

Rain Gardens

*Why to Build Them +
How to Avoid Pitfalls*



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What is a Rain Garden?

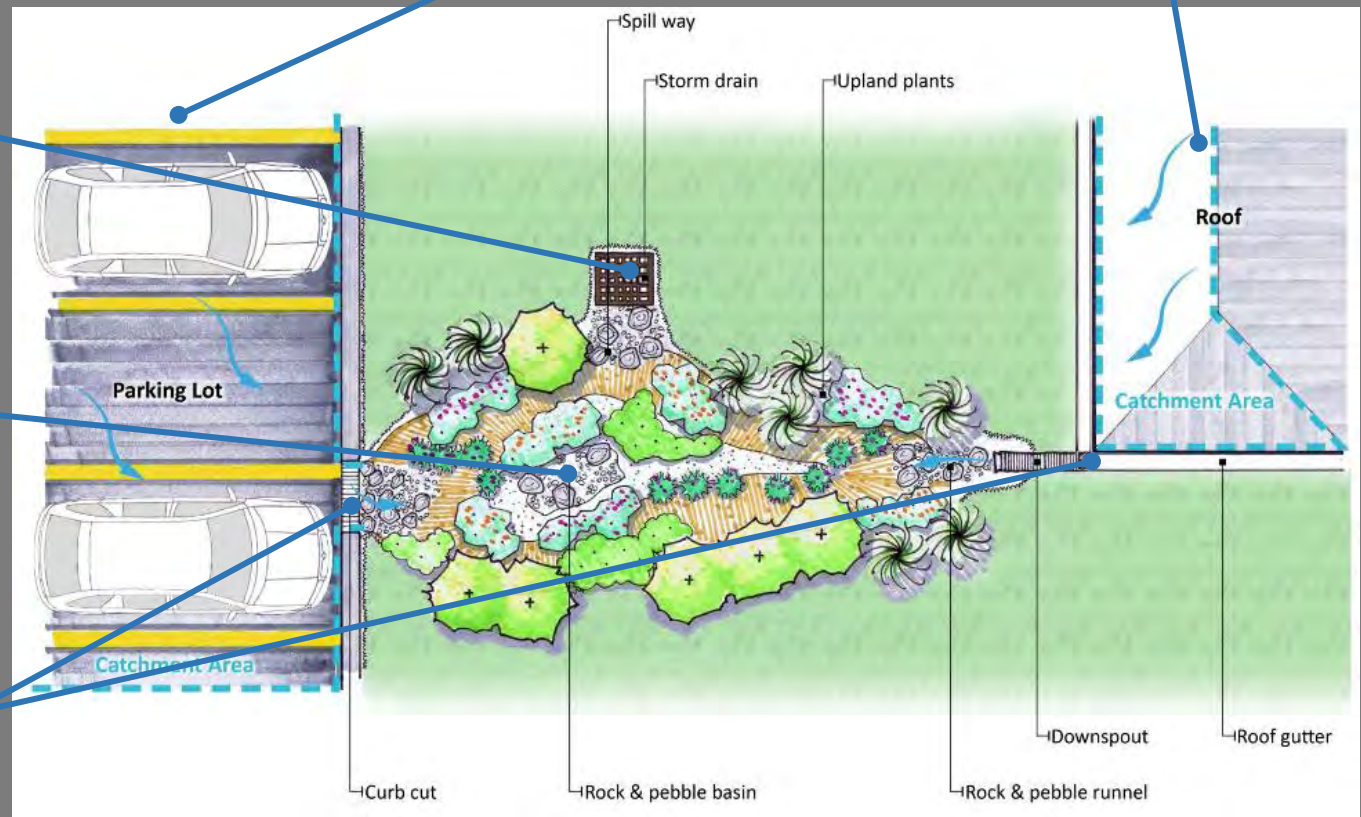
- A planted depression designed to clean, filter, and reduce stormwater runoff
- A Nature-Based Solution/example of Green Infrastructure

