GAS
FC129	663457	2215 E WESTMORELAND ST	FACILITIES	PRIVATE	MARANO DOMINIC C	RECOMMENDED	P339	151,467	151,467		NO		NO	GIS, GAS
FC130	73138	2220 E ONTARIO ST	FACILITIES	PRIVATE	ONTAZIO ASSOCIATES LLC	RECOMMENDED	P479, S593	127,825	127,825		NO		NO	GIS, GAS
FC80	513787	3434 KENSINGTON AVE	FACILITIES	PUBLIC	CITY OF PHILADELPHIA	RECOMMENDED	SEE PARCELID: 590842	-	-		NO		NO	GIS, GAS

SITE VISITS

1. Confirm parcel name (if applicable)
2. Inlet locations - identify type and current condition
3. Tree locations - identify location and note condition.
4. Access points - identify locations of gates, doors, curb cuts and driveways
5. Utility mark-outs- identify type and distance from front of curb
6. Valves and manholes - identify type (gas, sewer, water, unknown)
7. Handicap ramp locations and condition
8. Bus stops and other public transit
9. Sidewalk widths
10. Sidewalk condition
11. Curb reveal- identify material and reveal
12. Parking-identify no parking zones and the type and location of parking spaces
13. Bike lanes - note location
14. Overhead wires - identify location and clearance
15. Runoff flow directions (i.e. surface flow directions)
16. Misc. features such as fire hydrants, bollards, traffic lights, and poles



PROJECT SHEETS

901 EAST WESTMORELAND STREET

VL1

Drainage Area Managed	Size (SF)
S751	7,506
S825	3,671
S844	14,224

Existing Site Photos

GSI Project Number	Site Name	Ownership	Drainage Area Numbers Managed	Estimated Drainage Area (SF)	Max Potential Drainage Area (SF)	SMP Footprint (SF)	SMP Location	SMP Type
VL1	901 E WESTMORELAND ST	CITY OF PHILADELPHIA	S751, S825, S844	7,300	25,401	2,430	On-Site	RAIN GARDEN

Utility Crossings For Drainage Areas

H Street

- 6" Gas Line, 3'-0" Cover (Source: PGW)
- 30" RCP Sewer Line, Cover Unknown (Source: PWD)
- 6" Abandoned Water Line, Cover Unknown (Source: PWD)
- 8" DI Water Line, Cover Unknown (Source: PWD)

Relevant Site Notes

- Middle parcel – Tax Delinquent 12 Years
- Other two parcels are Project Opportunity Parcels
- Young existing tree in southwest corner

Relevant Site Constraints

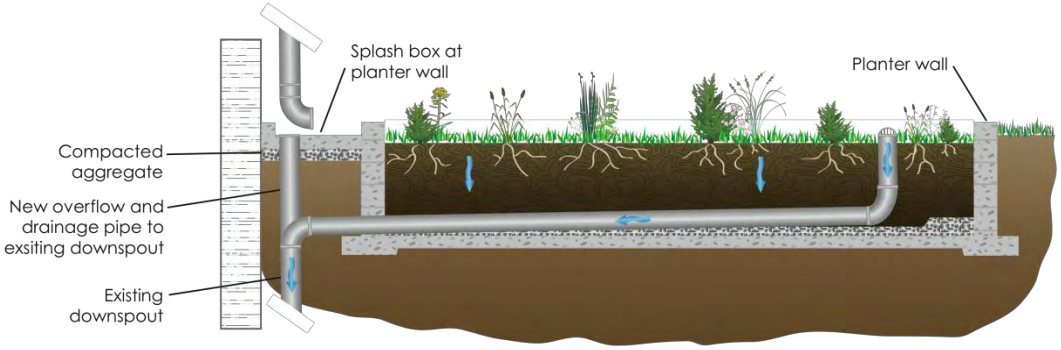
- Existing laterals - assumed to be abandoned
- Steep topography
- Fire hydrant on east side of H street
- Low wooden fence

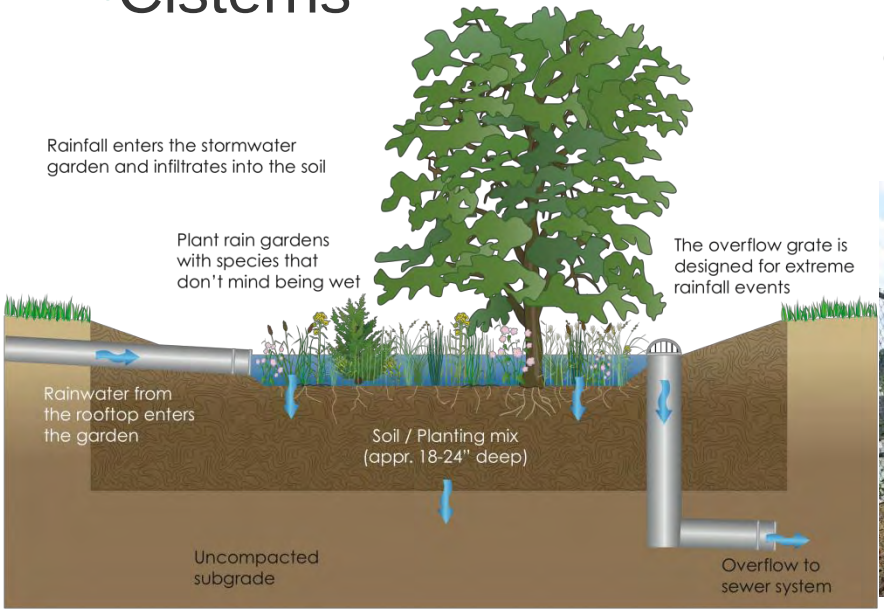
VICINITY MAP

STORMWATER BMP EXAMPLES

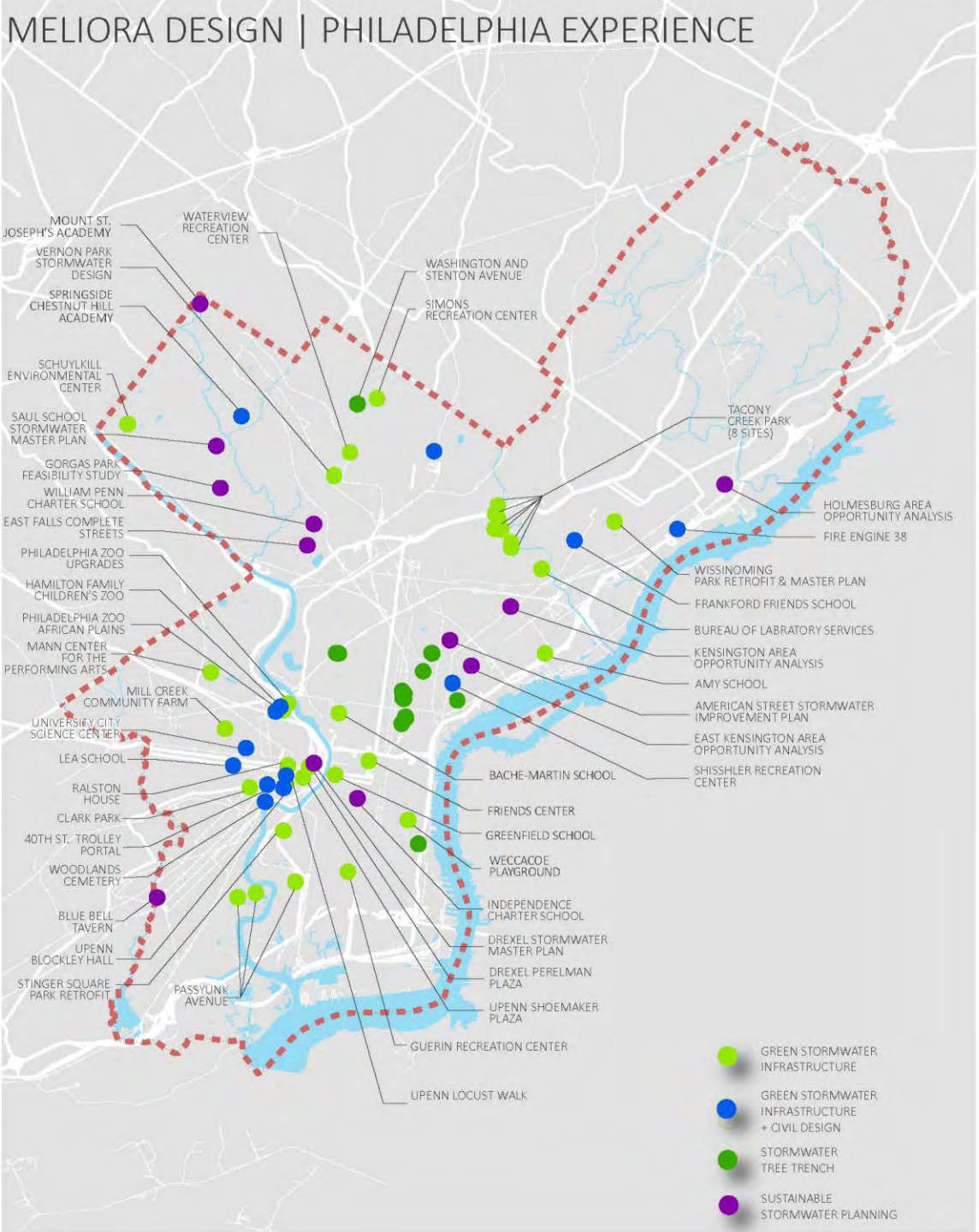
- Rain Gardens
- Porous Pavements
- Planter Boxes
- Tree Trenches
- Curb Bump-outs
- Cisterns

Green infrastructure provides stormwater filtration, storage, and infiltration, enhances aesthetics, and reduces flooding and burdens on storm sewer systems.





MELIORA DESIGN | PHILADELPHIA EXPERIENCE



PLANT PALETTE

Key	Botanical Name	Common Name
AT	*Asclepias tuberosa*	Butterfly Milkweed
AL	*Aster laevis*	Smooth Blue Aster
DF	*Deschampsia flexuosa*	Common Hair Grass
EP	*Echinacea purpurea*	Purple Coneflower
GA	*Gaillardia aristata*	Blanket Flower
HM	*Heuchera micrantha*	Smallflower Alumroot
PS	*Penstemon smallii*	Small's Penstemon
PhS	*Phlox subulata*	Mountain Phlox
ST	*Sedum ternatum*	Woodland Stonecrop
VD	*Viburnum dentatum* 'Blue Muffin'	'Blue Muffin' Arrowwood Viburnum


Asclepias tuberosa
Butterfly Milkweed


Aster laevis
Smooth Blue Aster


Deschampsia flexuosa
Common Hair Grass


Echinacea purpurea
Purple Coneflower


Gaillardia aristata
Blanket Flower


Heuchera micrantha
Small's Penstemon


Penstemon smallii
Small's Penstemon


Phlox subulata
Mountain Phlox


Sedum ternatum
Woodland Stonecrop


Viburnum dentatum 'Blue Muffin'
'Blue Muffin' Arrowwood Viburnum

NATIVE SPLENDOR

DESIGNER

Christopher Dartley, Stewardship Assistant, Pennypack Ecological Restoration Trust

Dartley was the Urban and Community Forestry Intern at the Morris Arboretum of the University of Pennsylvania after graduating with a B.S. in Horticulture from Temple University. At the Pennypack Ecological Restoration Trust, he manages warm season native grasslands, acts as nursery manager, and assists with forest restoration and invasive plant control.

DESCRIPTION

Dartley's design features prairie-oriented and salt tolerant plants. These plants thrive best in partial sun to full sun, and could complement particular urban settings.

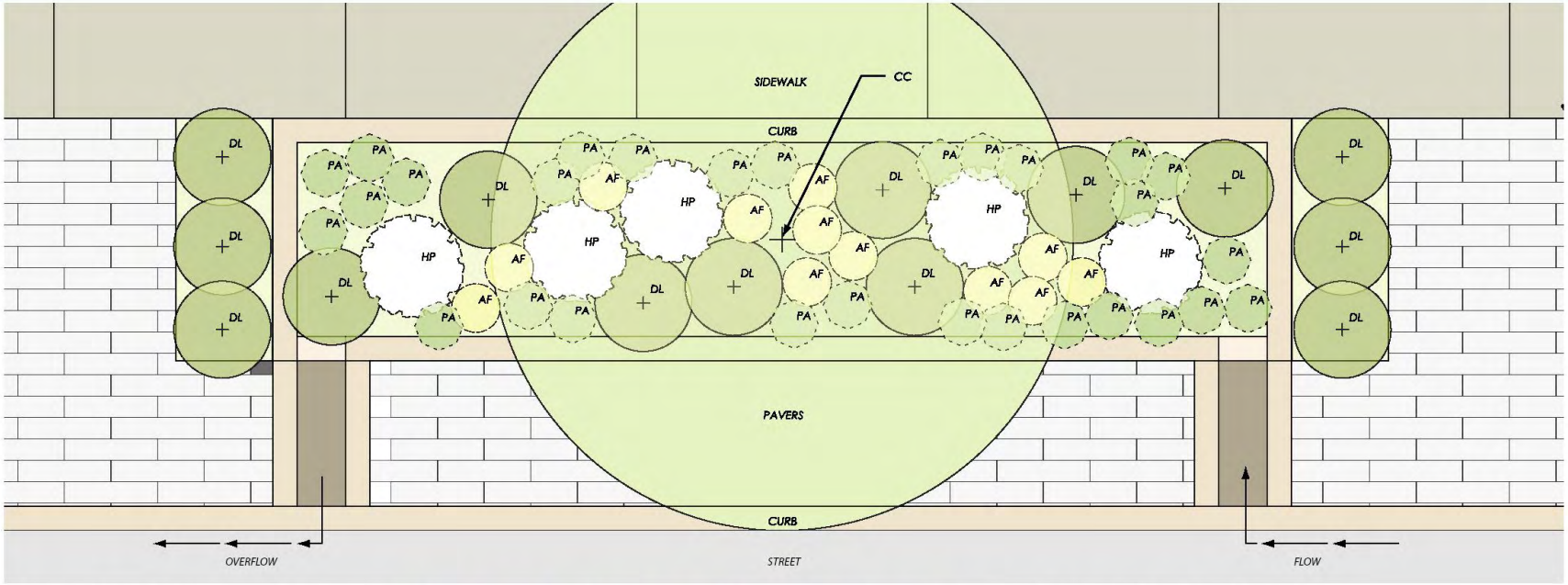
DETAILS AND MAINTENANCE NOTES

- This is a low maintenance planter. Pruning of shrubs and cutting back of perennials and grasses are needed once a year in the late spring.
- Leaving the foliage on the plants provides habitat area for wildlife through the winter.

STORMWATER PLANTER DESIGN SHOWCASE

Recommended Plants for Urban Stormwater Management Publication

Image Source: PHS



PLANT PALETTE

Sym	Botanical Name	Common Name
AF	*Athyrium filix-femina*	Lady Fern
CC	*Carpinus caroliniana*	Hornbeam
DL	*Diervilla lonicera*	Southern-bush Honeysuckle
HP	*Hypericum prolificum*	Shrubby St. John's Wort
PA	*Polystichum acrostichoides*	Christmas Fern

Athyrium filix-femina
Lady Fern

Carpinus caroliniana
Hornbeam

Diervilla lonicera
Southern-bush Honeysuckle

Hypericum prolificum
Shrubby St. John's Wort

Polystichum acrostichoides
Christmas Fern

STREETSMARTS

DESIGNER

John Munro, Certified Ecologist, Munro Ecological Services, Harleysville, PA

Munro has worked in applied ecology since the 1970's and has earned professional certifications in Wetlands and Ecology. He has designed ecological restoration plans for forests, grasslands, shorelines, waterways, and wetlands in northeast North America.

DESCRIPTION

This planter design starts with native plants expected to tolerate most of the limiting factors of a city environment on the street. Shape, size, adaptability, and ornamental characteristics were also considered. Designed as a true demonstration planting, monitoring will be crucial, taking particular note of the individual set of stresses present at the installation site. The recommended plants are a mix of woody and herbaceous FACW plants that will thrive in partial shade or sun.

DETAILS AND MAINTENANCE NOTES

- Annual pruning.
- Watering necessary only in the first growing season.

STORMWATER PLANTER DESIGN SHOWCASE

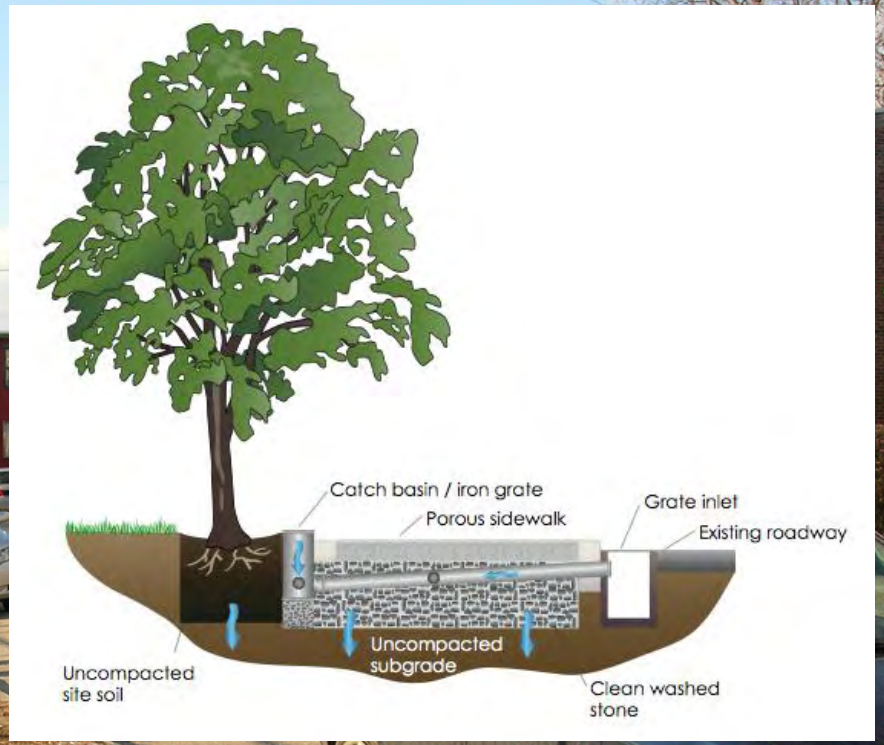
Recommended Plants for Urban Stormwater Management Publication

Image Source: PHS

Before

After

Tree Trench



Before

Tree Trench

Traffic Island

Overflow water exits to an inlet

Bio-retention

Water from the street enters through a trench drain

63RD STREET (S.R. 3004)

PASSYUNK AVENUE (S.R. 3019)