Designed for
specific
catchment areas

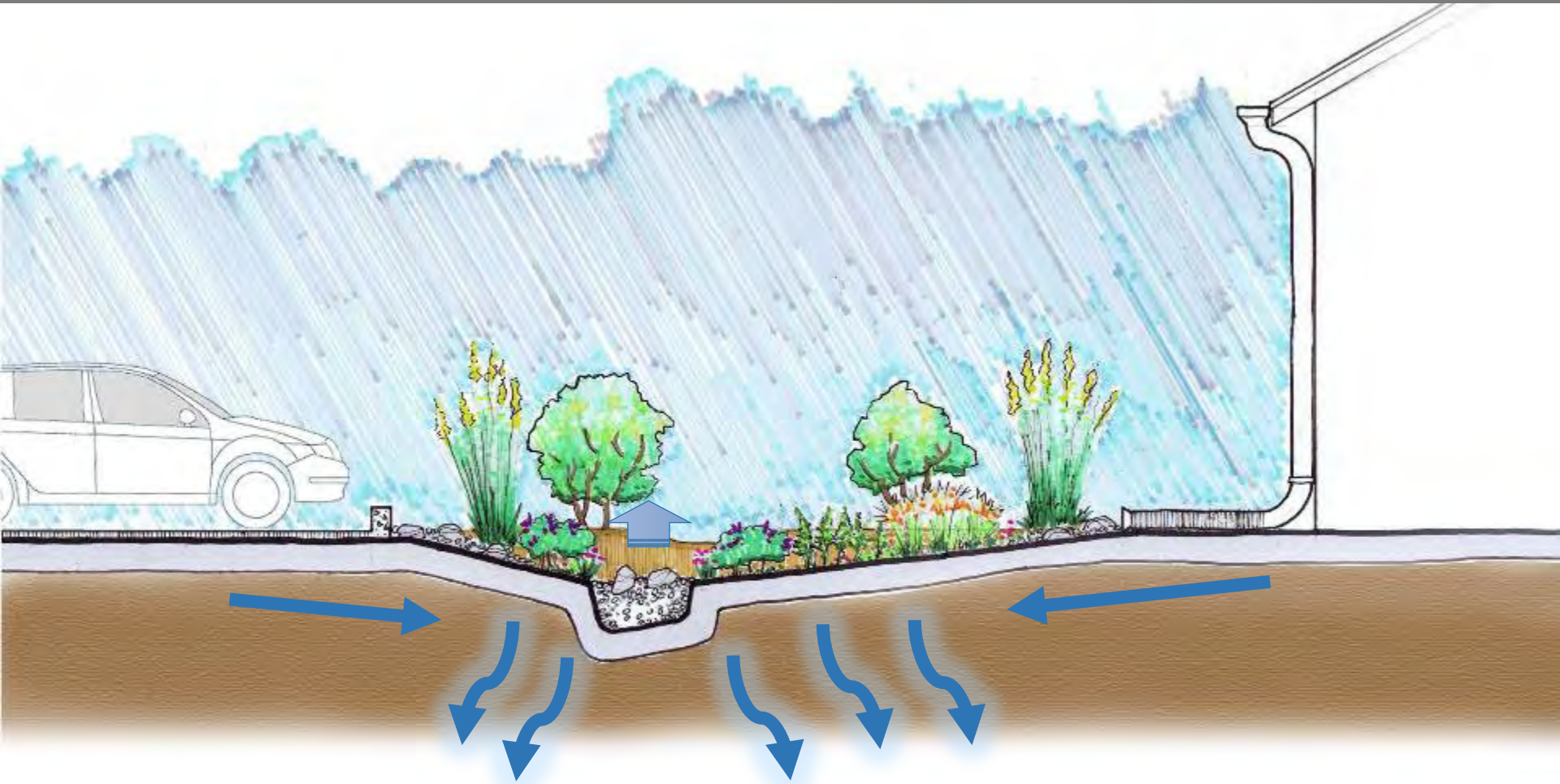
Outlet

Ponding area
volume is
determined by
the catchment
area

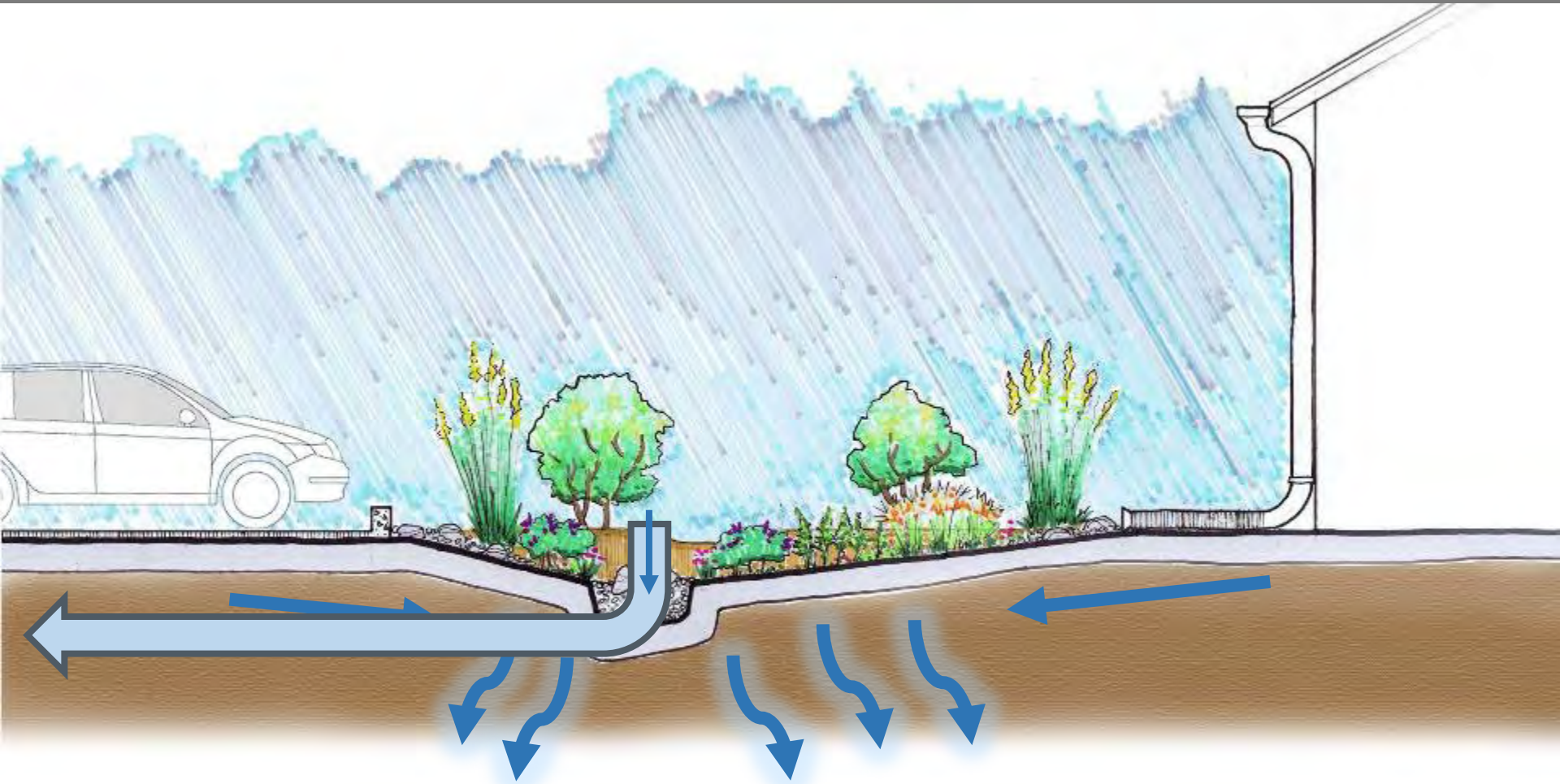
Inlets



Overflow Outlet



Underdrain Outlet



Site-appropriate plants



Why build Rain Gardens?