SUNOCO
28th St


28th St
28th St
Passyunk Ave
95
76
NO TURN ON RED
UNOCO
ZOO

Porous Asphalt – Independence Charter School

Greenfield School

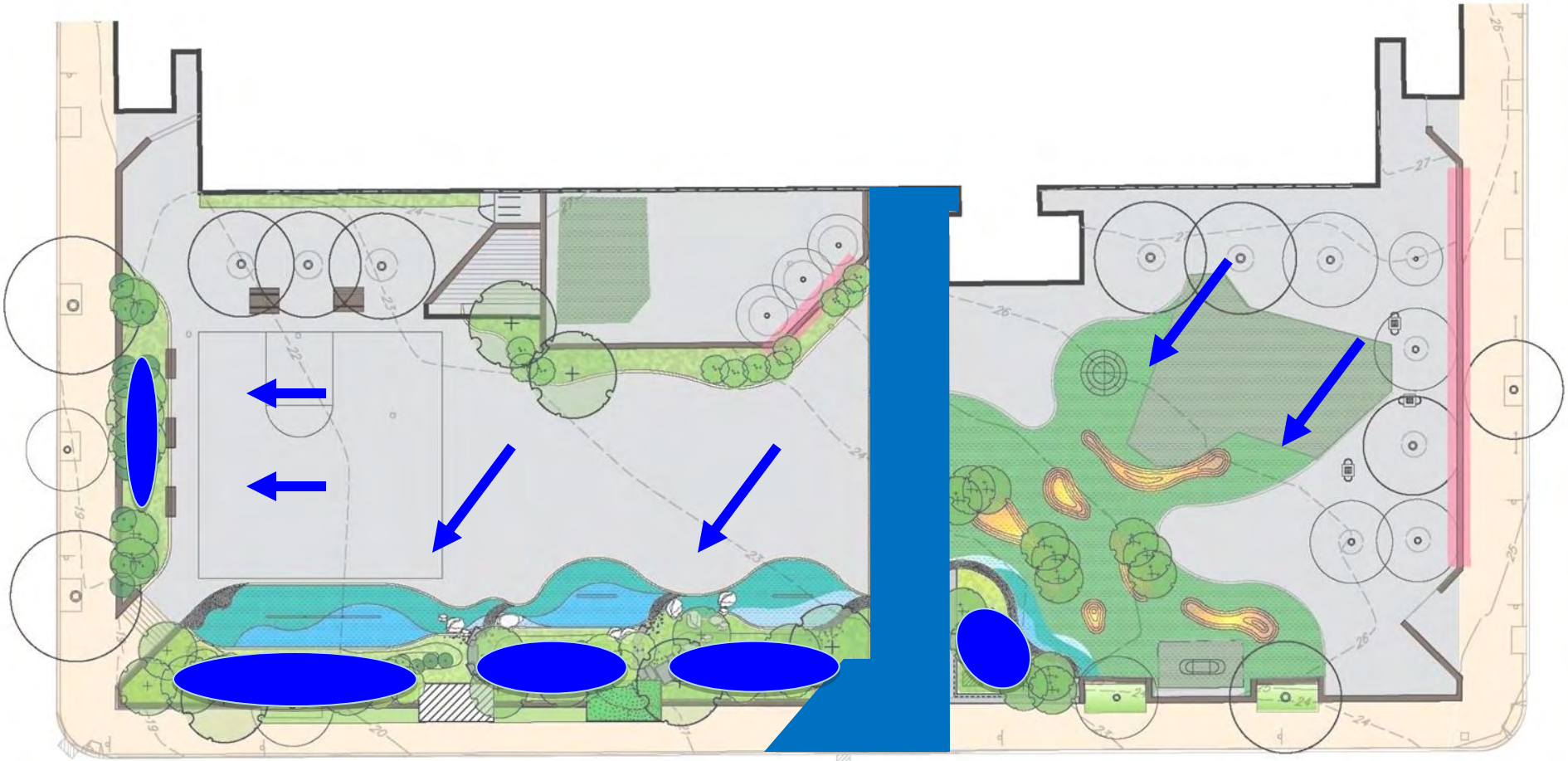


Image Source: Viridian Landscape Studio

Greenfield School

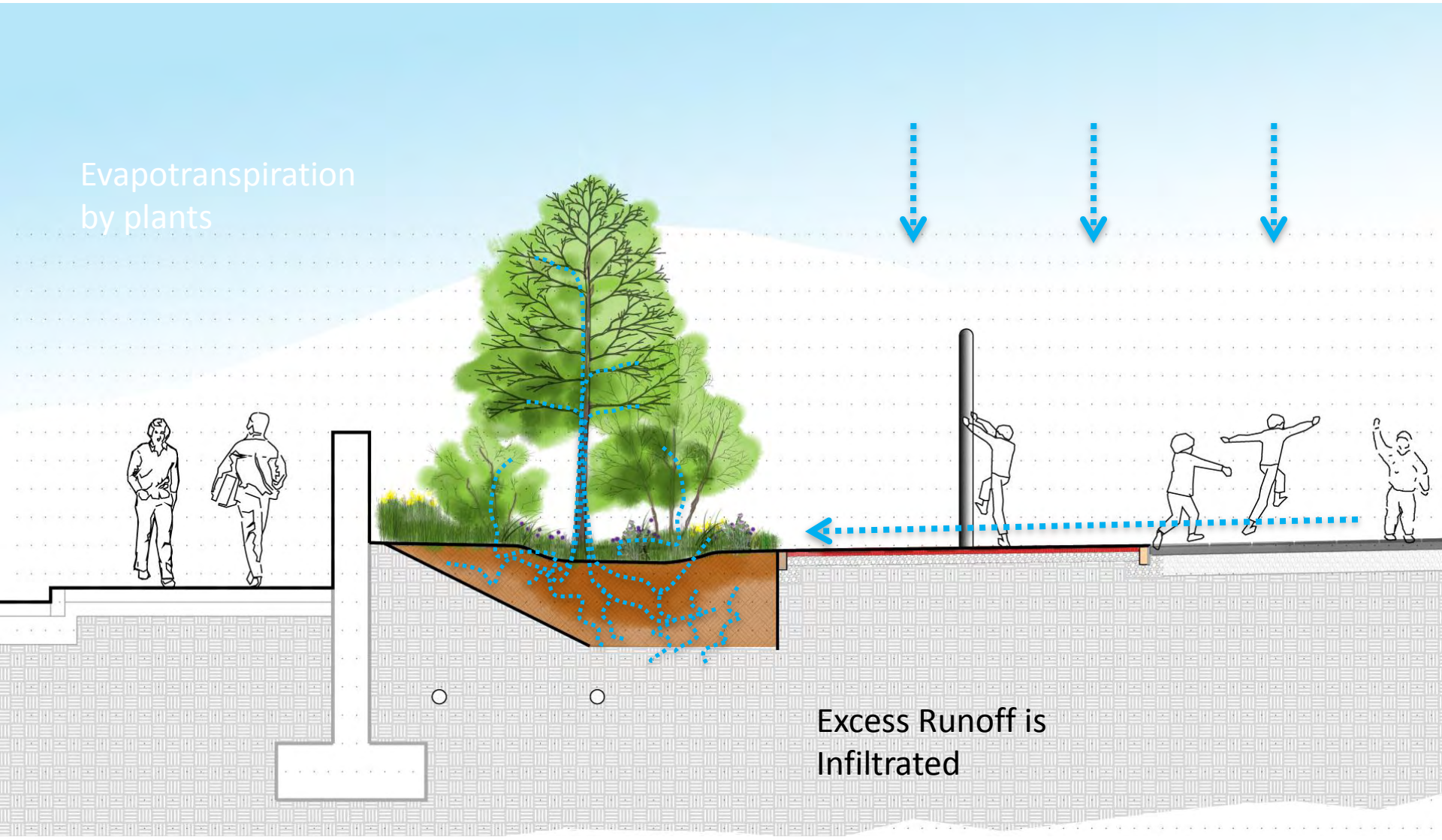


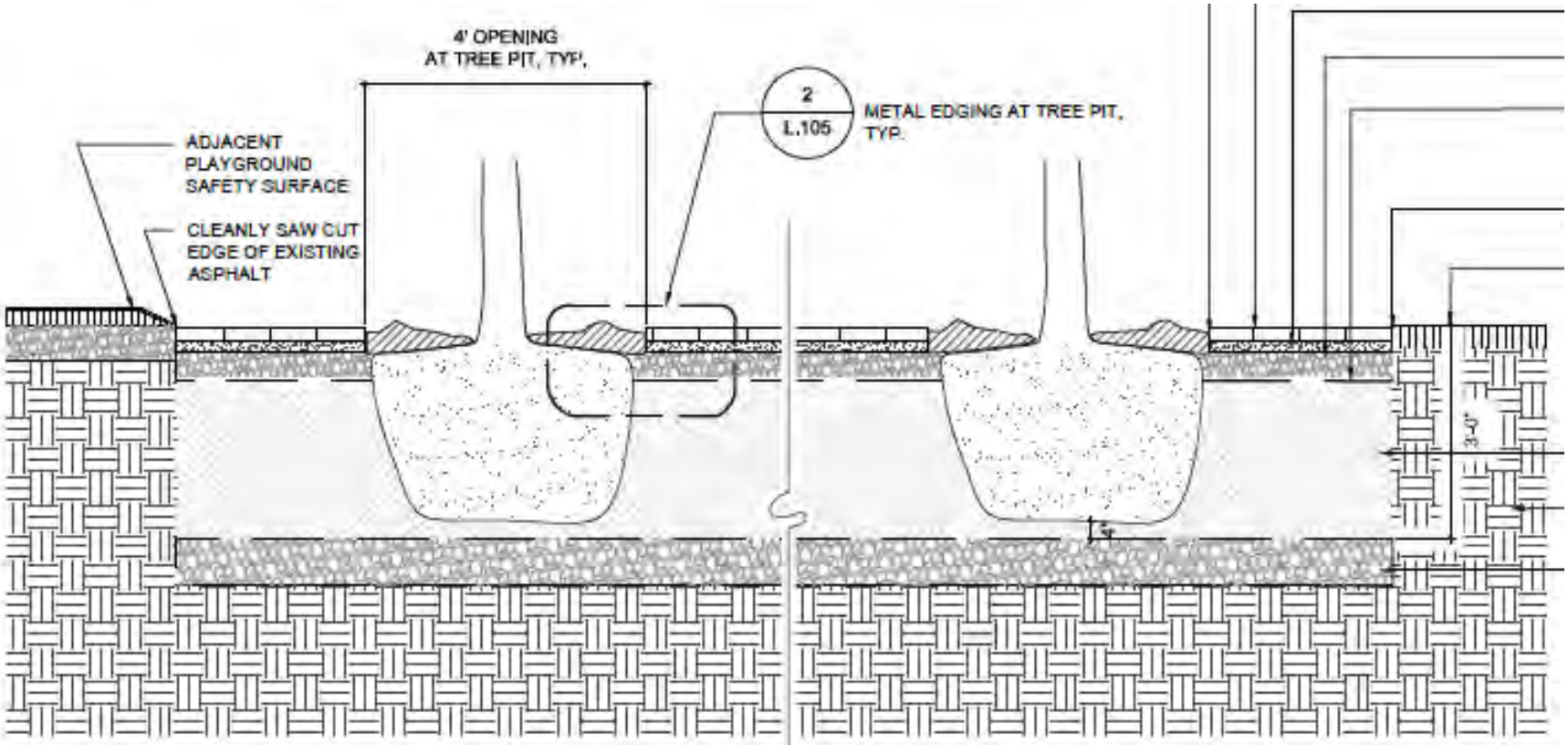
Image Source: Viridian Landscape Studio


STOP
BONNERS

Lea School

Excellence in GSI Awards Ceremony: Celebrating the Triple Bottom Line

Image Source: SALT Design Studio



1 TREE IN BOSQUE PLANTING DETAIL

Image Source: SALT Design Studio

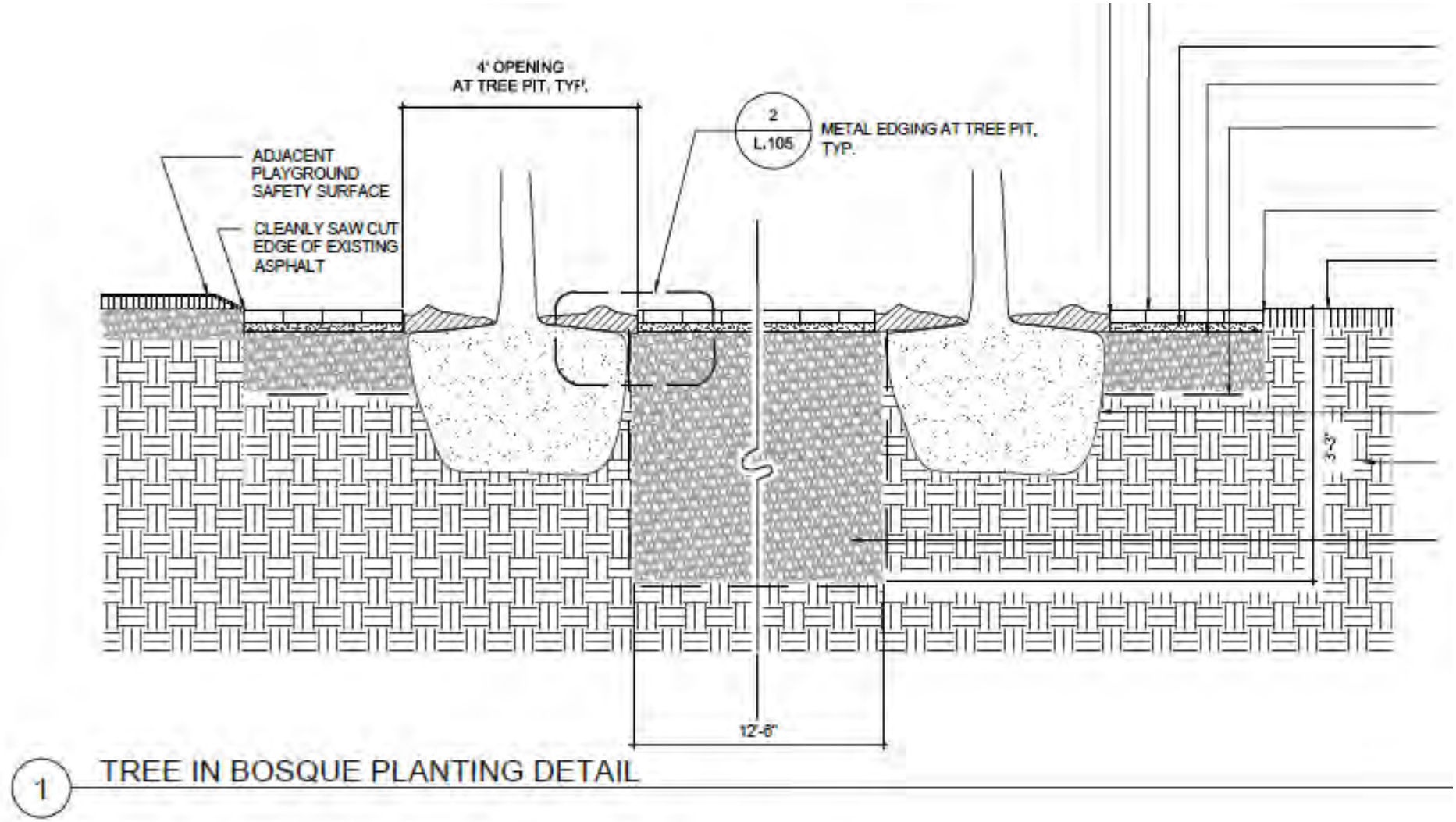


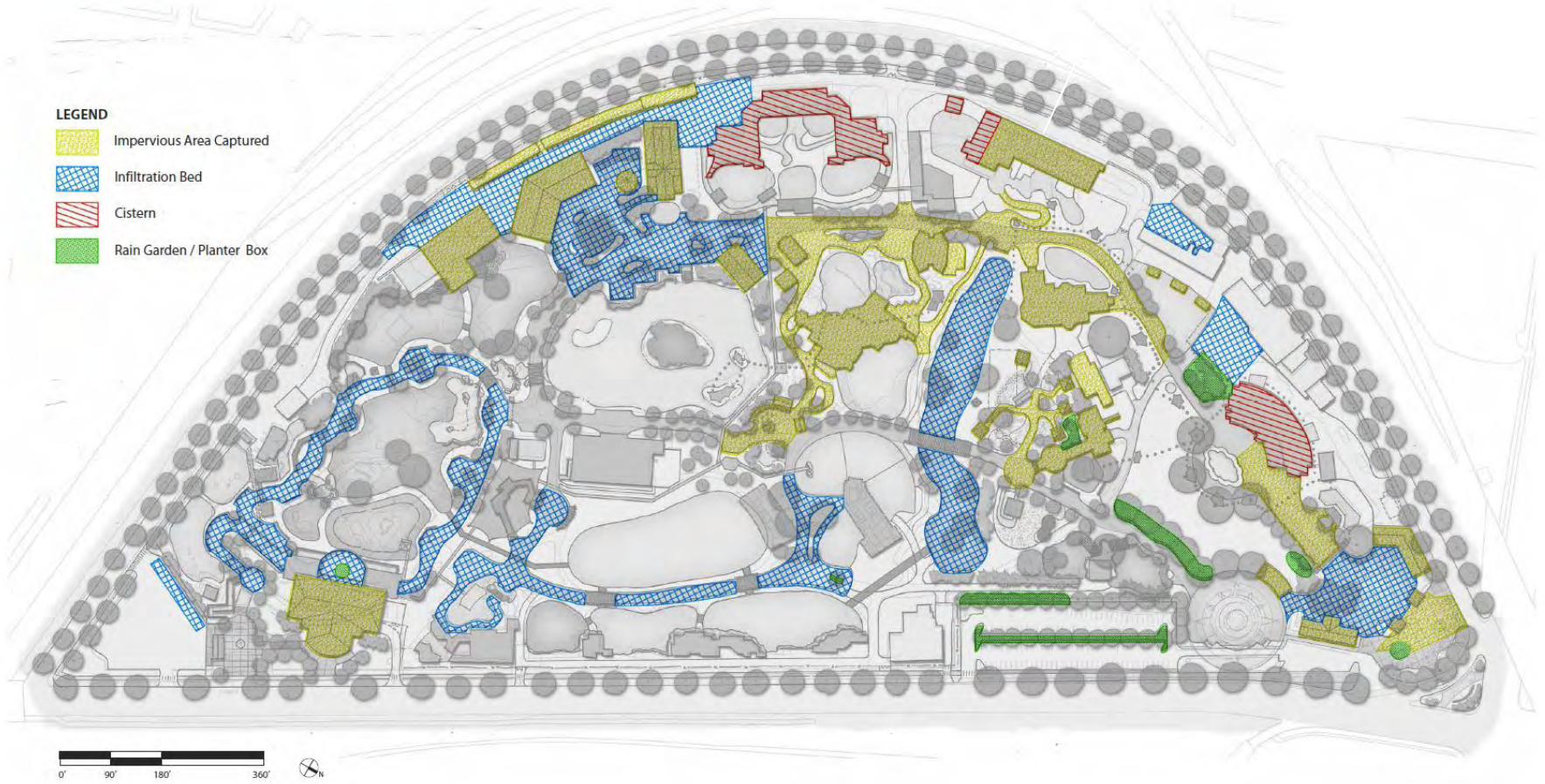
Image Source: SALT Design Studio

Philadelphia Zoo

COMBINED RACEWAYS PLAN

Stormwater Management Plan

STORMWATER MANAGEMENT RECOMMENDATIONS



Parking Lot Retrofit

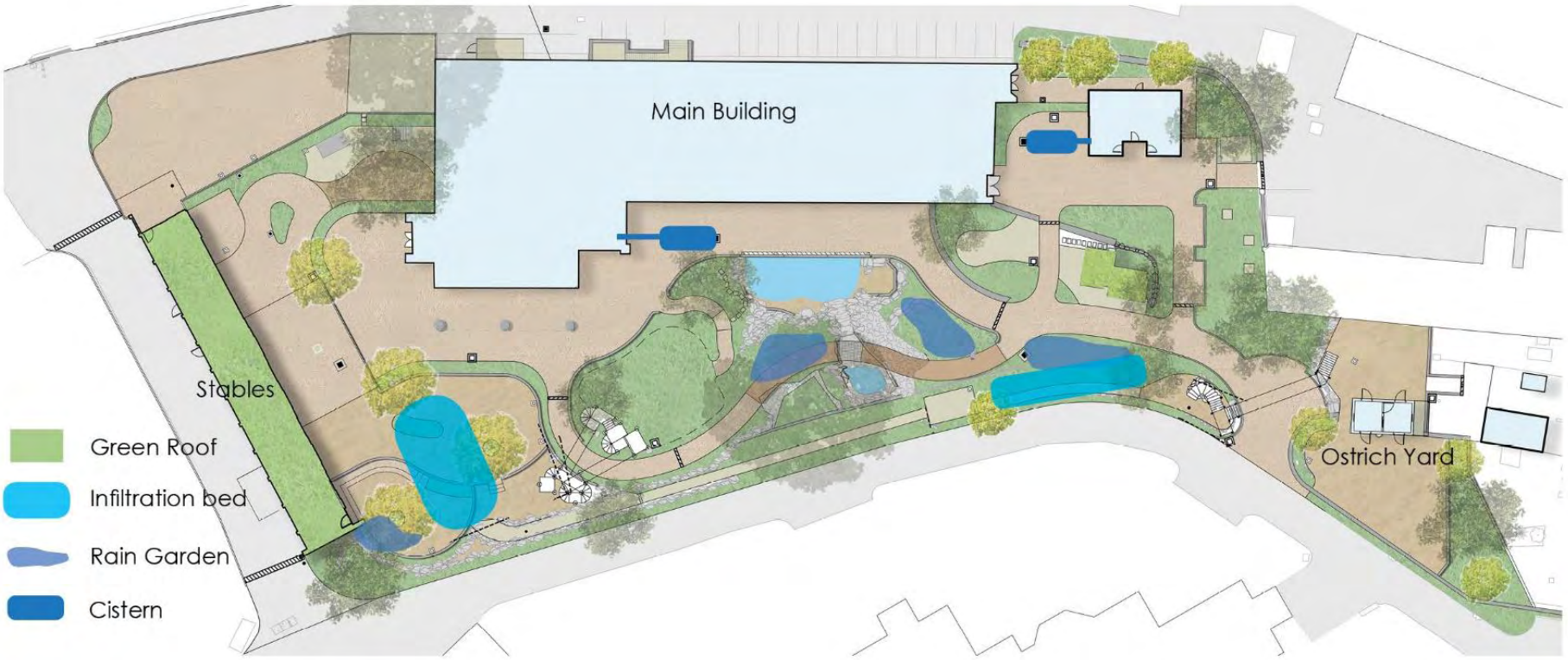
Tiger Lot


N 34TH STREET
NEW CURB WITH CURB CUTS
RAIN GARDEN WITH SUBSUR-
FACE STONE BED
RAIN GARDEN WITH SUBSURFACE STONE BED
NEW CURB WITH CURB CUTS
RAIN GARDEN WITH
SUBSURFACE STONE BED
NEW CURB WITH CURB CUTS
NEW TRENCH DRAIN
RAIN GARDEN WITH SUB-
SURFACE STONE BED
LEGEND
4' WIDE PEDESTRIAN CROSSING
SURFACE FLOW TO CURB CUT
STONE BED
RAIN GARDEN

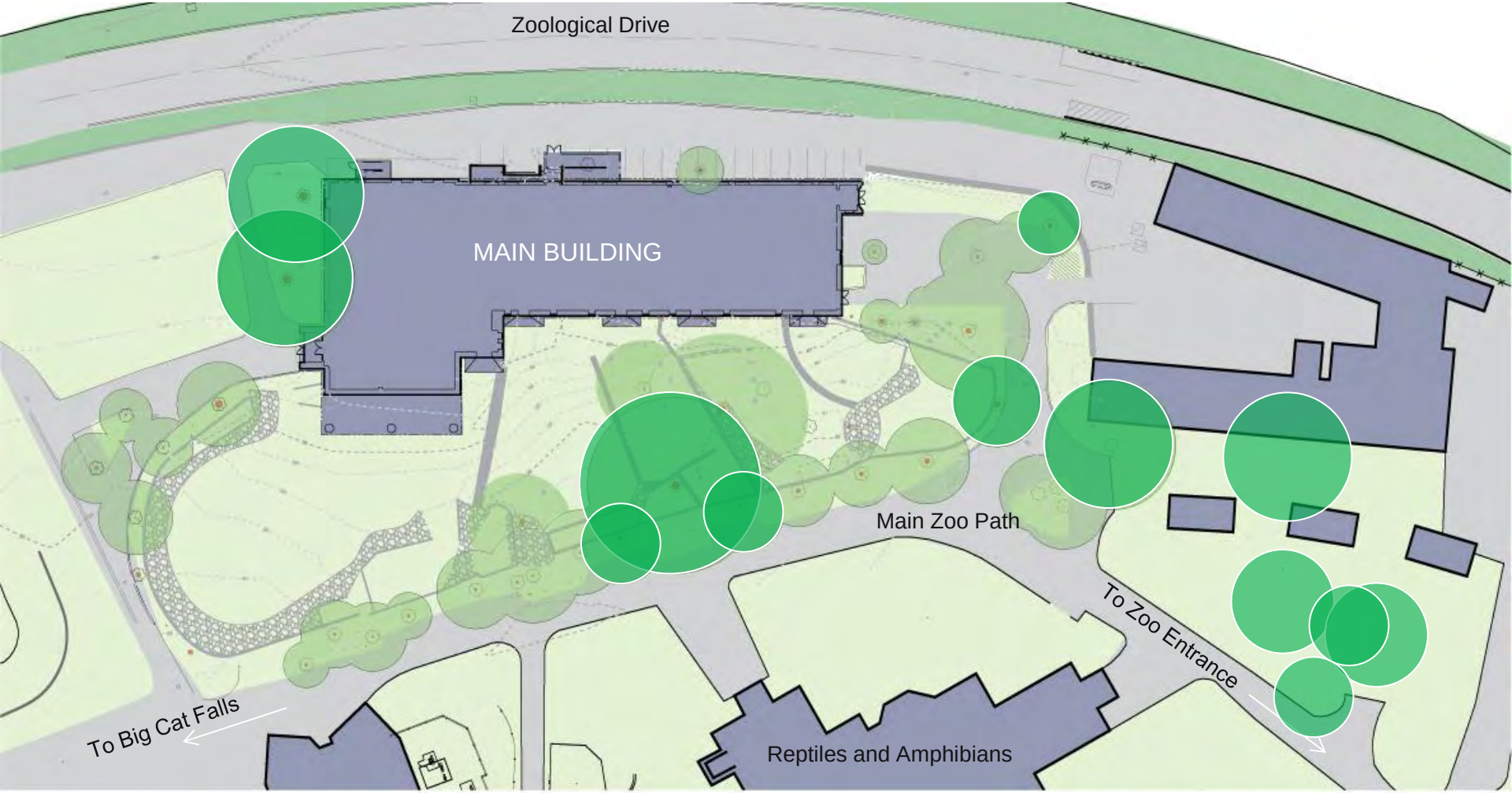

GOING GREEN!
We're fixing an old storm sewer which will help ensure that rainwater, that can pick up dirt, oils, and litter, won't leak into the ground water and pollute our rivers. And we're planting trees and a rain garden to help absorb rainwater.