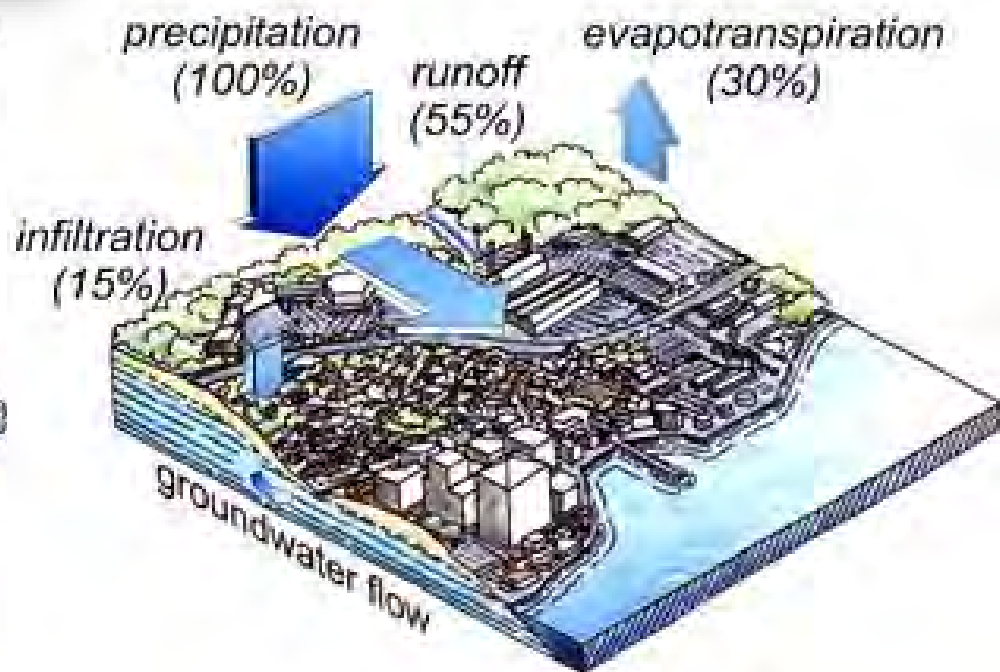
- To intercept or divert water to where it should be filtered and infiltrated before entering a stormwater drain or water body.
- Rain Gardens are designed to help **improve water quality**, not make standing water go away.
- Rain Gardens are not wetlands.

Rain Gardens won't solve
this





Development of land increases surface runoff



Impervious Surface Landcover

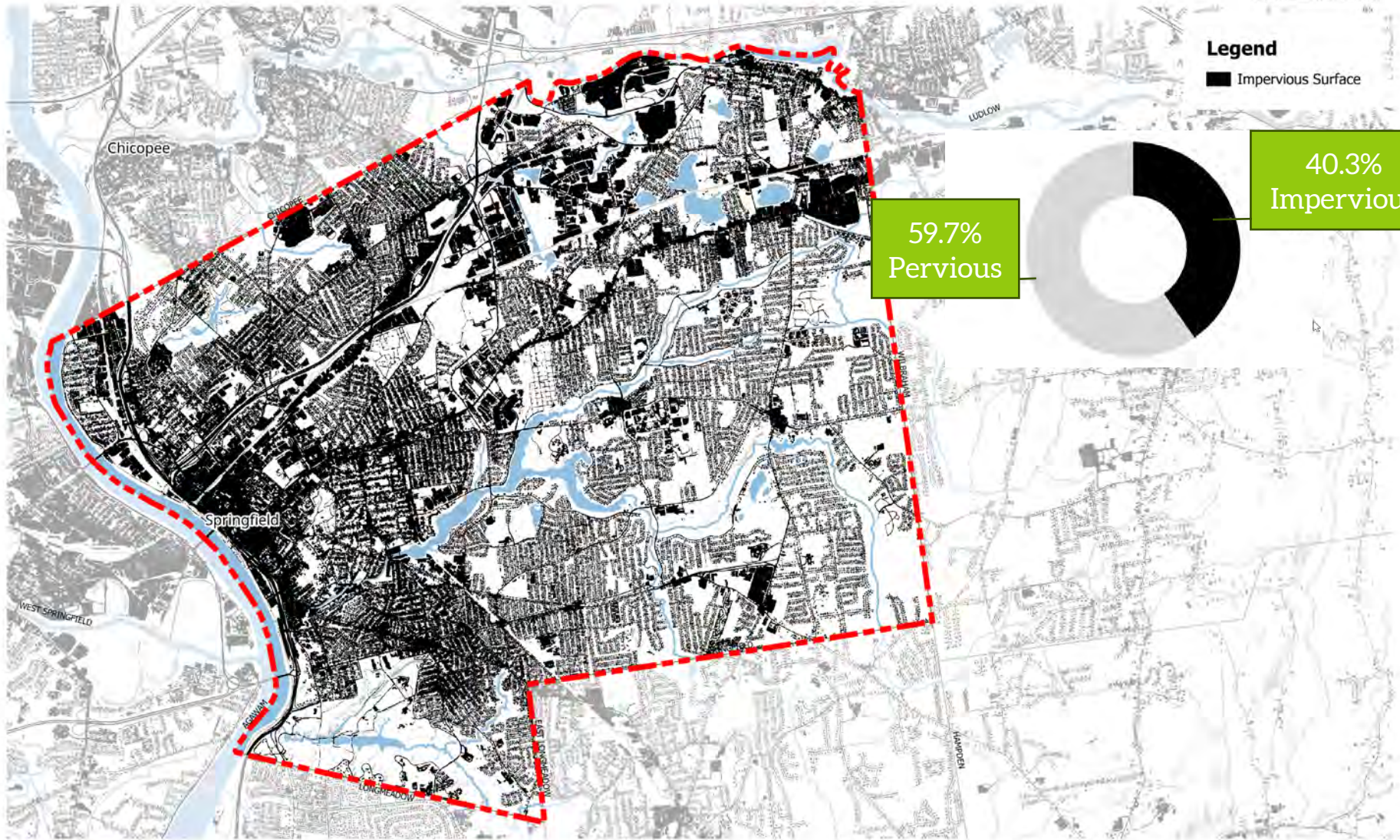


Rule of Thumb:

At ~10% watershed impervious cover we start to see:

- More water quality issues (sediments and contaminants)
- Increased flooding
- Increased stream erosion
- Impacts to biological communities
- Loss of recreational uses
- Shellfish bed closures