Tiger Lot: Before & After

Philadelphia Zoo – KidZooU



KidZooU: Trees



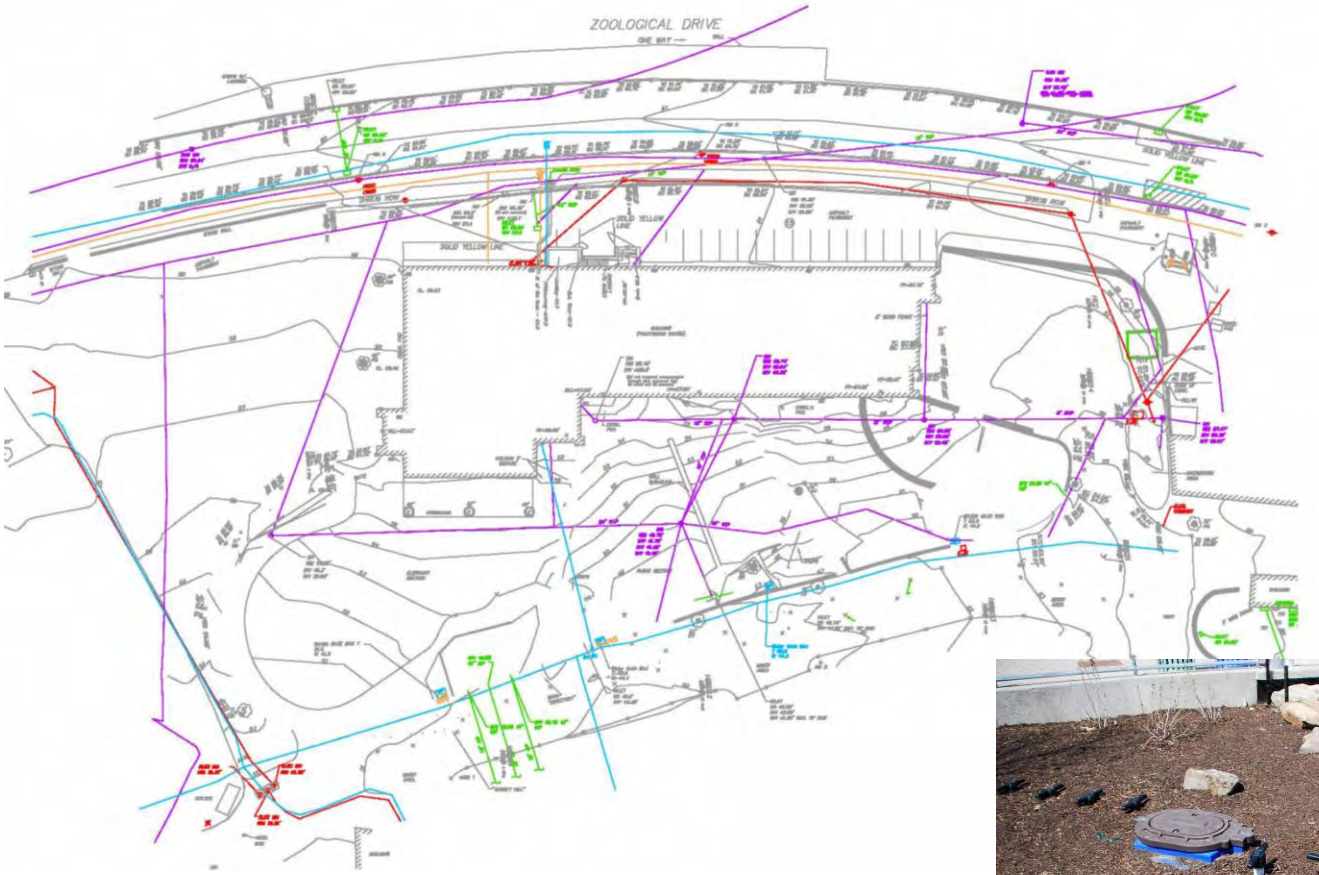
Rendering by Viridian Landscape Studio

KidZooU: Trees

KidZooU: Trees

Photos by Arborilogical Services, Inc.

KidZooU: Utility Coordination



KidZooU: Stormwater Infiltration Beds

KidZooU: Stormwater - Cisterns

Saving Water Saves Animals

Why does it matter?

1. Treating water and delivering water to our homes and businesses uses an enormous amount of energy.

2. Wasting water creates more greenhouse gases that contribute to climate change, which affects animals all over the world. The amount of energy we use each year to treat water generates as much carbon dioxide as 10 million cars.

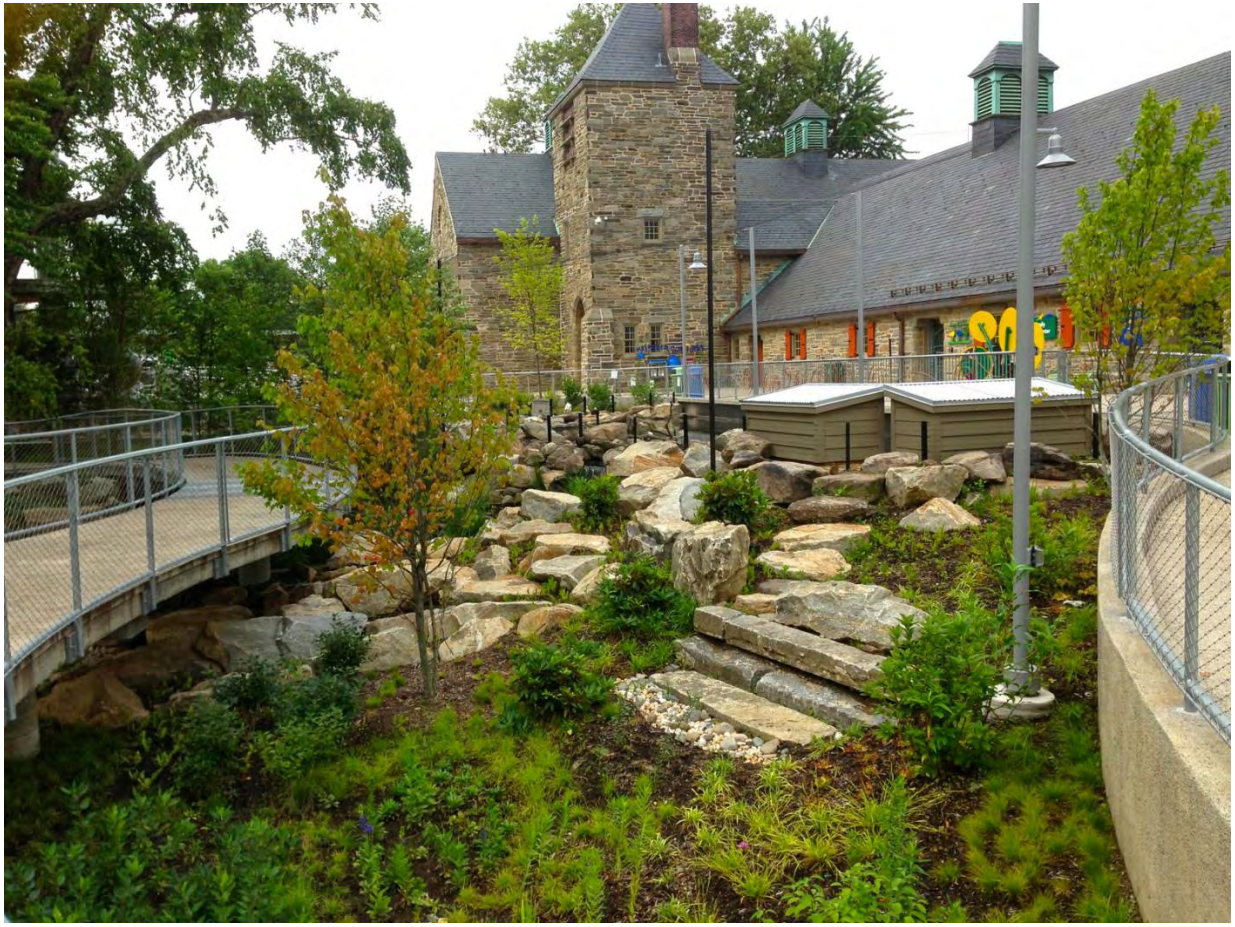
3. Check out our sustainable restrooms for tips on how to save water at home and save energy.

4. 

5.

Start with Rainwater

KidZooU: Rain Gardens



Cliveden

Cliveden

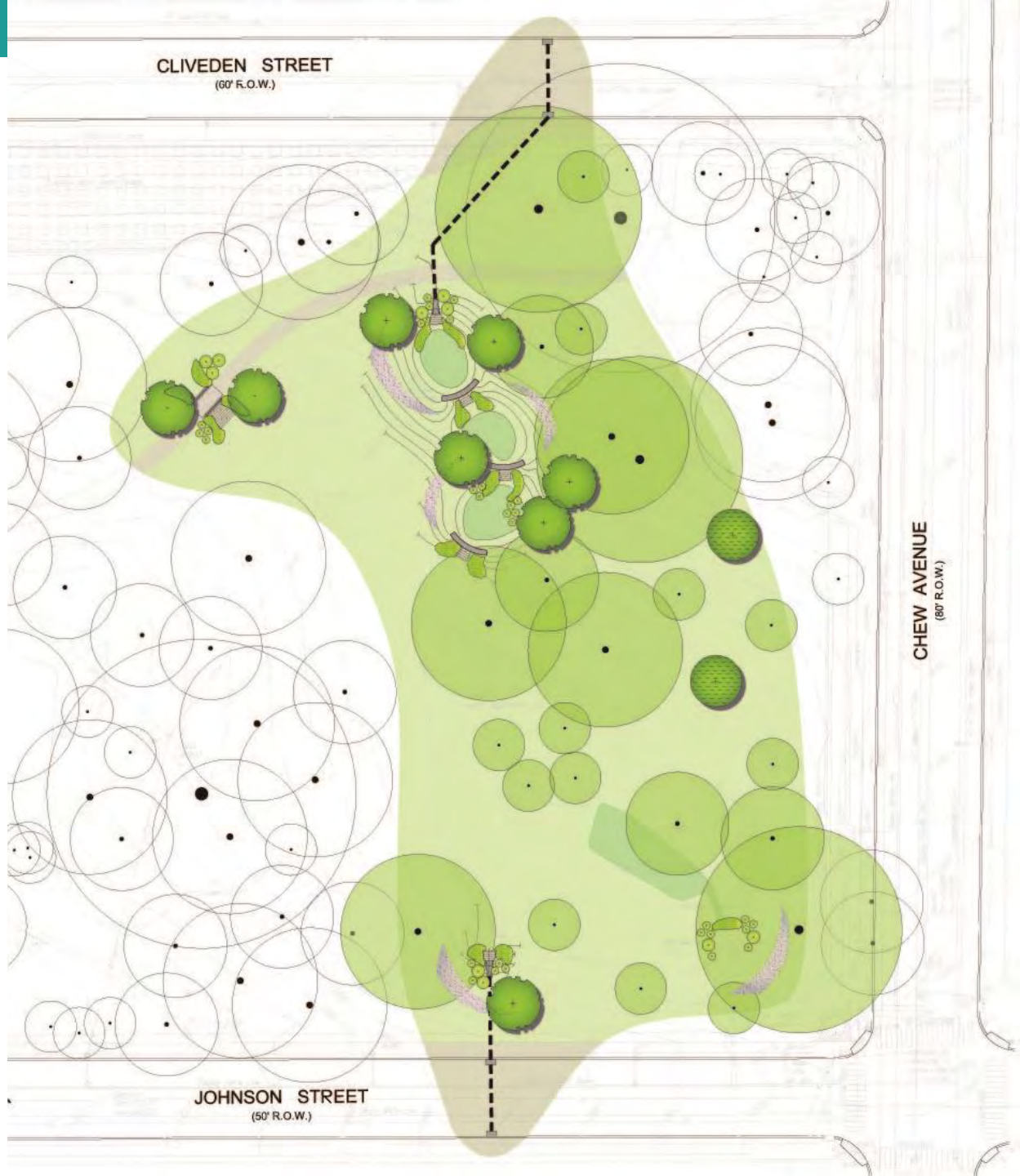


Image Source: PHS

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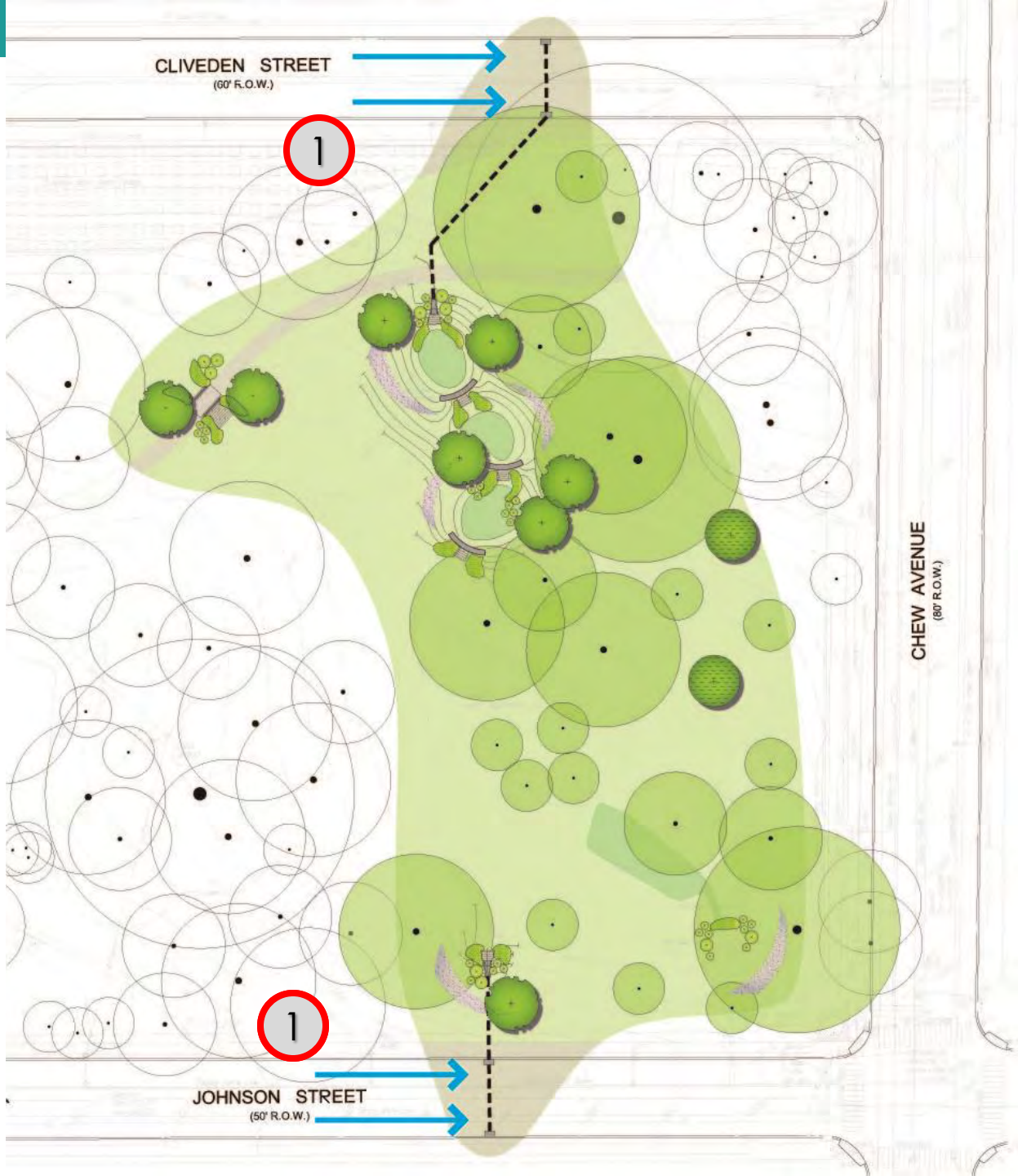

Image Source: PHS

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Image Source: PHS

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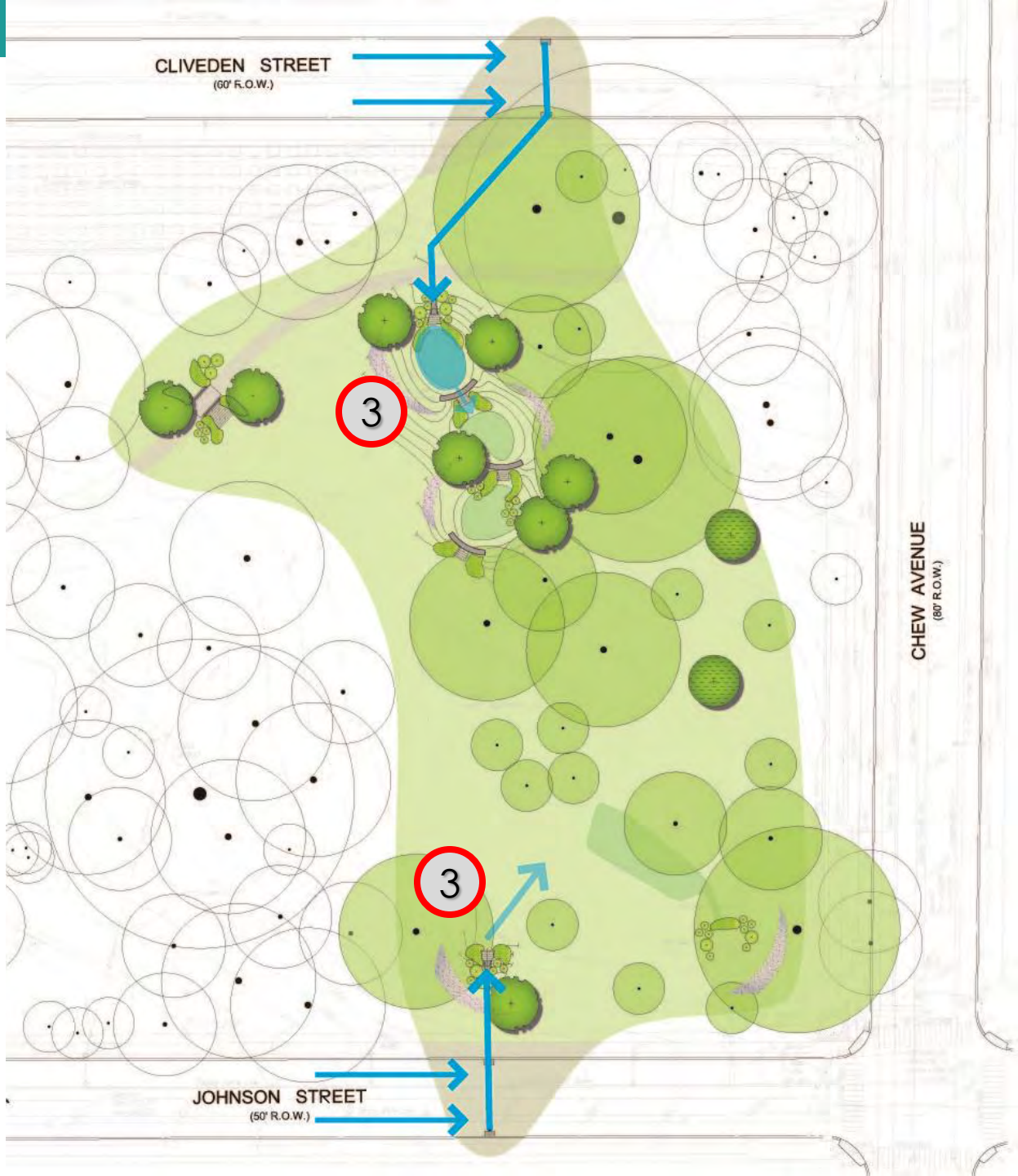

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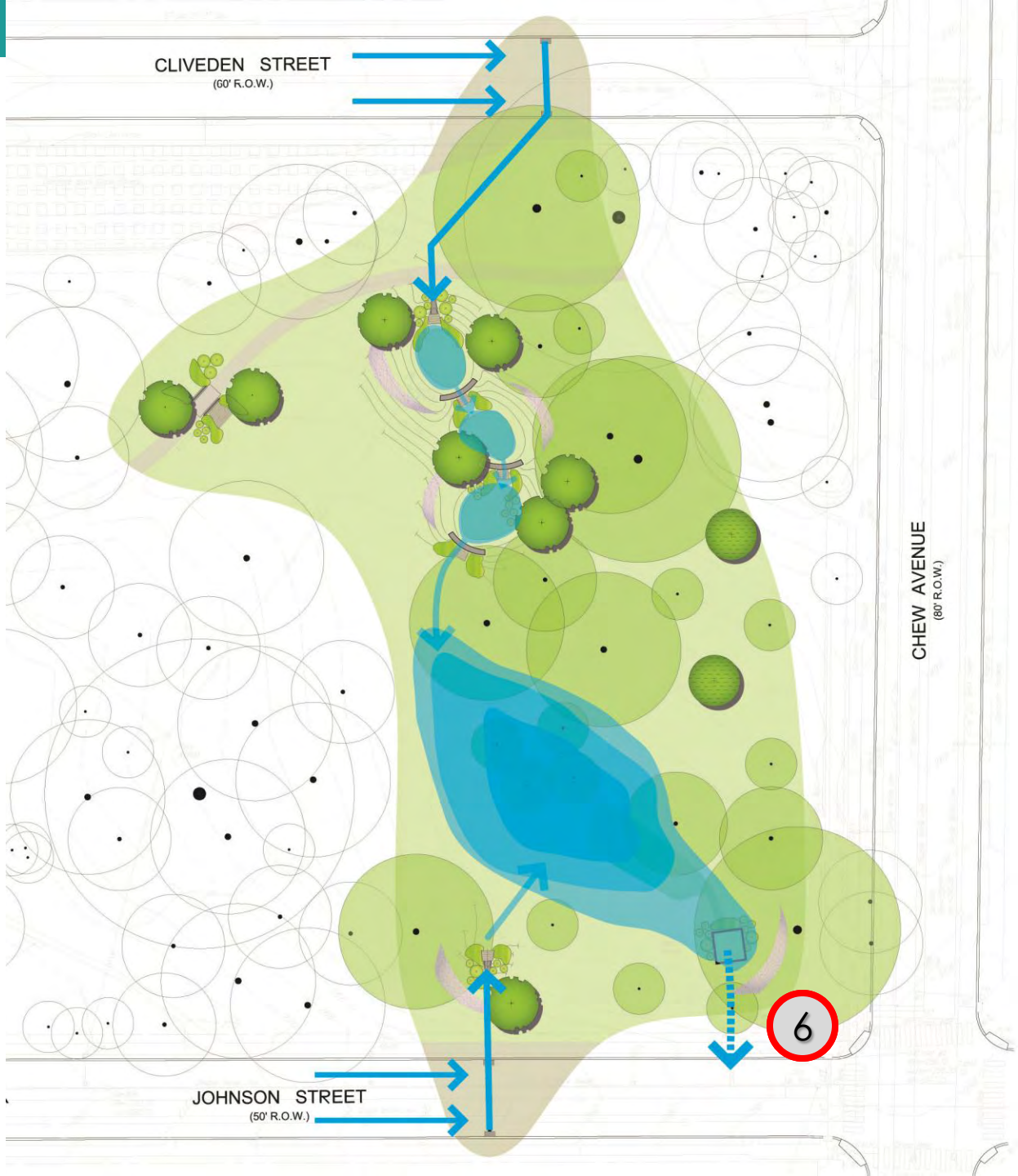

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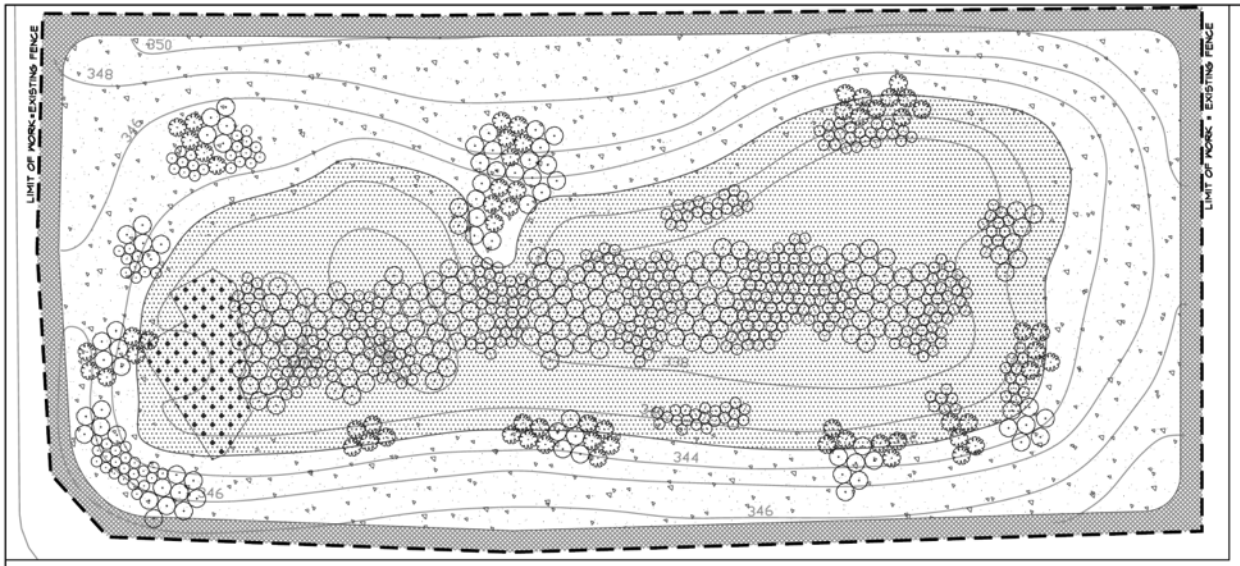
Detention Basin Retrofit

Detention Basin Retrofit

Detention Basin Retrofit

Provide a simple maintenance plan



LEGEND

- LOW-MOW TURF GRASS
- DRY MEADOW
- WET MEADOW
- LIVE STAKES
- CANOPY TREE
- UNDERSTORY/FLOWERING TREE
- SHRUB

FIRST YEAR MAINTENANCE

LOW-MOW TURF GRASS:

1. MOW TURF AREAS AS SOON AS TOP GROWTH IS TALL ENOUGH TO CUT. MOW GRASS TO 4-5 INCHES HIGH. REPEAT MOWING TO MAINTAIN SPECIFIED HEIGHT WITHOUT CUTTING MORE THAN 40 PERCENT OF GRASS HEIGHT. DO NOT DELAY MOWING UNTIL GRASS BLADES BEND OVER AND BECOME MATTED. DO NOT MOW WHEN GRASS IS WET.

2. WATER OR SUPPLEMENT NATURAL RAINFALL TO PROVIDE A MINIMUM RATE OF 1 INCH PER WEEK UNTIL A HEALTHY, DENSE, CLOSE STAND OF GRASS HAS BEEN ESTABLISHED.

WET & DRY MEADOW AREAS:

1. MOW MEADOW AREAS TO A HEIGHT OF 6 INCHES WHEN WEEDS REACH 10 INCHES IN HEIGHT.

2. MOW ON A MONTHLY BASIS THROUGH GROWING SEASON. REMOVE OR FINELY CHOP AND REDISTRIBUTE MOWINGS TO PREVENT CUT WEEDS FROM SMOTHERING NATIVE GRASS SEEDLINGS. THE USE OF A FLAIL-TYPE MOWER IS RECOMMENDED BECAUSE IT CHOPS MATERIAL INTO FINE PIECES, ENCOURAGING MORE RAPID BREAKDOWN OF LEAF LITTER AND PREVENTING SMOTHERING OF SEEDLINGS.

3. WATER OR SUPPLEMENT NATURAL RAINFALL TO PROVIDE A MINIMUM RATE OF 1 INCH PER WEEK.

SECOND YEAR MAINTENANCE

LOW-MOW TURF GRASS:

1. MOW TURF AREAS AS SOON AS TOP GROWTH IS TALL ENOUGH TO CUT. MOW TO 4-5 INCHES HIGH. REPEAT MOWING TO MAINTAIN SPECIFIED HEIGHT WITHOUT CUTTING MORE THAN 40 PERCENT OF GRASS HEIGHT. DO NOT DELAY MOWING UNTIL GRASS BLADES BEND OVER AND BECOME MATTED. DO NOT MOW WHEN GRASS IS WET.

WET & DRY MEADOW AREAS:

1. MOW MEADOW AREAS TO A HEIGHT OF 8 INCHES IN MID SPRING BEFORE WARM SEASON GRASSES EMERGE, BUT WHEN COOL SEASON WEEDS ARE ACTIVELY GROWING. IF WET MEADOW AREAS ARE TOO WET TO MOW IN SPRING, MOW IN LATE FALL. REMOVE OR FINELY CHOP AND REDISTRIBUTE MOWINGS.

2. INSPECT 1-2 TIMES ANNUALLY FOR INVASIVE SPECIES. IF BIENNIAL WEEDS SUCH AS SWEET CLOVER, WILD PARNIP, QUEEN ANN'S LACE, OR BURDOCK APPEAR, THEY SHOULD BE MOWED OR WEED WHACKED TO A HEIGHT OF 12 INCHES OR LESS WHEN IN BLOOM. DO NOT ALLOW BIENNIAL WEEDS TO GO TO SEED.

3. TO MAINTAIN MEADOW AND PREVENT SUCCESSION TO WOODY HABITAT, MOW TO A HEIGHT OF 6-8" ONCE EVERY TWO YEARS IN MID SPRING. REMOVE OR FINELY CHOP AND REDISTRIBUTE MOWINGS.

GENERAL REQUIREMENTS

1. DO NOT MOW OR USE WEED WHACKERS NEAR TREES & SHRUBS.

2. DO NOT MOW TO LESS THAN RECOMMENDED MOWING HEIGHT.

3. INSPECT ALL SEEDED AREAS FOR BARE SPOTS (GREATER THAN 1 SQUARE FOOT) IN LATE SUMMER. RESEED BARE SPOTS WITH APPROPRIATE SEED MIXES DURING THE FALL SEEDING WINDOW (AUGUST 15 - SEPTEMBER 30) OR SPRING SEEDING WINDOW (APRIL 15 - JUNE 15).

4. REPLENISH MULCH AROUND TREES AND SHRUBS EACH SPRING TO SUPPRESS WEEDS. REMOVE WEEDS BY HAND AS NEEDED. VIGOROUS WEED CONTROL IS NEEDED FOR THE FIRST THREE YEARS OR UNTIL TREES ARE TALL ENOUGH TO SHADE OUT COMPETING WEEDS.

5. INSPECT TREE SHELTERS AND STAKES TO ENSURE THEY ARE SOUND AND UPRIGHT. REMOVE DECOMPOSING SHELTERS AND PIECES. REMOVE TREE SHELTERS THAT HAVE BEEN SPLIT ALONG THE LASER LINE BY FAST-GROWING TREES.

6. MONITOR FOR DEER DAMAGE DURING ESTABLISHMENT YEARS. USE REPELLANT AS NEEDED.

7. ESTABLISH AN EMERGENCY DROUGHT WATERING PLAN FOR THE FIRST AND SECOND YEARS. IF NO WATERING IS PROVIDED, BE PREPARED TO RESEED BARE AREAS AND REPLACE DEAD OR DAMAGED TREES & SHRUBS IF LOSS IS 20% OR GREATER.

8. MONITOR AND REMOVE INVASIVE SPECIES IN ALL AREAS. IT IS RECOMMENDED THAT AN INVASIVE SPECIES EXPERT BE CONTRACTED FOR ANNUAL OR BIANNUAL VISITS TO ASSIST IN IDENTIFICATION AND ELIMINATION OF ANY LOCAL INFESTATIONS OF BIENNIAL OR PERENNIAL WEEDS OR INVASIVE WOODY SPECIES.

9. KEEP PHOTO RECORDS AND WRITTEN LOGS AS A RECORD OF SUCCESSES AND FAILURES OF PLANTING AND MANAGEMENT TECHNIQUES. TAKE PHOTOS WITHIN THE FIRST MONTH AFTER INSTALLATION ("BEFORE") AND ONCE EACH SEASON (FOUR TIMES ANNUALLY). TAKE PHOTOS FROM THE SAME LOCATION SO THAT CHANGES CAN BE COMPARED.

0 15 30 60

NORTH

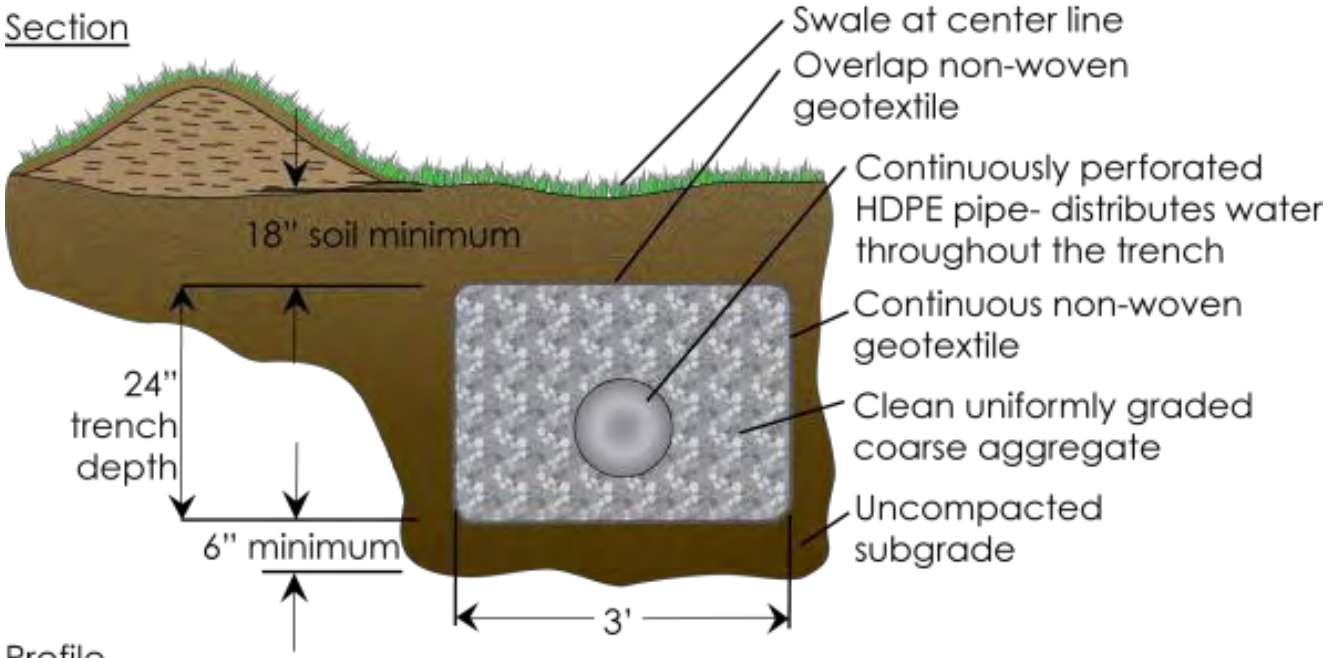
SCALE: 1" = 30'

CAHILL ASSOCIATES, INC. 104 SOUTH HIGH STREET WEST CHESTER, PA 19382	SCALE: AS NOTED APRIL 1, 2006	L2.0 MAINTENANCE PLAN
ROLF SAUER & PARTNERS, LTD. 3868 TERRACE STREET PHILADELPHIA, PA 19182 215-482-7973	EAST WHITELAND TOWNSHIP DETENTION BASIN RETROFIT AT SIDLEY RD. & THAYER RD.	

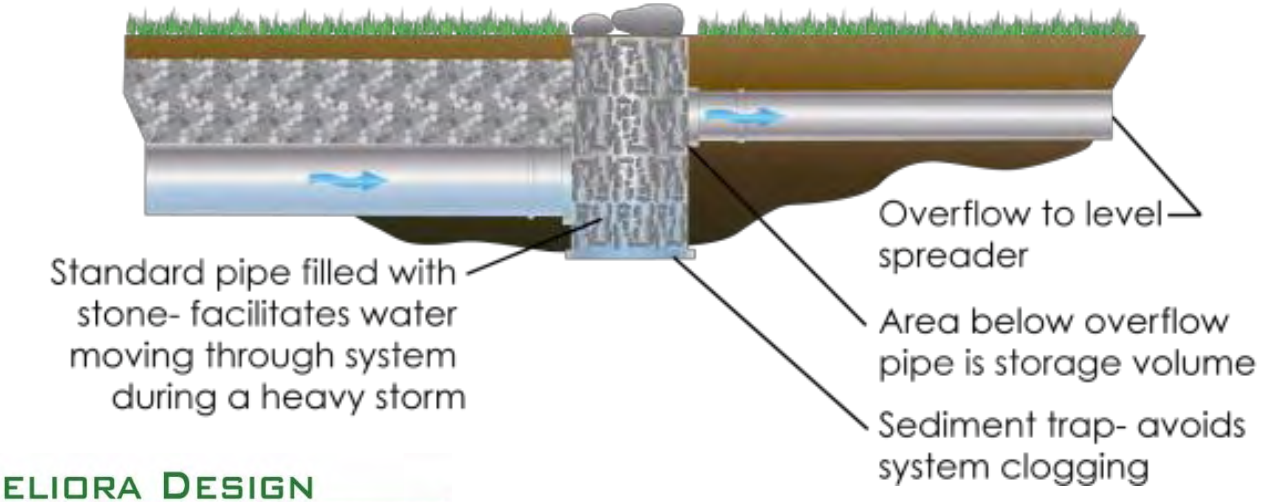
Pittsburgh GSI – Panther Hollow Park

Infiltration Trench

Section



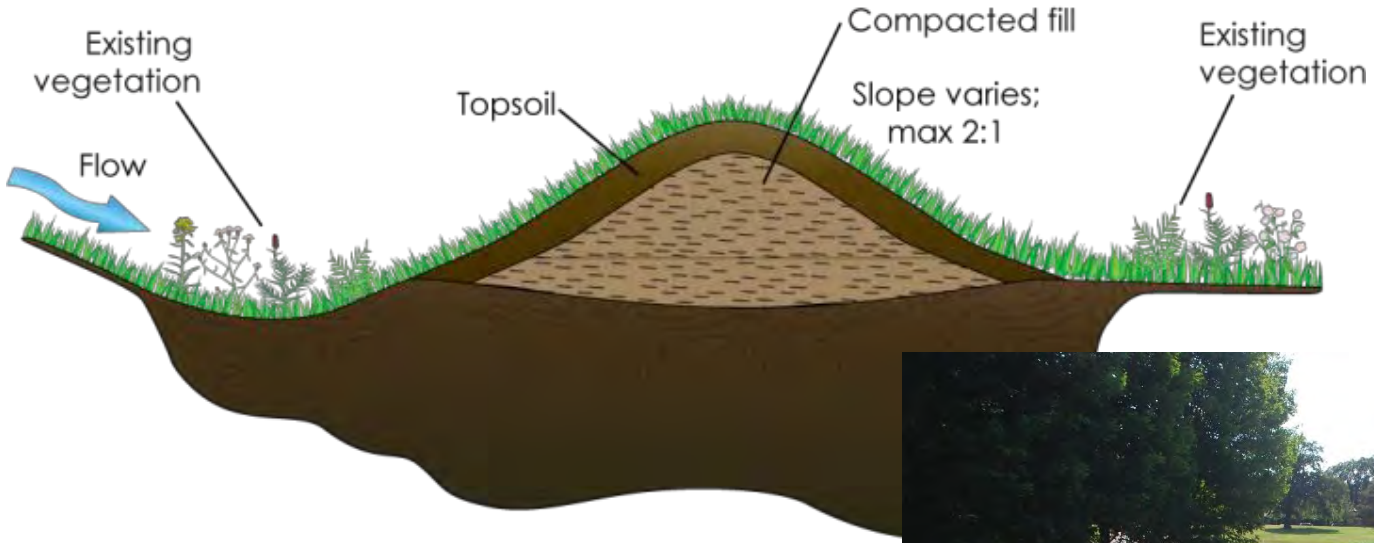
Profile



Infiltration Trench

Golf Course – Infiltration Berms

- Infiltration Berm – Reduces Runoff, Promotes Recharge
  - Allows runoff to naturally pond along the contour and infiltrate into the soil.



Washington D.C.

What's happening in Bartholdi Park?

Originally created in 1932, when the U.S. Botanic Garden (USBG) was moved to its current location, Bartholdi Park has served as a two-acre home demonstration garden for 84 years, but has not undergone a renovation since its construction.

The USBG and the Architect of the Capitol are renovating the park to include accessible pathways, improved access to the American Veterans Disabled for Life Memorial, increased safety via new lighting, improved stormwater collection, updated irrigation, new plantings, and restoration of the small fountain at the northwest corner.