Geographic Vulnerability & Critical Infrastructure

Panel Map- Springfield, MA

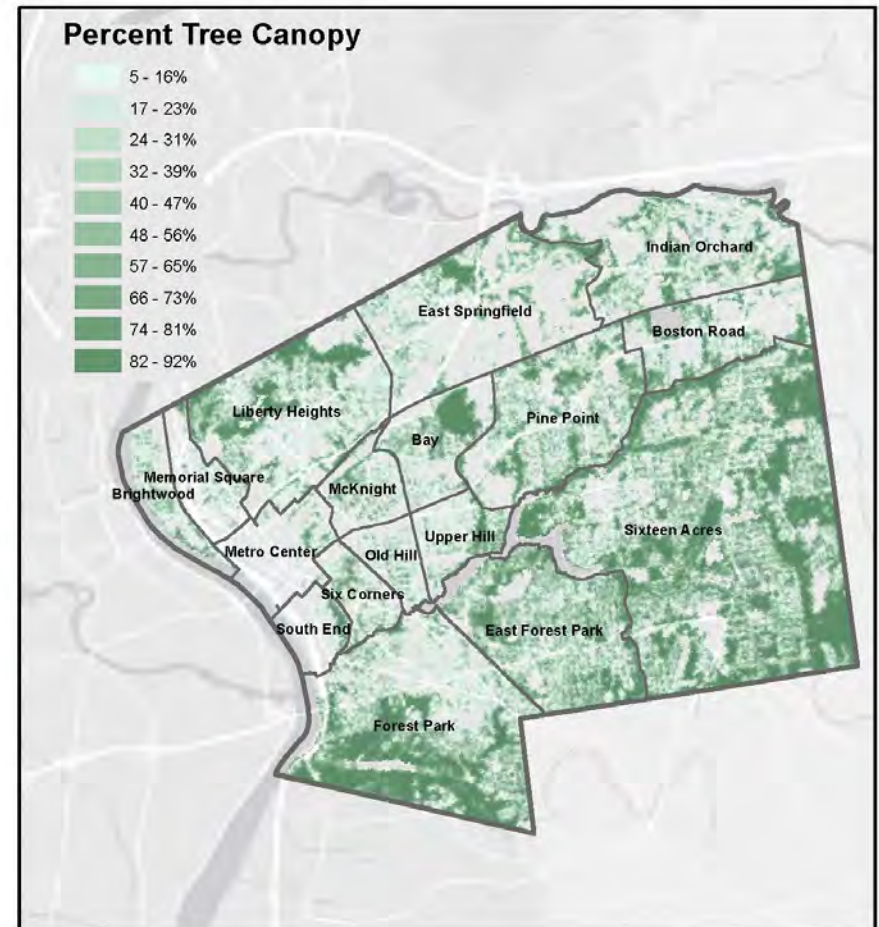
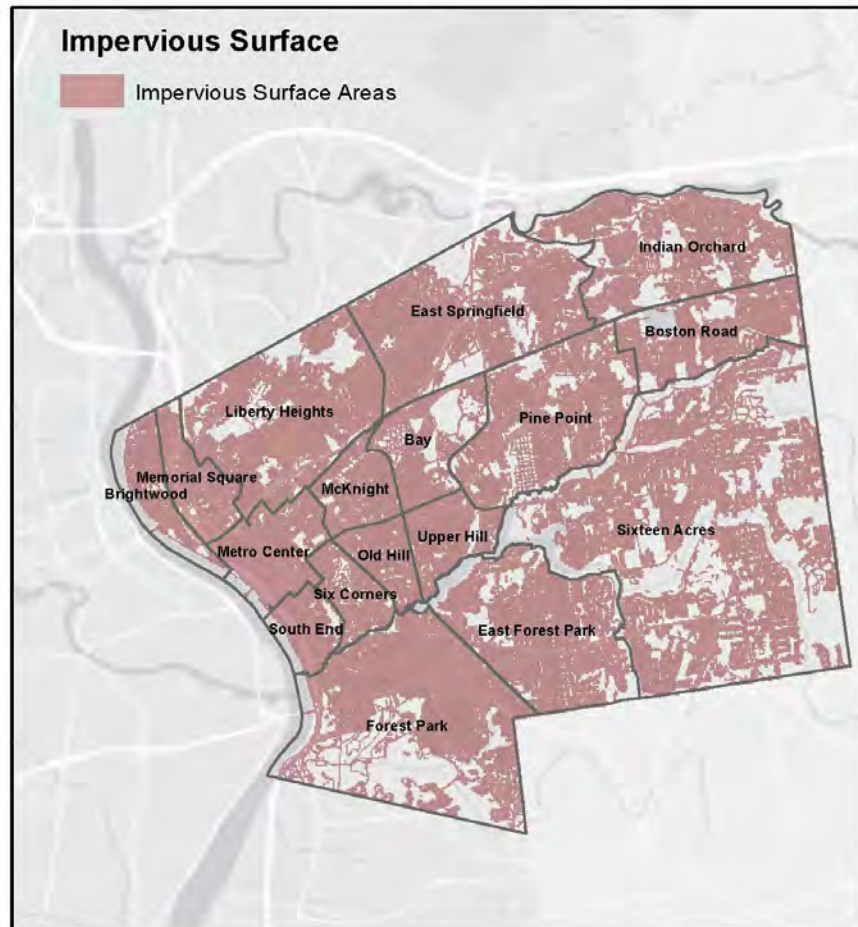
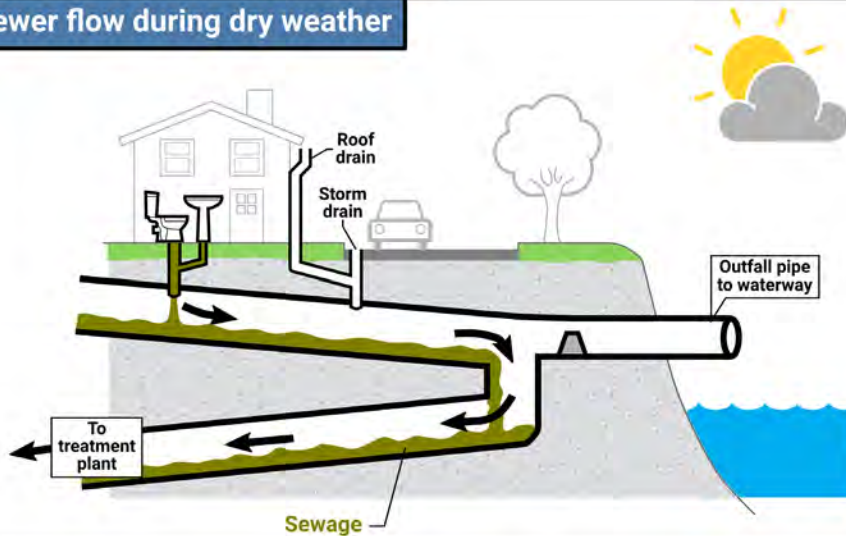


Image: Public Health Institute of Western MA Data sources: Info USA Data Services, Massachusetts Office of Geographic Information Systems, Pioneer Valley Planning Commission, U.S. Department of Agriculture Forest Service.