Bartholdi Park will continue to have demonstration and educational gardens, featuring additional seating, native American plants, patio gardens, rain gardens, an edible garden, and accessible gardening areas. Many of the larger woody plants are being saved in place and much of the plant material will be used elsewhere at the USBG and on the grounds of the Library of Congress, the Supreme Court of the United States, and D.C. public schools.

Follow the progress of the renovation through construction fence windows and from across the street on the canopy walkway in The Tropics room of the Conservatory. We look forward to welcoming you to the renovated Bartholdi Park in 2016!

www.usbg.gov/bartholdi

Construction of Bartholdi Park 1932

United States Botanic Garden

Architect of the Capitol

Washington D.C. – USBG Bartholdi Park

- 95th Percentile = 1.7”
- Stormwater Credits
- SITES

Lancaster, PA

SAVE IT!

YOUR WATER. YOUR MONEY. YOUR CITY.

The U.S. Environmental Protection Agency enforces strict regulations on polluted stormwater. The City faces potential fines of up to $37,500 per day if we cannot show progress towards eliminating at least 750 million gallons of polluted water discharged into the Conestoga River. To recover the costs of services the City is mandated to provide, the City has adopted a stormater management fee—an equitable, fair and low-cost solution.

Revenue raised through the fee would be specifically dedicated to important infrastructure repairs and improvements that will not only help avoid Federal fines, but also make Lancaster a healthier and greener place to live.

Newly renovated Brandon Park Basketball courts and Parking lot

There are over 100,000 sq. feet of green roofs in Lancaster City.

Planning for Success

- Mapping
- Site Analysis
- Capital Projects are an opportunity for GI:
  - Sidewalk improvements
  - Intersection improvements
  - Water and sewer line work
- All municipal and public projects maximize GI (schools, parks, streets, etc.) are opportunities
- Public involvement early on
- Project tracking
- Maintenance Plans & Training

BRANDYWINE CONSERVANCY

MUNICIPAL SEPARATE STORM SEWER SYSTEM (MS4) REQUIREMENTS

BRANDYWINE CONSERVANCY

Municipal Stormwater Regulations

- National Pollutant Discharge Elimination System (NPDES)
  - 1990 - “Phase I” MS4 municipalities (medium and large, as defined by federal regulations) required to get NPDES permits
  - 1999 - “Phase II” MS4 municipalities (small municipalities in urbanized areas and other municipalities designated by the permitting authority) required to get NPDES permits

NPDES Requirements for Small MS4s

- The NPDES requires operators of Small MS4s to:
  - Apply for NPDES permit coverage (individual or general)
  - Develop a stormwater management program which includes the 6 minimum control measures
  - Implement the stormwater management program using appropriate stormwater management controls, or best management practices (BMPs)
  - Develop measurable goals for the program
  - Evaluate the effectiveness of the program.

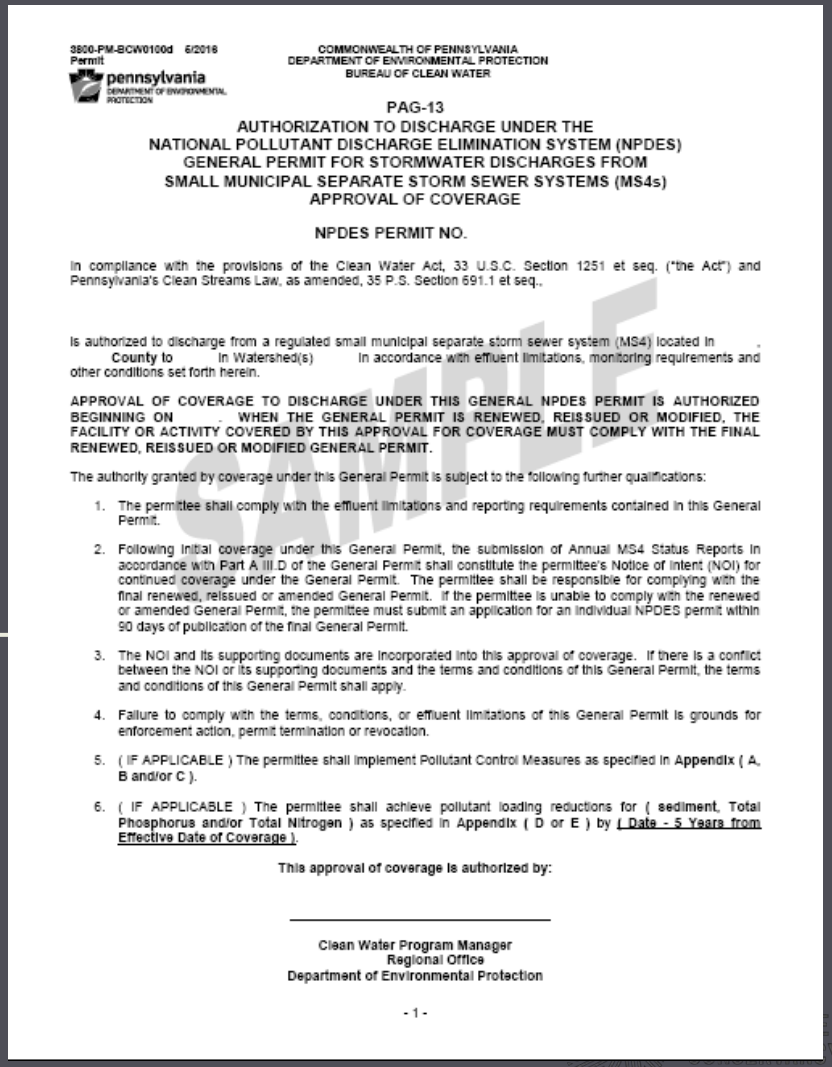
Six Minimum Control Measures (MCMs)

Operators of regulated small MS4s are required to include these 6 minimum control measures in their stormwater management programs:

1) Public Education and Outreach
2) Public Participation/Involvement
3) Illicit Discharge Detection and Elimination
4) Construction Site Runoff Control
5) Post-Construction Runoff Control
6) Pollution Prevention/Good Housekeeping

BRANDYWINE CONSERVANCY

NEW MS4 REGULATIONS FOR PA MUNICIPALITIES



3800-PM-BCW0100d 6/2016
Permit

pennsylvania
DEPARTMENT OF ENVIRONMENTAL PROTECTION

COMMONWEALTH OF PENNSYLVANIA
DEPARTMENT OF ENVIRONMENTAL PROTECTION
BUREAU OF CLEAN WATER

PAG-13
AUTHORIZATION TO DISCHARGE UNDER THE
NATIONAL POLLUTANT DISCHARGE ELIMINATION SYSTEM (NPDES)
GENERAL PERMIT FOR STORMWATER DISCHARGES FROM
SMALL MUNICIPAL SEPARATE STORM SEWER SYSTEMS (MS4s)
APPROVAL OF COVERAGE

NPDES PERMIT NO.

In compliance with the provisions of the Clean Water Act, 33 U.S.C. Section 1251 et seq. ("the Act") and Pennsylvania's Clean Streams Law, as amended, 35 P.S. Section 691.1 et seq.,

Is authorized to discharge from a regulated small municipal separate storm sewer system (MS4) located in , County to In Watershed(s) In accordance with effluent limitations, monitoring requirements and other conditions set forth herein.

APPROVAL OF COVERAGE TO DISCHARGE UNDER THIS GENERAL NPDES PERMIT IS AUTHORIZED BEGINNING ON . WHEN THE GENERAL PERMIT IS RENEWED, REISSUED OR MODIFIED, THE FACILITY OR ACTIVITY COVERED BY THIS APPROVAL FOR COVERAGE MUST COMPLY WITH THE FINAL RENEWED, REISSUED OR MODIFIED GENERAL PERMIT.

The authority granted by coverage under this General Permit is subject to the following further qualifications:

1. The permittee shall comply with the effluent limitations and reporting requirements contained in this General Permit.
2. Following initial coverage under this General Permit, the submission of Annual MS4 Status Reports in accordance with Part A III.D of the General Permit shall constitute the permittee's Notice of Intent (NOI) for continued coverage under the General Permit. The permittee shall be responsible for complying with the final renewed, reissued or amended General Permit. If the permittee is unable to comply with the renewed or amended General Permit, the permittee must submit an application for an individual NPDES permit within 90 days of publication of the final General Permit.
3. The NOI and its supporting documents are incorporated into this approval of coverage. If there is a conflict between the NOI or its supporting documents and the terms and conditions of this General Permit, the terms and conditions of this General Permit shall apply.
4. Failure to comply with the terms, conditions, or effluent limitations of this General Permit is grounds for enforcement action, permit termination or revocation.
5. (IF APPLICABLE) The permittee shall implement Pollutant Control Measures as specified in **Appendix** (A, B and/or C).
6. (IF APPLICABLE) The permittee shall achieve pollutant loading reductions for (**sediment**, Total Phosphorus and/or Total Nitrogen) as specified in Appendix (D or E) by (Date - 5 Years from Effective Date of Coverage).

This approval of coverage is authorized by:

Clean Water Program Manager
Regional Office
Department of Environmental Protection

- 1 -

SAMPLE

PA DEP MS4 Requirements Table

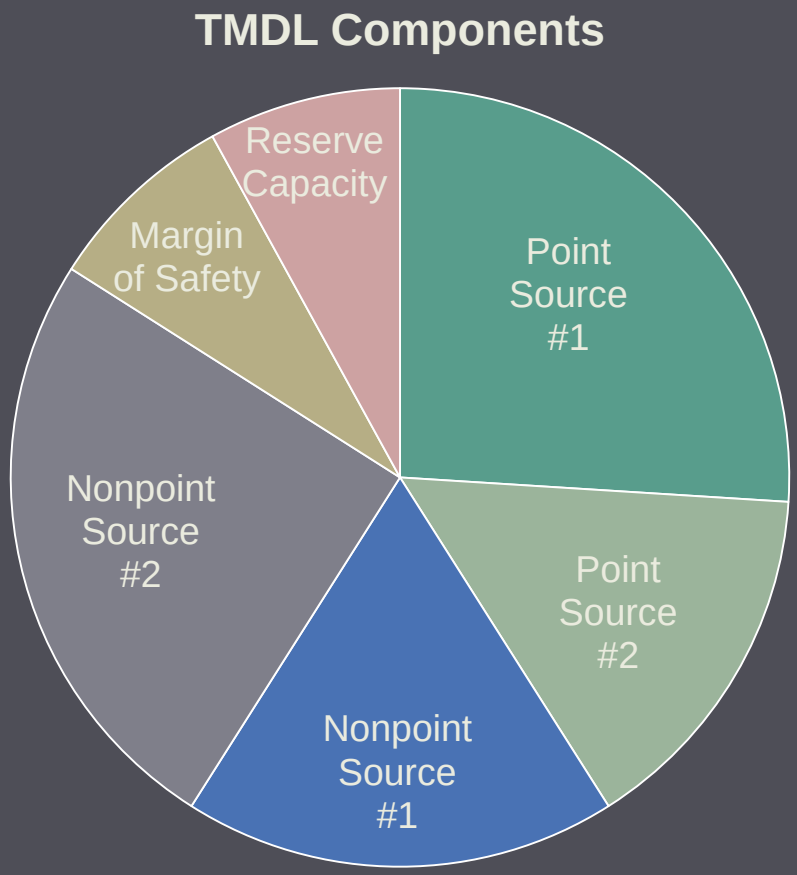
MS4 Name	NPDES ID	Individual Permit Required?	Reason	Impaired Downstream Waters or Applicable TMDL Name	Requirement(s)	Other Cause(s) of Impairment
Chester County						
DOWNINGTOWN BORO	PAG130140	No		Beaver Creek		Cause Unknown (4a), Other Habitat Alterations, Water/Flow Variability (4c)
				East Branch Brandywine Creek		Cause Unknown (4a), Other Habitat Alterations, Water/Flow Variability (4c)
EAST BRADFORD TWP	PAI130523	Yes	TMDL Plan, SP, IP	Plum Run		Water/Flow Variability (4c)
				Valley Creek	Appendix C-PCB (4a), Appendix B-Pathogens (5), Appendix E-Siltation (5)	Cause Unknown (5), Other Habitat Alterations, Water/Flow Variability (4c)
				Blackhorse Run		Other Habitat Alterations, Water/Flow Variability (4c)
				Broad Run		Water/Flow Variability (4c)
				Christina River Basin Sediment	TMDL Plan-Siltation, Suspended Solids (4a)	
				Taylor Run		Other Habitat Alterations (4c)
				Unnamed Tributaries to East Branch Brandywine Creek		Other Habitat Alterations (4c)
				East Branch Brandywine Creek		Cause Unknown (4a), Water/Flow Variability (4c)
EAST BRANDYWINE TWP	PAI130524	Yes	SP, IP	Unnamed Tributaries to Beaver Creek	Appendix E-Siltation (4a)	
				Beaver Creek		Cause Unknown (4a), Other Habitat Alterations, Water/Flow Variability (4c)
				Culbertson Run	Appendix E-Siltation (4a)	Other Habitat Alterations (4c)
				East Branch Brandywine Creek		Cause Unknown (4a), Other Habitat Alterations, Water/Flow Variability (4c)

PA DEP MS4 Requirements Table

MS4 Name	NPDES ID	Individual Permit Required?	Reason	Impaired Downstream Waters or Applicable TMDL Name	Requirement(s)	Other Cause(s) of Impairment
NEW GARDEN TWP	PAI130516	Yes	TMDL Plan, SP, IP	East Branch White Clay Creek	Appendix B-Pathogens (5)	
				Egypt Run	Appendix B-Pathogens (5)	
				Bucktoe Creek	Appendix C-PCB (4a)	
				Christina River Basin Sediment	TMDL Plan-Siltation, Suspended Solids (4a)	
				Christina River Basin Nutrients	TMDL Plan-Nutrients, Organic Enrichment/Low D.O. (4a)	
				White Clay Creek	Appendix B-Pathogens (5)	
				Trout Run	Appendix C-Pesticides (4a)	
				Broad Run	Appendix B-Pathogens (5)	Water/Flow Variability (4c)
				West Branch Red Clay Creek	Appendix C-PCB (4a)	
				Walnut Run	Appendix B-Pathogens (5)	Water/Flow Variability (4c)
				Unnamed Tributaries to East Branch White Clay Creek		Other Habitat Alterations (4c)
				Red Clay Creek	Appendix C-PCB (4a)	
NEW LONDON TWP	PAI130526	Yes	TMDL Plan, SP, IP	White Clay Creek	Appendix B-Pathogens (5)	
				West Branch White Clay Creek	Appendix B-Pathogens (5)	
				Middle Branch White Clay Creek	Appendix B-Pathogens (5)	
				East Branch Big Elk Creek	Appendix E-Organic Enrichment/Low D.O. (5)	
				Christina River Basin Nutrients	TMDL Plan-Nutrients, Organic Enrichment/Low D.O. (4a)	
				Chesapeake Bay Nutrients/Sediment	Appendix D-Nutrients, Siltation (4a)	
				Christina River Basin Sediment	TMDL Plan-Siltation, Suspended Solids (4a)	

What is a TMDL?

- Total Maximum Daily Load
- EPA - “a calculation of the maximum amount of a pollutant that a waterbody can receive and still meet water quality standards”
- Pollution diet
- TMDLs provide EPA and states with a mechanism to address pollution from both point and nonpoint sources.



BRANDYWINE CONSERVANCY

Example Allocations for the Christina Basin Sediment TMDL

Subbasin	Total Baseline Load (ton/day)	Total TMDL Allocation (ton/day)	Percent Reduction (%)	% of TMDL Allocated to MS4s
Brandywine Creek	23.19	12.16	47.6%	78.8%
White Clay Creek	105.95	46.93	55.7%	88.0%
Red Clay Creek	60.16	30.17	49.9%	91.4%
Total	**189.31**	**89.26**	**52.9%**	**87.9%**

TMDL Plans

- Explains how the municipality plans to reduce stormwater pollution consistent with WLA requirements
- For the current permit cycle, it may be submitted in two parts:
  - TMDL Strategy (due at time of application – already submitted)
  - TMDL Design Details (due one year after permit application is approved)
- Next permit cycle (2017 application), TMDL Plans are expected to be submitted in a single step with the permit application.

Pollutant Reduction Plans (PRPs)

- PRP is a planning document that is designed to guide BMP selection in a manner that will reduce pollutant loading to impaired waters.
- Describe expected municipal upgrades and look for opportunities to implement BMPs that will reduce sediment and nutrient pollution to affected water body by 10% and 5% over the 5-year permit term.
- For next permit cycle, DEP proposes that the following municipalities will be required to submit PRPs:
  - Municipalities that discharge to waters impaired by nutrients and/or sediment without a TMDL
  - Municipalities that discharge to Special Protection Waters (HQ/EV)

Multi-Municipal Collaboration for MS4s

- PA DEP allows for municipalities to work together on meeting pollution reductions
- Drivers
  - NPDES/PA DEP Municipal Stormwater Requirements
  - Challenges to addressing impaired streams
  - Local economic/resource limitations
  - Existing multi-municipal planning initiatives and collaboration
  - Local champion/coordinating organization
  - Public pressure
- Examples – York County, Wissahickon Watershed, Christina Watersheds Partnership, Oxford Region

BRANDYWINE CONSERVANCY

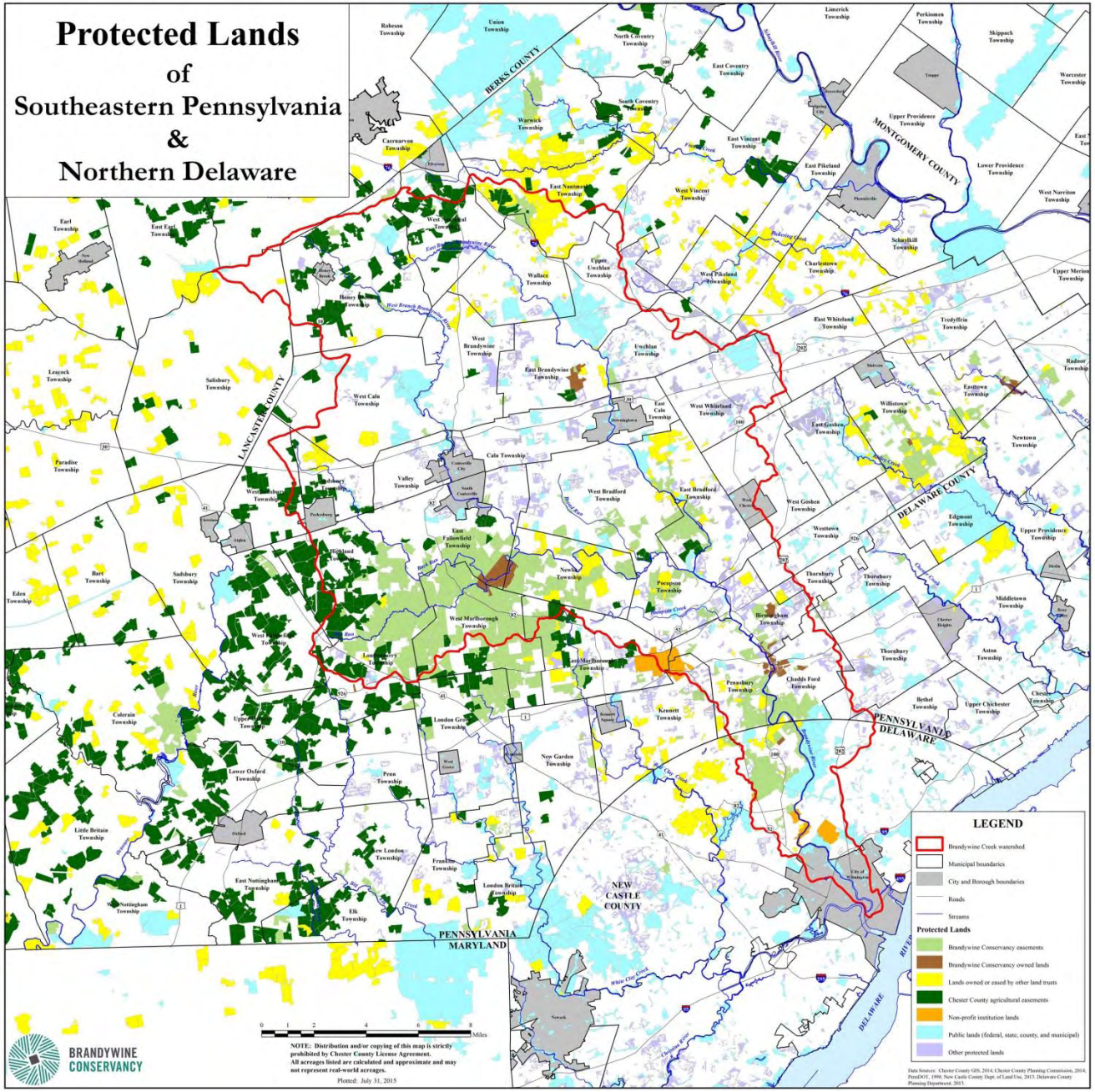
The Brandywine Conservancy

Our Mission is:

To conserve the natural and cultural resources of the Brandywine watershed and other selected areas with a primary emphasis on water quality and quantity of the Brandywine watershed.

BRANDYWINE CONSERVANCY

Photo by Chuck Bowers



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Resource Protection Tools

Comprehensive Plan

Zoning Ordinance

- Ag. Preservation
- Conservation Design
- Natural Resource Protection
- Timber Harvesting
- Transferable Development Rights
- Renewable Energy

Subdivision & Land Development Ordinance

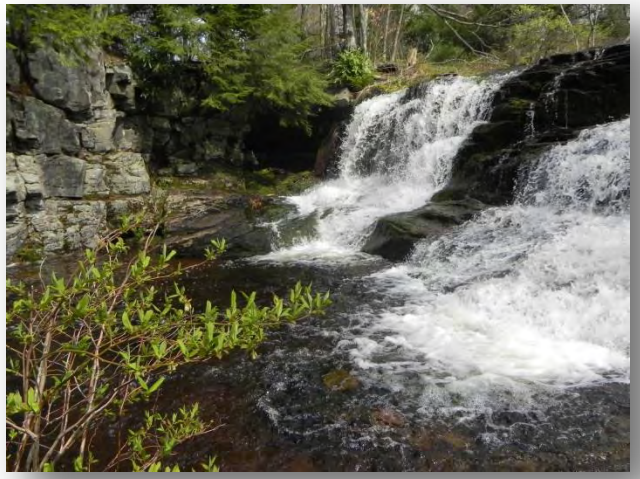
- Existing Resources and Site Analysis
- Sketch Plan
- Site Visit
- Erosion & Sedimentation
- Low Impact Development Standards
- Public Land Dedication or Fee In-Lieu

Stormwater Ordinance

- Site Design
- Best Management Practices

Official Map

- Right of first refusal



BRANDYWINE CONSERVANCY

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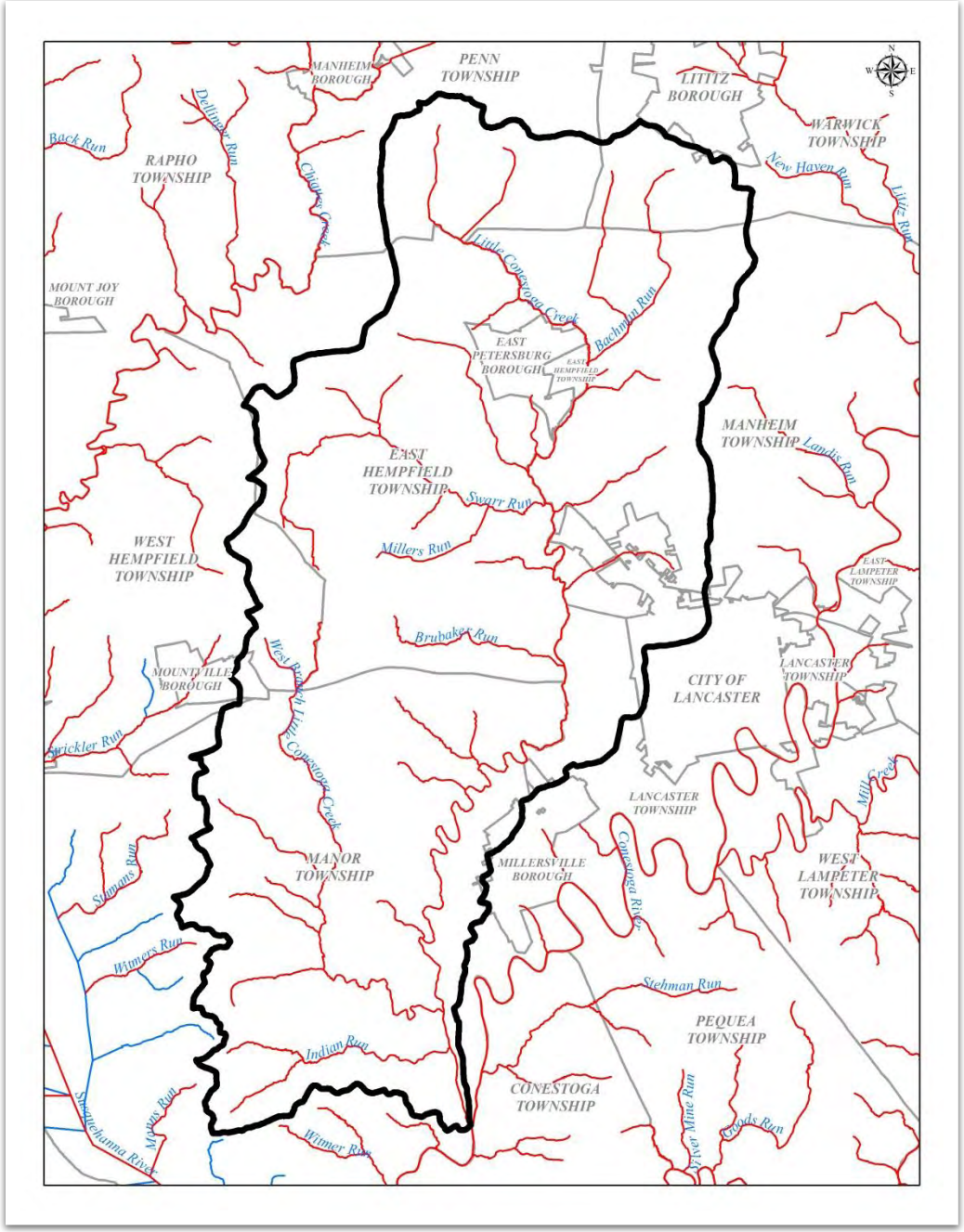
LITTLE CONESTOGA WATERSHED (LANCASTER COUNTY, PA)

Municipal Ordinances to Address Stormwater and Promote GSI

BRANDYWINE CONSERVANCY

Little Conestoga Watershed



BRANDYWINE CONSERVANCY

Little Conestoga Watershed – Community Watershed Approach

- Local Partnership Efforts
  - Little Conestoga Watershed Alliance formed (2000)
  - Watershed Assessment and Restoration Plan (2003)
  - Lancaster County Clean Water Consortium (2010)
- NFWF Grant Awarded in 2012 to Conservation Foundation of Lancaster County
  - Work proceeded 2012-2015
- Little Conestoga Partnership:
  - Alliance of the Chesapeake Bay, Brandywine Conservancy, Chesapeake Bay Foundation, Habitat MT, Lancaster Area Sewer Authority, Lancaster Clean Water Consortium, Lancaster County Conservancy, Lancaster County Conservation District, Lancaster county Planning Commission, Little Conestoga Watershed Alliance, Penn State University, PA Landscape and Nursery Association, PADEP, PA DCNR

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Little Conestoga Partnership
Municipal Assistance

- Municipal Team – worked with interested municipalities to demonstrate municipal tools to address stormwater from future development
- Tools to Address Stormwater from New Development
  - Aligning SALDO, zoning ordinance provisions (site planning process)
  - More stringent stormwater ordinance provisions
  - Assessments for 4 municipalities (Manor, Mannheim, **Penn**, and **West Hempfield** Townships)
  - Toolboxes developed for 2 Little Conestoga municipalities
- Challenges include “ordinance fatigue”

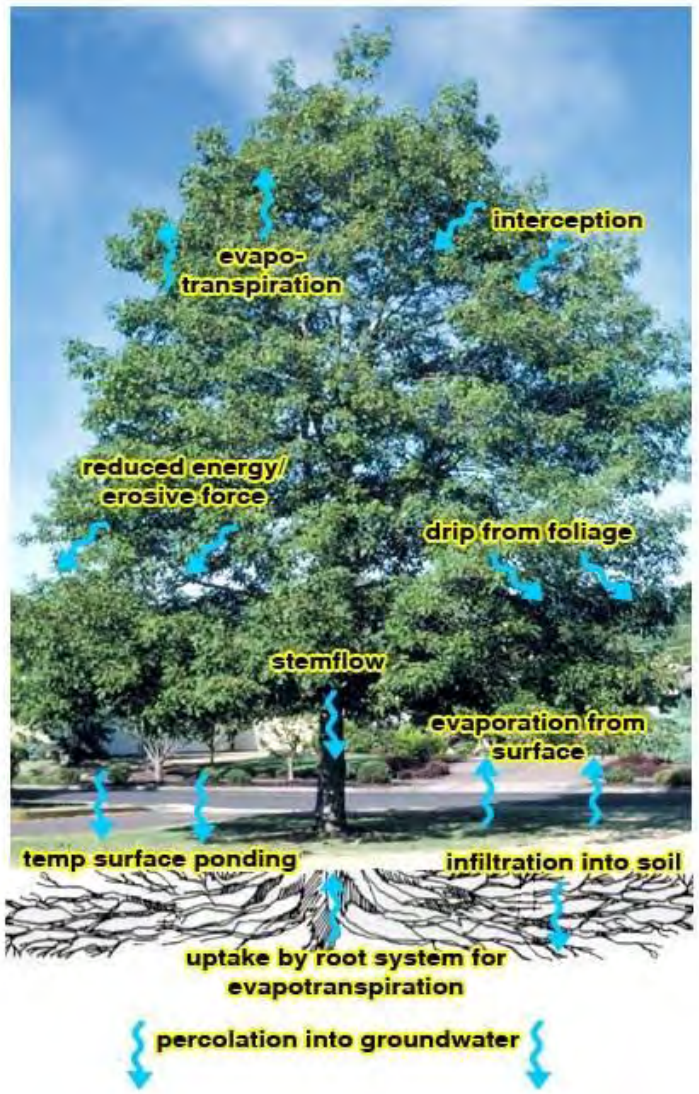
BRANDYWINE CONSERVANCY

BRANDYWINE CONSERVANCY

RIPARIAN BUFFER PROTECTION THROUGH ORDINANCES

BRANDYWINE CONSERVANCY

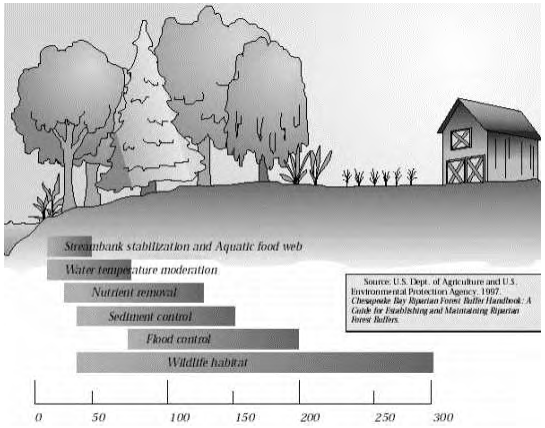
Trees as THE Best Management Practice



BRANDYWINE CONSERVANCY

Buffer Width

Riparian Buffer Zones: Functions and Recommended Widths (Ellen Hawes and Markelle Smith, Yale School of Forestry, April 2005)



- Lots of data showing lots of things, depending on study structure….

• Erosion control	30 to 98 feet
• Water quality	
• Nutrients	49 to 164 feet
• Pesticides	49 to 328 feet
• Biocontaminants (fecal, etc.)	30 feet or more
• Aquatic habitat	
• Wildlife	33 to 164 feet
• Litter/debris	50 to 100 feet
• Temperature	30 to 230 feet
• Terrestrial habitat	15 to 330 feet

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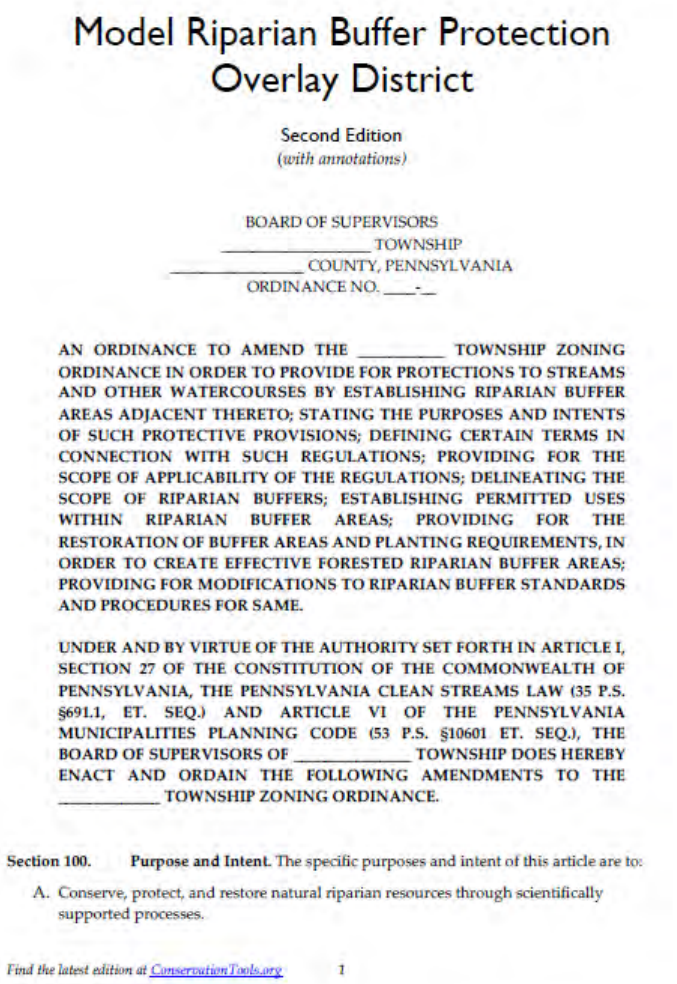
So….municipalities can get tough on protection!

- Within a Zoning Ordinance
  - Overlay district
  - Protection standards
- Within a SALDO
  - Design standards
- Within a Stormwater Ordinance
  - Riparian buffer requirements



Model Riparian Buffer Protection Overlay District

Second Edition
(with annotations)

BOARD OF SUPERVISORS
_____ TOWNSHIP
_____ COUNTY, PENNSYLVANIA
ORDINANCE NO. ____-__

AN ORDINANCE TO AMEND THE _____ TOWNSHIP ZONING ORDINANCE IN ORDER TO PROVIDE FOR PROTECTIONS TO STREAMS AND OTHER WATERCOURSES BY ESTABLISHING RIPARIAN BUFFER AREAS ADJACENT THERETO; STATING THE PURPOSES AND INTENTS OF SUCH PROTECTIVE PROVISIONS; DEFINING CERTAIN TERMS IN CONNECTION WITH SUCH REGULATIONS; PROVIDING FOR THE SCOPE OF APPLICABILITY OF THE REGULATIONS; DELINEATING THE SCOPE OF RIPARIAN BUFFERS; ESTABLISHING PERMITTED USES WITHIN RIPARIAN BUFFER AREAS; PROVIDING FOR THE RESTORATION OF BUFFER AREAS AND PLANTING REQUIREMENTS, IN ORDER TO CREATE EFFECTIVE FORESTED RIPARIAN BUFFER AREAS; PROVIDING FOR MODIFICATIONS TO RIPARIAN BUFFER STANDARDS AND PROCEDURES FOR SAME.

UNDER AND BY VIRTUE OF THE AUTHORITY SET FORTH IN ARTICLE I, SECTION 27 OF THE CONSTITUTION OF THE COMMONWEALTH OF PENNSYLVANIA, THE PENNSYLVANIA CLEAN STREAMS LAW (35 P.S. §691.1, ET. SEQ.) AND ARTICLE VI OF THE PENNSYLVANIA MUNICIPALITIES PLANNING CODE (53 P.S. §10601 ET. SEQ.), THE BOARD OF SUPERVISORS OF _____ TOWNSHIP DOES HEREBY ENACT AND ORDAIN THE FOLLOWING AMENDMENTS TO THE _____ TOWNSHIP ZONING ORDINANCE.

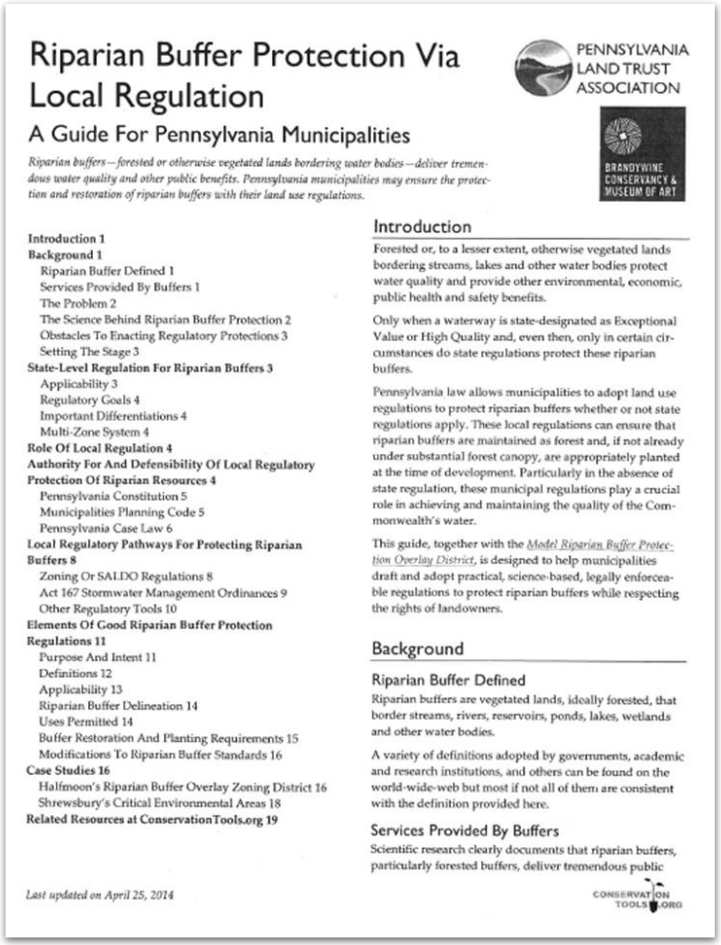
Section 100. Purpose and Intent. The specific purposes and intent of this article are to:

A. Conserve, protect, and restore natural riparian resources through scientifically supported processes.

Find the latest edition at ConservationTools.org 1

BRANDYWINE CONSERVANCY

Guidance for Pennsylvania's Municipalities



Riparian Buffer Protection Via Local Regulation

PENNSYLVANIA LAND TRUST ASSOCIATION

BRANDYWINE CONSERVANCY & MUSEUM OF ART

A Guide For Pennsylvania Municipalities

Riparian buffers—forested or otherwise vegetated lands bordering water bodies—deliver tremendous water quality and other public benefits. Pennsylvania municipalities may ensure the protection and restoration of riparian buffers with their land use regulations.

Introduction

Forested or, to a lesser extent, otherwise vegetated lands bordering streams, lakes and other water bodies protect water quality and provide other environmental, economic, public health and safety benefits.

Only when a waterway is state-designated as Exceptional Value or High Quality and, even then, only in certain circumstances do state regulations protect these riparian buffers.

Pennsylvania law allows municipalities to adopt land use regulations to protect riparian buffers whether or not state regulations apply. These local regulations can ensure that riparian buffers are maintained as forest and, if not already under substantial forest canopy, are appropriately planted at the time of development. Particularly in the absence of state regulation, these municipal regulations play a crucial role in achieving and maintaining the quality of the Commonwealth's water.

This guide, together with the *Model Riparian Buffer Protection Overlay District*, is designed to help municipalities draft and adopt practical, science-based, legally enforceable regulations to protect riparian buffers while respecting the rights of landowners.

Background

Riparian Buffer Defined

Riparian buffers are vegetated lands, ideally forested, that border streams, rivers, reservoirs, ponds, lakes, wetlands and other water bodies.

A variety of definitions adopted by governments, academic and research institutions, and others can be found on the world-wide-web but most if not all of them are consistent with the definition provided here.

Services Provided By Buffers

Scientific research clearly documents that riparian buffers, particularly forested buffers, deliver tremendous public

Last updated on April 25, 2014

CONSERVATION TOOLS.ORG

A Scientific Foundation for Shaping Riparian Buffer Protection Regulations

PENNSYLVANIA LAND TRUST ASSOCIATION

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Extensive scientific research documents that vegetated strips of land along water bodies provide extensive water quality and other environmental benefits. The science shows that development should be kept away from the water's edge, wider protected strips provide greater benefits, forested buffers are more effective than grassy ones, and forested buffers in headwaters provide the greatest benefits of all.

Overview

Summary

Scientific research has strongly established the harm to water quality, the increased flooding and the damage to the ecosystem that results from failure to protect riparian buffers. This guide identifies the key scientifically grounded principles that municipalities should follow when developing riparian buffer protection regulations.

Pennsylvania's streams, rivers, wetlands, and other natural water bodies are a major part of our state's "life blood" and at one time, virtually all were in a naturally forested landscape that contributed to their high quality. Riparian buffers, particularly when forested, effectively prevent non-source pollutants from degrading these resources. Extensive scientific research documents that undisturbed, vegetated buffers provide extensive water quality and other environmental benefits. New research shows an even higher ecological value of riparian buffers in headwaters, or first-order streams that should be protected from disturbance or degradation. As explained in later sections, headwater streams are primary food/fuel production areas and have been found to be essential to the health of the entire aquatic system.

Conservation Impact

- Riparian buffers, particularly forested buffers, have been documented to provide the following conservation benefits: prevent stream bank erosion; protect natural stream morphology (i.e., broad meanders with maximum stream bottom habitat); remove excess nitrogen, phosphorus and sediment from surface water runoff; reduce downstream flooding; provide thermal protection to adjoining streams, wetlands, and water bodies; provide food and habitat for wildlife; provide food and habitat for fish and amphibians; form corridors for habitat conservation and greenways; and protect associated wetlands.
- Forested riparian buffers in headwaters (first-order streams) generate high levels of organic inputs directly from land to water, which in turn maximize in-stream processing functions that provide the "fuel" needed for downstream energy and nutrient processing.

Riparian Buffer Defined

Riparian buffers are vegetated lands, ideally forested, that border streams, rivers, reservoirs, ponds, lakes, and wetlands. Riparian buffers provide an array of valuable ecological functions (often termed "eco-services") and are critical natural resources worthy of both public and private landowner protection efforts. Riparian buffers effectively intercept non-point source pollutants carried by surface water runoff or groundwater from adjoining land uses, preventing these pollutants from reaching water bodies. Forested buffers, in particular, minimize erosion of stream- or river-banks, help to control stream temperature fluctuations and elevated temperatures harmful to aquatic life, provide food and habitat for wildlife, fish and amphibians, allow for wildlife movement within stream or river corri-

Last updated on May 16, 2014

Pennsylvania Land Trust Association (PALTA) and the Brandywine Conservancy – www.ConservationTools.org.

BRANDYWINE CONSERVANCY

Contents

- *Purpose and Intent*
- *Definitions*
- *Applicability*
- *Riparian Buffer Delineation*
- *Uses Permitted*
- *Buffer Restoration and Planting Requirements*
- *Modifications to Riparian Buffer Standards*

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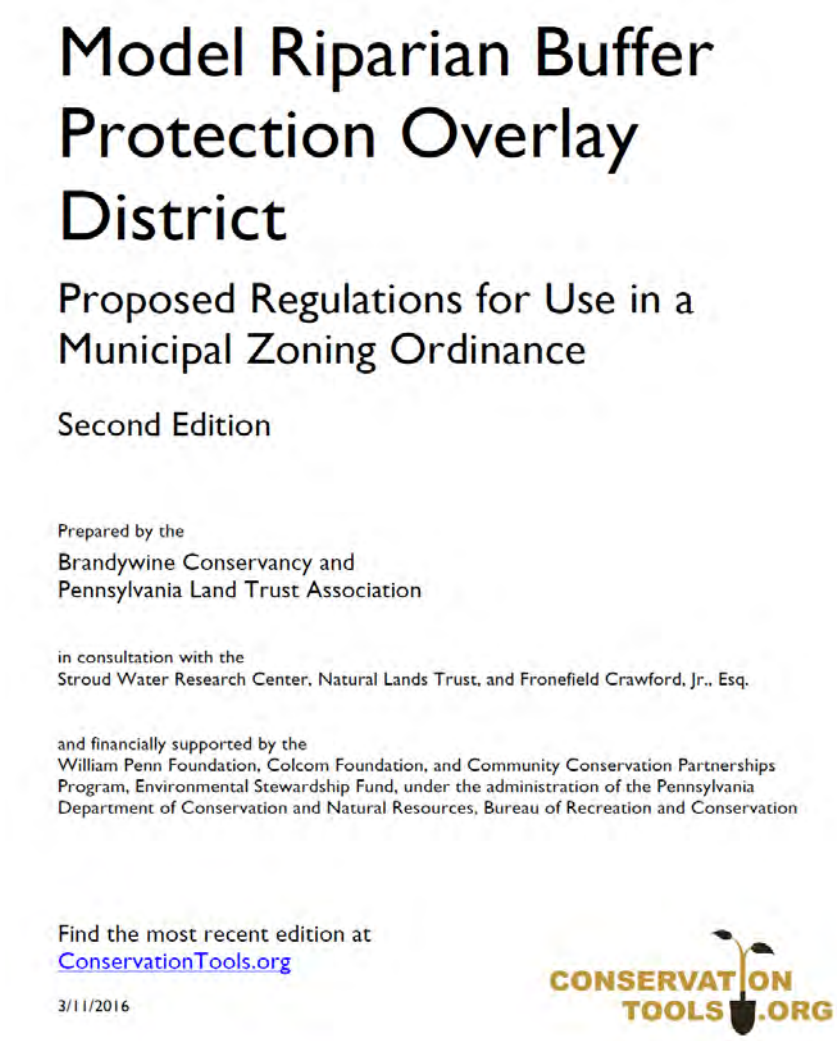


Model Riparian Buffer Protection Overlay District

Proposed Regulations for Use in a Municipal Zoning Ordinance

Second Edition

Prepared by the
Brandywine Conservancy and
Pennsylvania Land Trust Association

in consultation with the
Stroud Water Research Center, Natural Lands Trust, and Fronefield Crawford, Jr., Esq.

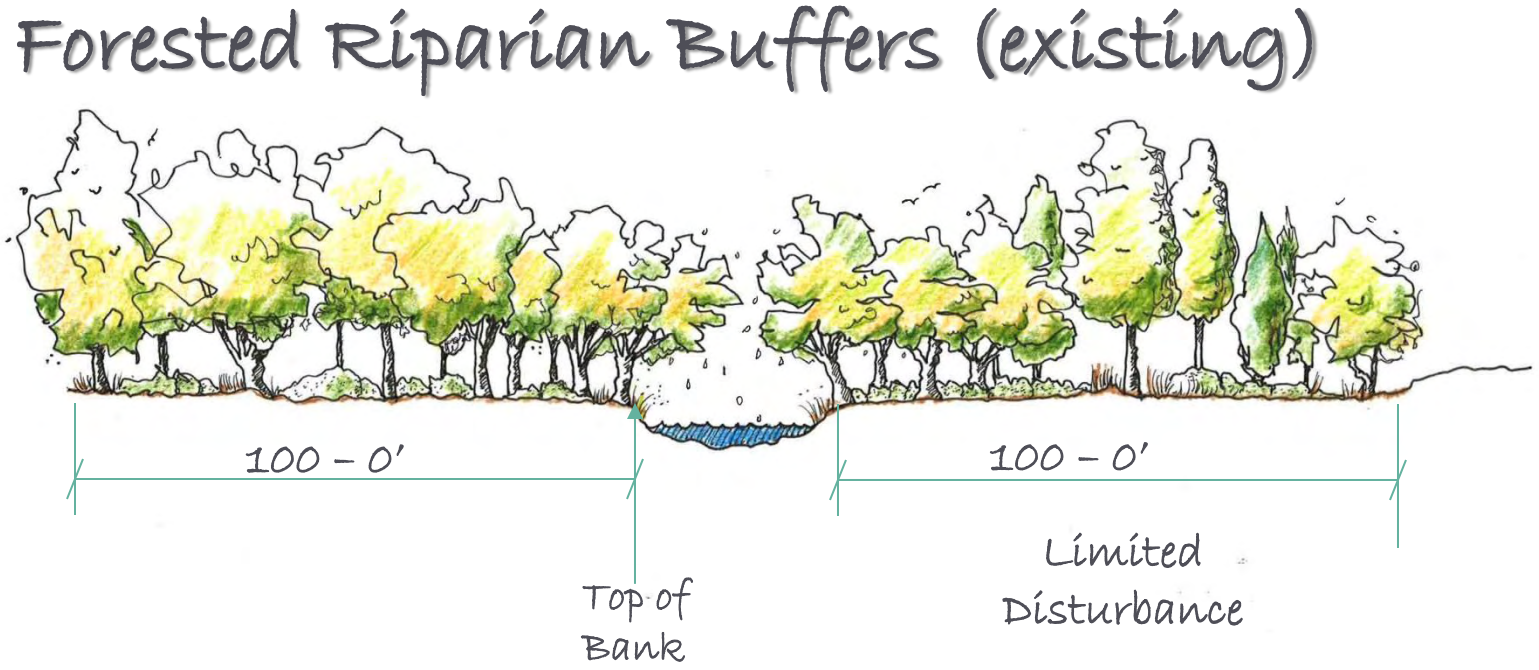
and financially supported by the
William Penn Foundation, Colcom Foundation, and Community Conservation Partnerships Program, Environmental Stewardship Fund, under the administration of the Pennsylvania Department of Conservation and Natural Resources, Bureau of Recreation and Conservation

Find the most recent edition at
ConservationTools.org

3/11/2016

CONSERVATION TOOLS .ORG

Preserves existing riparian buffers



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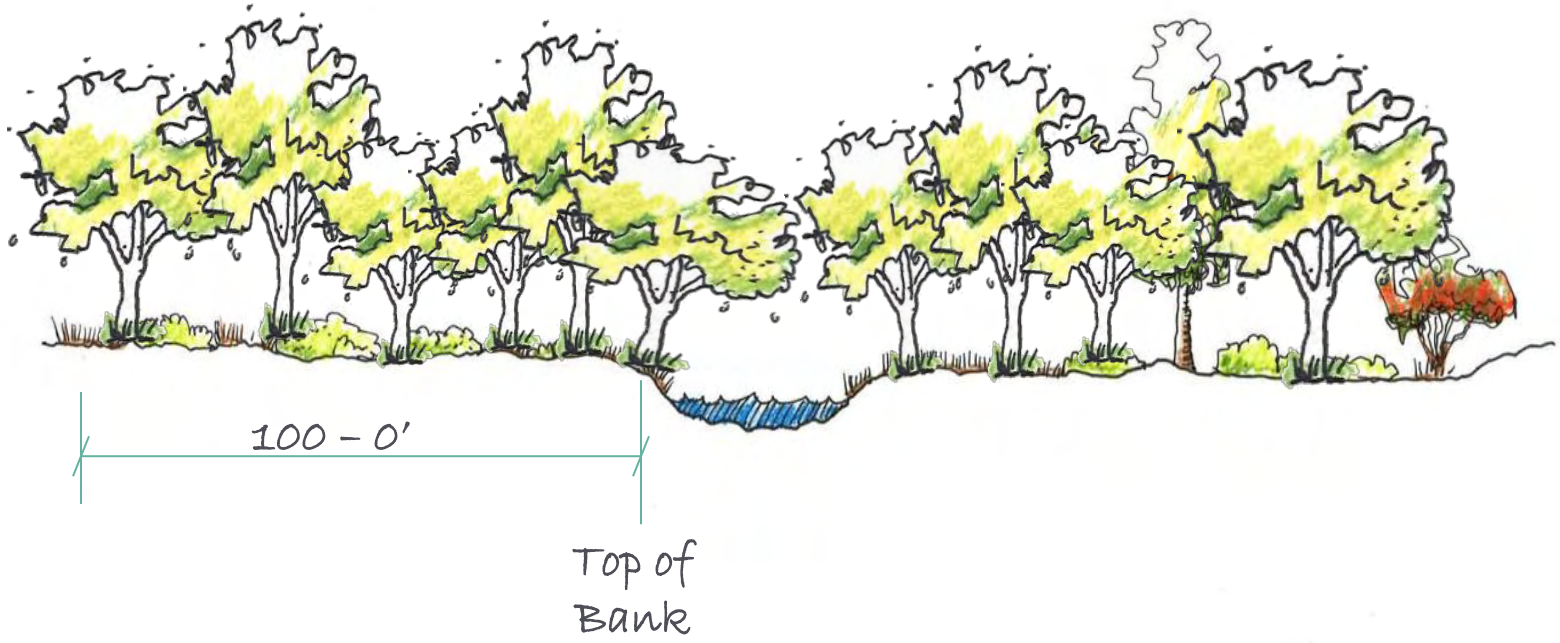
Minimum of 60% native tree canopy in riparian buffer

Impacted Riparian Buffer (Existing)



Restoration to minimum 60% native tree canopy in riparian buffer

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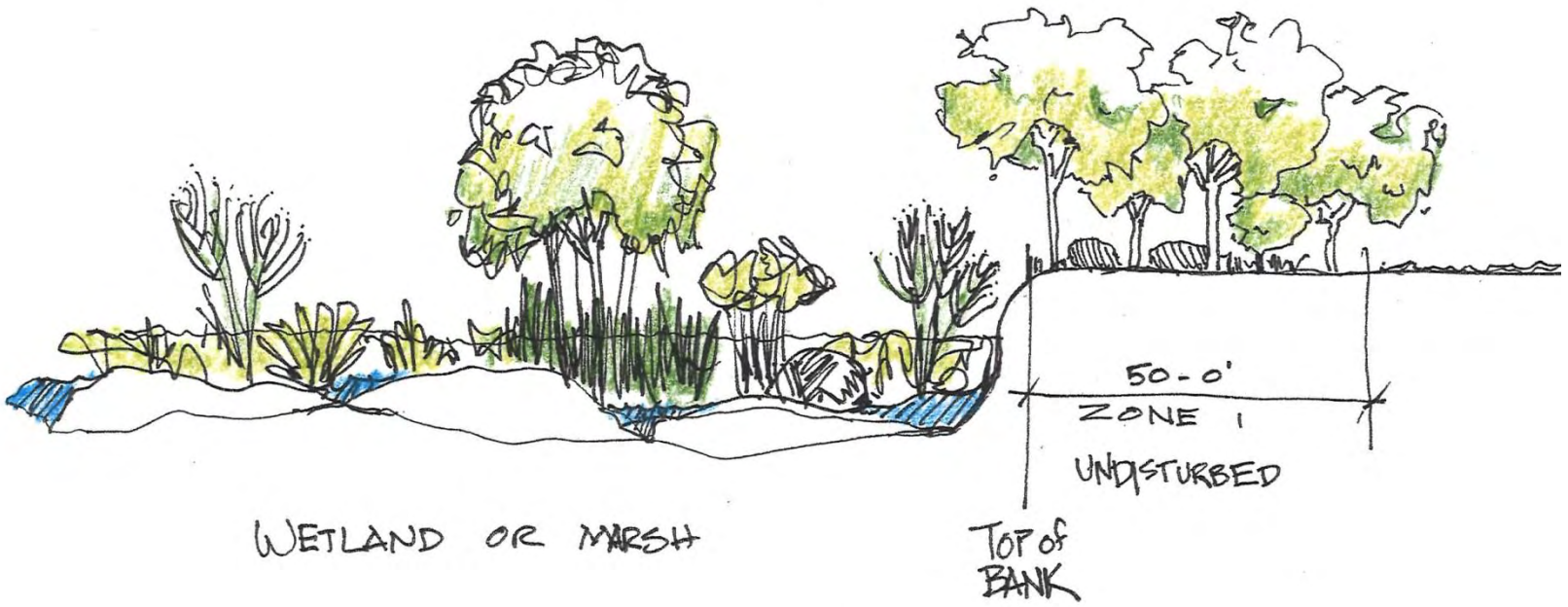
Restores impacted riparian buffers

CONSERVANCY MODEL APPLIES TO WETLANDS



AND CAN BE MODIFIED FOR WIDE FLOODPLAINS AND STEEP SLOPES.

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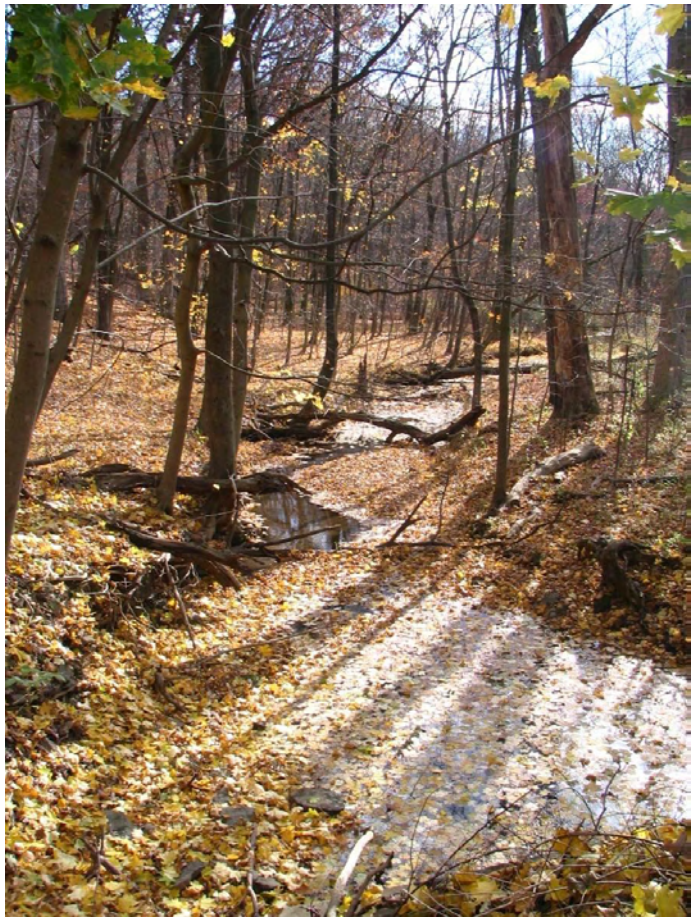
Modifications to Buffer Requirements

- Municipalities can get tough on protection provided…
  - A “safety valve” exists for unique/unforeseen circumstances
- Simpler modification process proposed
  - Requested at the time of conditional use, special exception, or variance approval, or subdivision or land development approval
  - Limited to minimum adjustment necessary to allow relief while adhering to riparian buffer purposes



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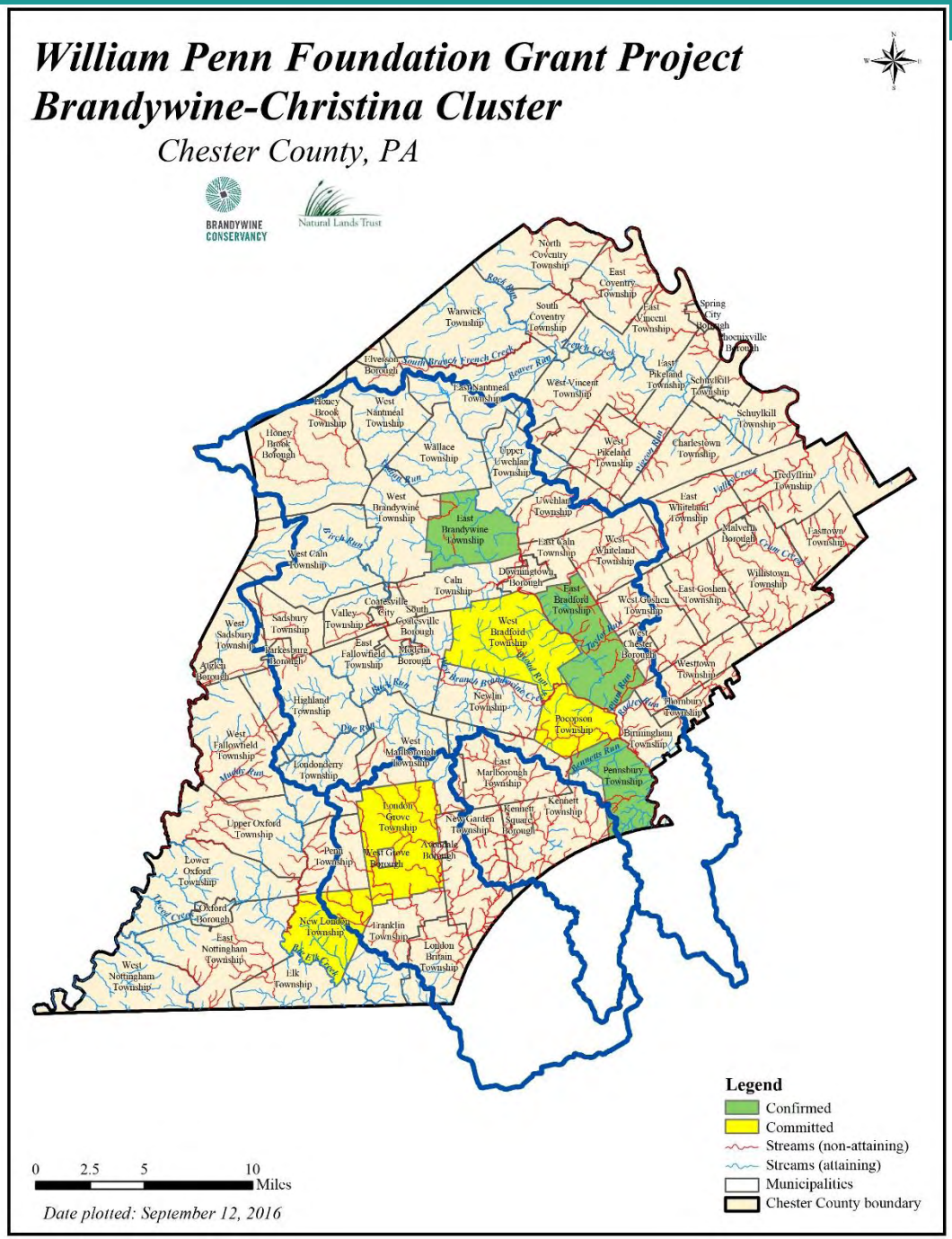
Riparian Buffer Ordinance Adoption

3 Confirmed

- *East Bradford*
- *East Brandywine*
- *Pennsbury*

4 In Process

- *London Grove*
- *Pocopson*
- *West Bradford*
- *New London*



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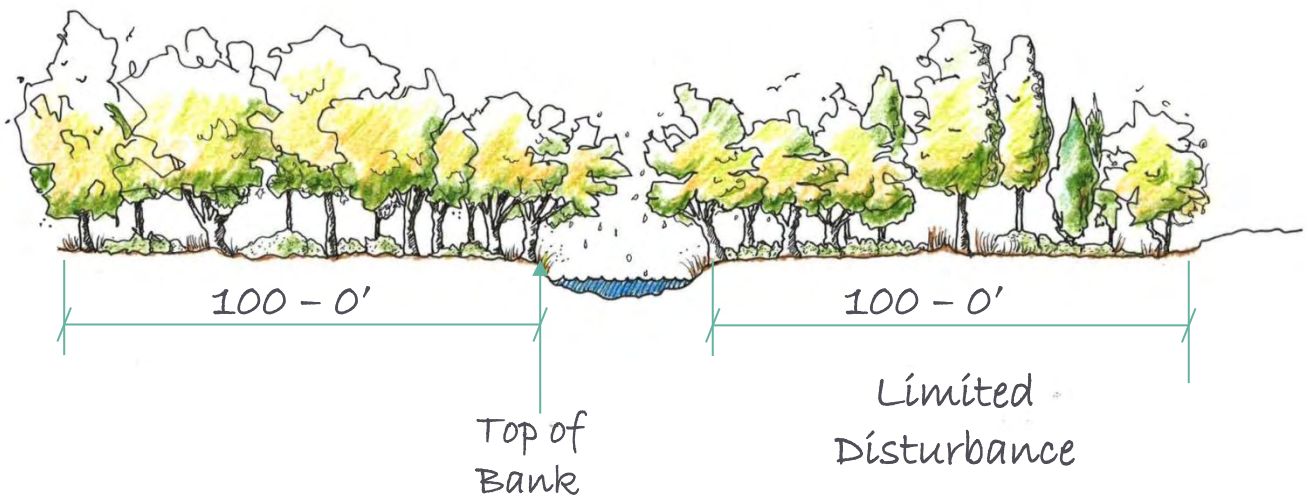
A Few Observations

- The minimum forested buffer width could be larger (or smaller)
- Should avoid terms such as “special protection waters” or “impaired streams” in ordinance
- Regulation of agricultural uses is very difficult from practical, political, and pre-emption perspectives
- Requiring restoration is a legitimate use of regulatory powers
- Seek MS4/TMDL credit for ordinance implementation



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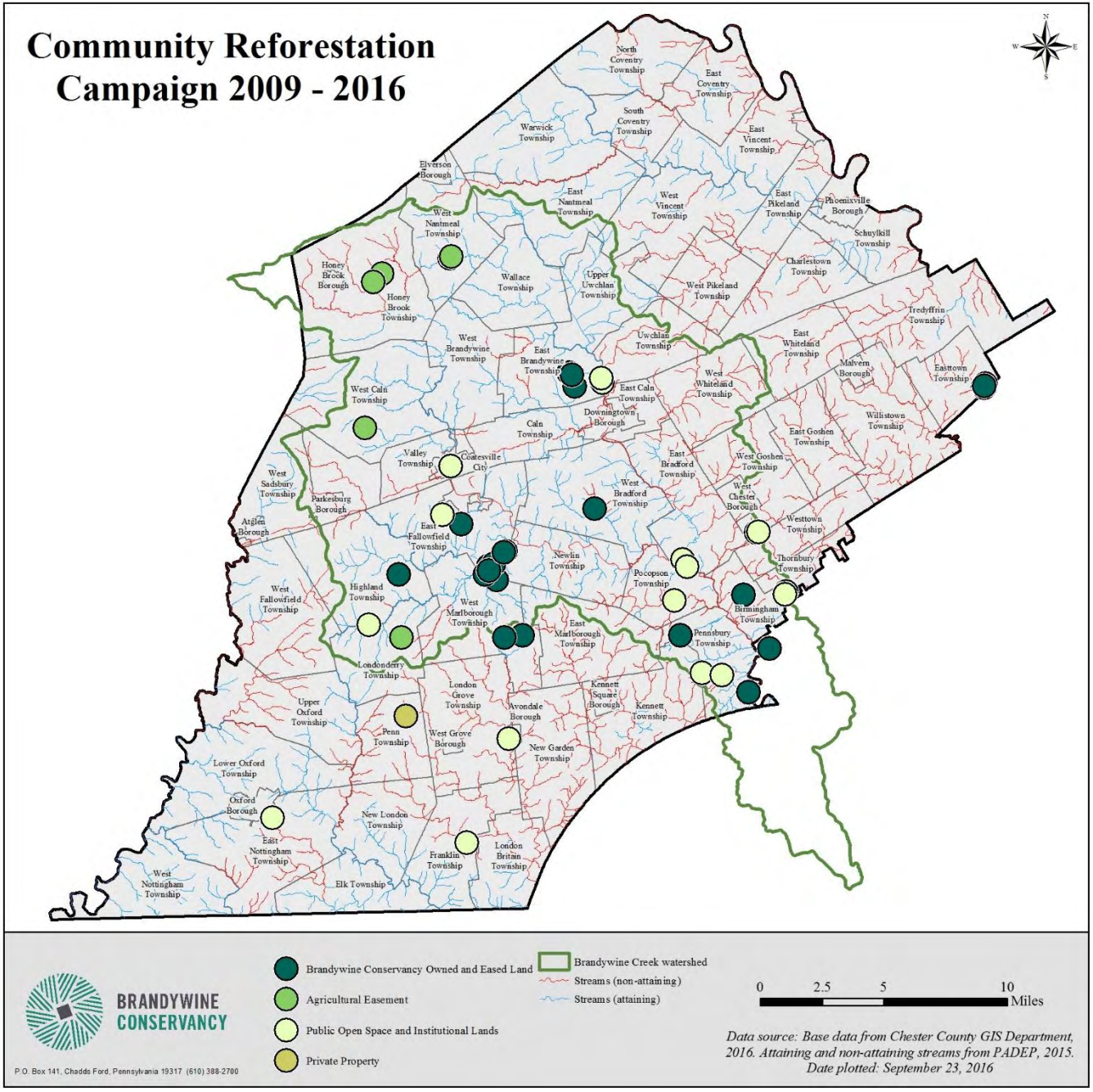
Community Reforestation Campaign 2009 - 2016



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P.O. Box 141, Chadds Ford, Pennsylvania 19317 (610) 388-2700

Data source: Base data from Chester County GIS Department, 2016. Attaining and non-attaining streams from PADEP, 2015. Date plotted: September 23, 2016

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Riparian Buffer Restoration

Best Management Practices on Farmland

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East Brandywine Township

2013

- *1200 trees planted*

2014

- *650 trees planted*

BRANDYWINE CONSERVANCY

East Fallowfield Township Park

2015

- *265 trees planted*

BRANDYWINE CONSERVANCY

Oxford Area School District

Nottingham Elementary School,

East Nottingham Township

2014

- *1200 trees planted*

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Upper Oxford Township Park – Rain Garden

BRANDYWINE CONSERVANCY

Upper Oxford Rain Garden – After Installation

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Catch the Rain

Green Stormwater Rebate Program

WHITE CLAY CREEK
National Wild & Scenic River
PENNSYLVANIA • DELAWARE
Ours to Enjoy. Ours to Protect.

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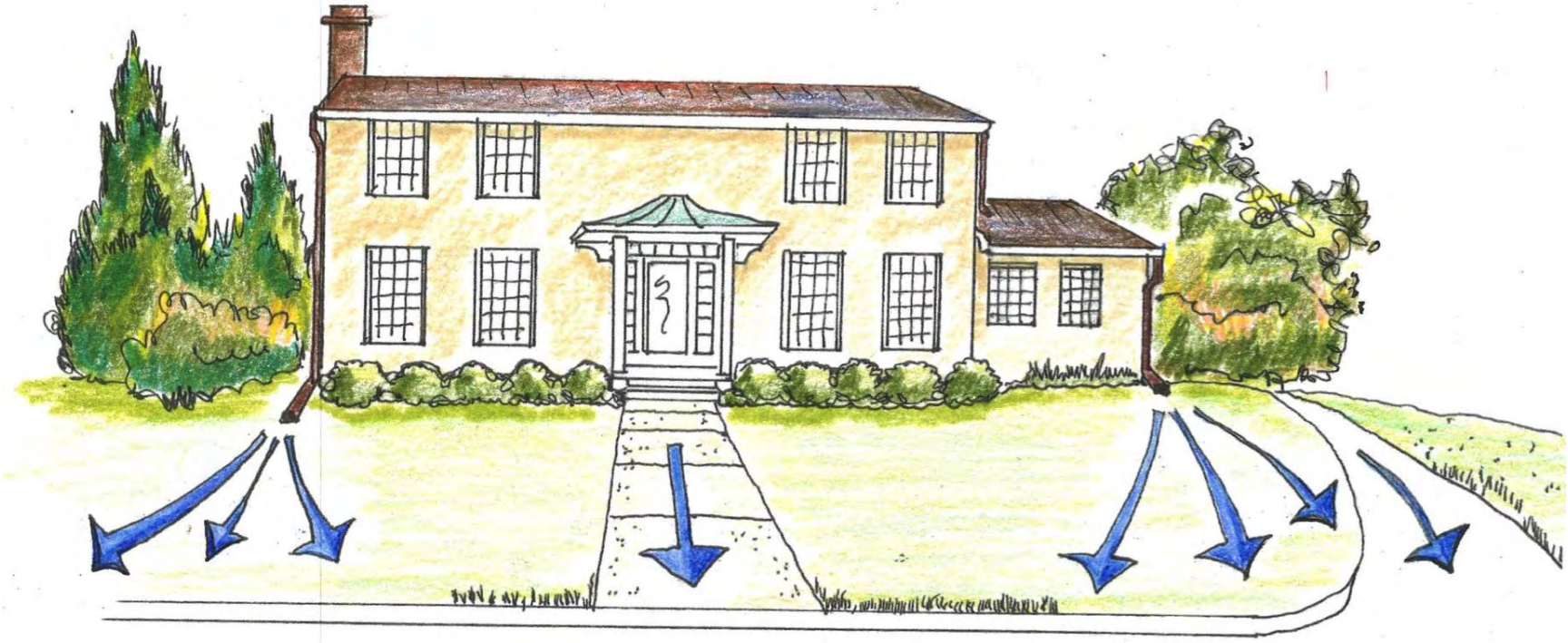
CATCH THE RAIN IN THE WHITE CLAY CREEK WATERSHED

BRANDYWINE CONSERVANCY

BEFORE. . .



EXISTING STORMWATER FLOW
GOES TO THE STREET, UNFILTERED

BRANDYWINE
CONSERVANCY

AFTER...

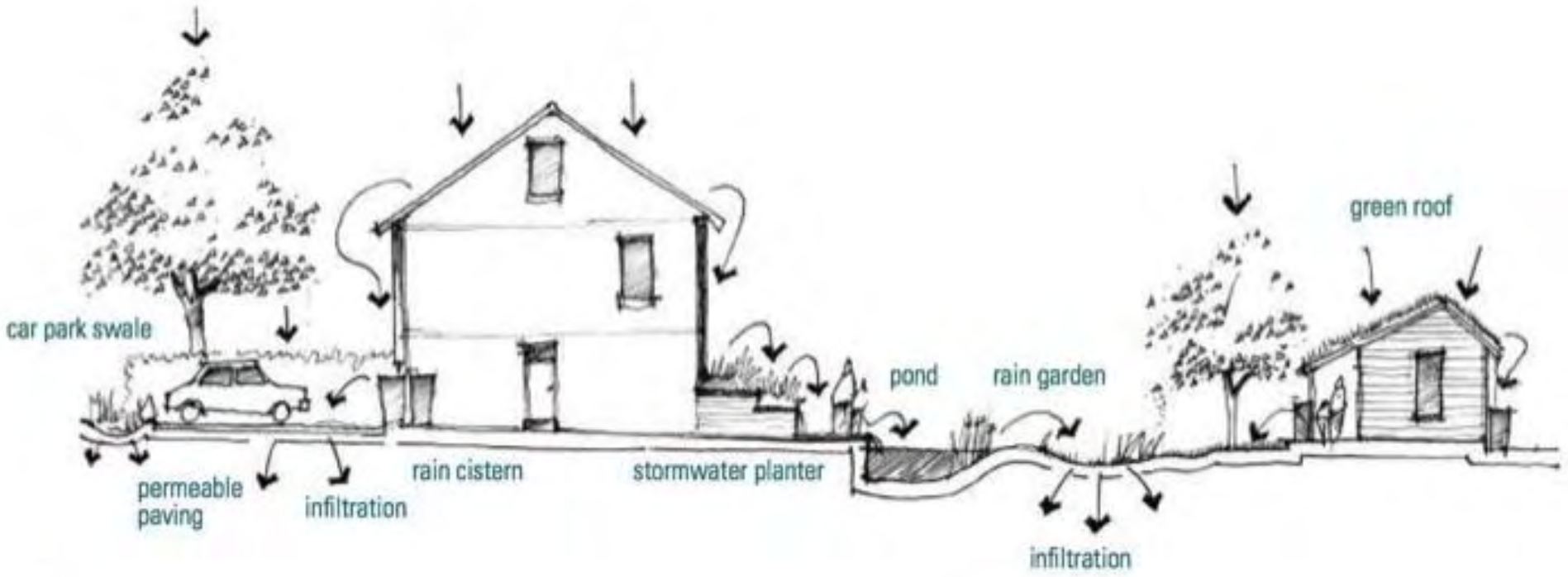
LAWN AREA IS REDUCED

RAIN GARDENS CATCH ROOF RUNOFF

PERVIOUS PAVERS ABSORB RAIN

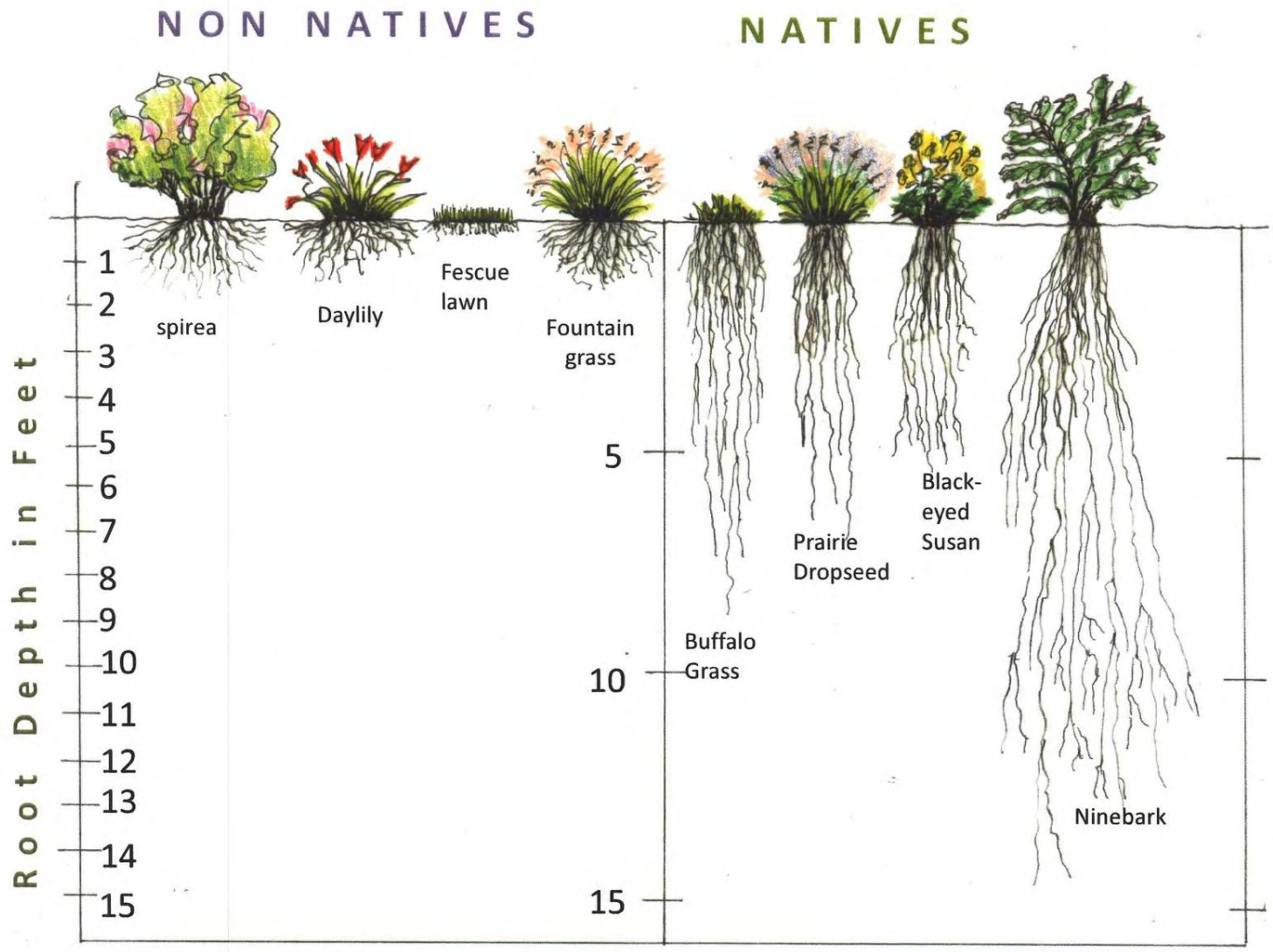
BRANDYWINE CONSERVANCY

Treatment Train Approach



BRANDYWINE CONSERVANCY

Why Native Plants?



Catch the Rain Practice	Residential Rebate Amount Total Maximum Rebate = $2500/parcel	Practice Requirements
Rain Gardens	**Typical cost:** $4–25/sq. ft. **Rebate:** $10/sq. ft, $2000 max.	**Minimum size:** 120 sq. ft. **Rain capture:** min. 1", max. 2.7" Location must pass percolation test
Conservation Landscapes	**Typical cost:** $4–10/sq. ft. **Rebate:** $3/sq. ft., $1200 max.	**Minimum size:** 250 sq. ft. **Rain capture:** must receive drainage from impervious surface and must have a microberm around the downhill perimeter to help slow and infiltrate water.
Permeable Paving Retrofit	**Typical cost:** $16–25/sq. ft. **Rebate:** $4/ sq. ft., $1200 max.	**Minimum size:** 150 sq. ft. of existing impervious surface must be replaced. **Must** be installed by a certified ICPI contractor with an additional certification in PICP.
Pavement Removal	**Typical cost:** $3–5/sq. ft. **Rebate:** $5/sq. ft. for conversion to conservation landscape; $2/sq. ft. for conversion to turf (grass), $2000 max.	**Minimum size:** 100 sq. ft.
Rain Barrels	**Typical cost:** $100 **Rebate:** $50/barrel, first rain barrel free if combined with another approved practice, $250 max.	**Minimum size:** 60 gallon barrel
Canopy Trees	**Typical installed cost:** $75–250/tree **Rebate:** $100/tree, $1000 max.	**Minimum size:** #7 pot or larger, 8' tall or 1" caliper. Tree must be planted 10–25' from permanent buildings. Planting shall occur between Sept. 15 and April 30. Tree must be mulched and have protection from deer.

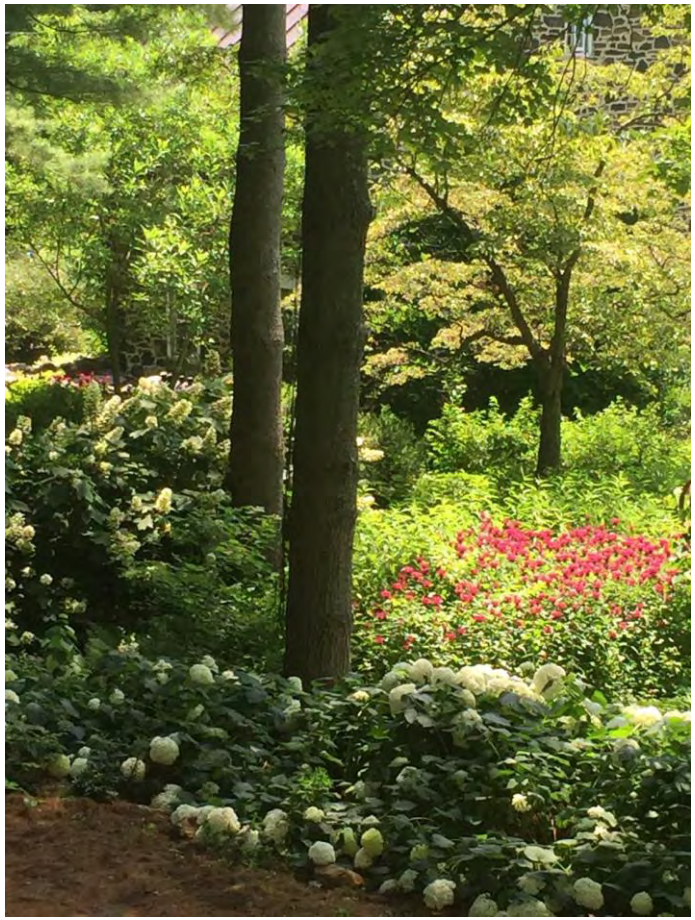
Rain Gardens

- Cost: $4-25/ sq. ft.
- Rebate: $10/sq. ft. ($2000 maximum)
- 120 square feet or more
- Minimum 1” rain capture
- Successful percolation test

BRANDYWINE CONSERVANCY

Conservation Landscapes

- Cost: $4-10/ sq. ft.
- Rebate: $3/sq. ft. ($1200 maximum)
- At least 250 sq. ft.
- Must receive drainage from impervious surface
- Must have a micro-berm (12” high or so) on the downhill edge to help slow and infiltrate water.



BRANDYWINE CONSERVANCY

Catch the Rain - Canopy Trees

Canopy Trees

- *Cost: $75-250/tree*
- *Rebate: $100/tree*
  - *($1000 max.)*
- *Minimum size: #7 pot, 8’ tall or 1” caliper*
- *At least 10-25’ from buildings*
- *Shade to pavement/buildings*
- *Mulch AND deer Protection.*

BRANDYWINE CONSERVANCY

Tree protection is required!

© Mark Raycroft

BRANDYWINE CONSERVANCY

Rain Barrels

- Typical cost: $100
- Rebate: $50/barrel
- First rain barrel free if combined with another approved practice
- $250 max rebate
- Minimum size: 60 gallon
- http://www.camels-hump.com/

BRANDYWINE CONSERVANCY

Catch the Rain – Paving Removal

Options for Paving Removal

- Remove existing and install pavers (requires certified professional installer)
- Remove existing and plant
  - Lawn, Conservation Landscaping, or Rain Garden.

BRANDYWINE CONSERVANCY

Permeable Paver Retrofit

- Cost: $16-25/ sq. ft.
- Rebate: $4/ sq. ft.
  - $1200 maximum
- At least 150 sq. ft. of existing impervious surface must be replaced
- Must be installed by a certified ICPI contractor with an additional certification in Permeable Interlocking Concrete Paving.

BRANDYWINE CONSERVANCY

Pavement Removal and Revegetation

- Cost:$3-5 sq. ft.
- Rebate: $5/sq. ft. for conversion to conservation landscape
- $2/ sq. ft. for conversion to turf (grass)
- $2000 max rebate
- Minimum size: 100 sq. ft.

Monitoring and Management

- Catch the Rain provides maintenance plan.
- Homeowner must agree to weed, water, and carefully monitor all plantings.
- Maintenance is more intensive at first and becomes easier as the plants mature.

BRANDYWINE CONSERVANCY

MELIORA DESIGN

Civil, Water Resources, and Structural Engineering

BRANDYWINE CONSERVANCY

Thank you!
Questions?

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