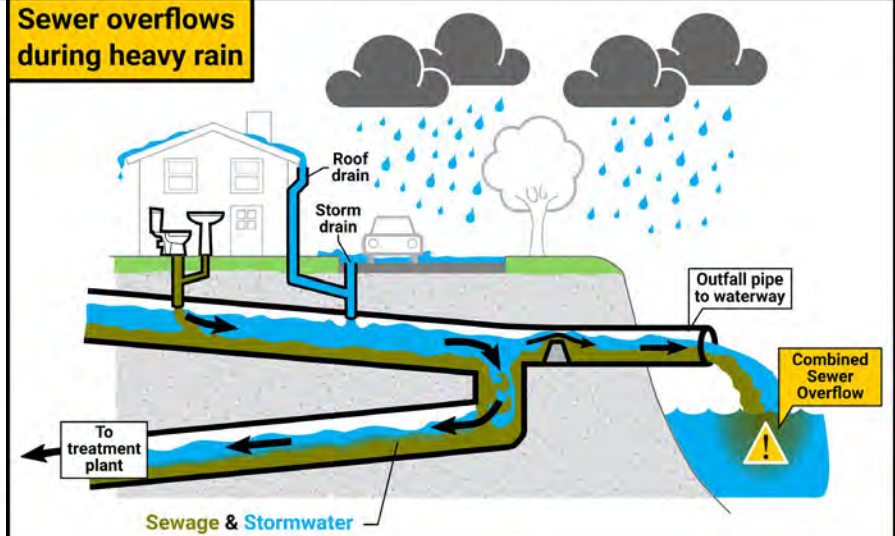
Combined Sewer Overflows



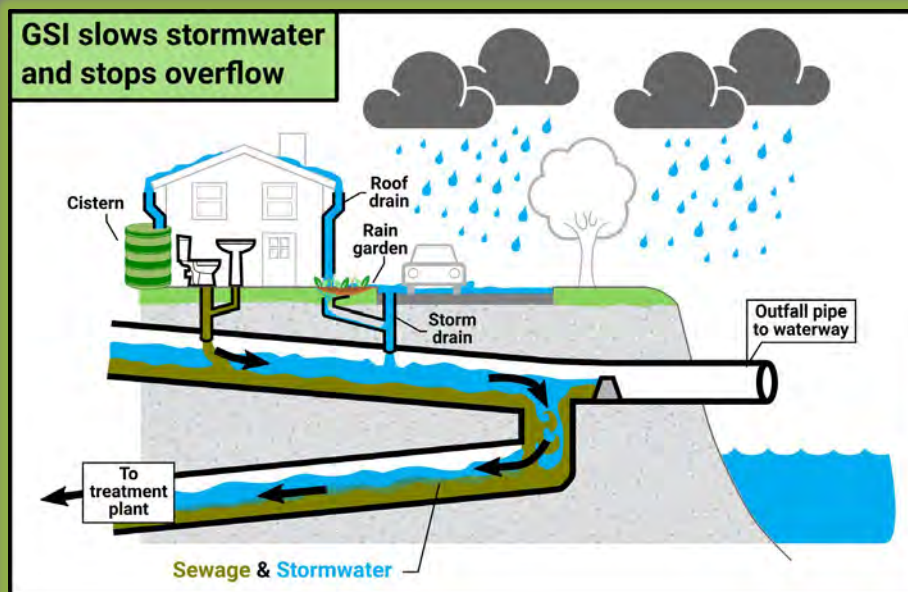
Sewer flow during dry weather



Sewer overflows during heavy rain



GSI slows stormwater and stops overflow





MASS LIVE

NEWS

13 million more gallons from Springfield sewers discharged into Conn. River

Published: Jun. 21, 2023, 1:13 p.m.



The Springfield Water and Sewer Commission is proposing a 5.9% rate increase for fiscal 2020. Here is file photo of Bondi's Island Regional Wastewater Treatment Plant (Don Treeger / The Republican)

June 21, 2023
13 Million Gallons

July 10, 2023
9 Million Gallons

WESTERN MASS NEWS
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Weekend rainfall leads to excessive sewage, stormwater in CT River



TEAM COVERAGE

RAINFALL AND SEWAGE FILLING LOCAL RIVERS

Rainfall from over the weekend into Monday has led to more sewage and storm water filling local area rivers.

By Kristin Burnell, Samantha O'Connor and Photojournalist: Kevin Culverhouse

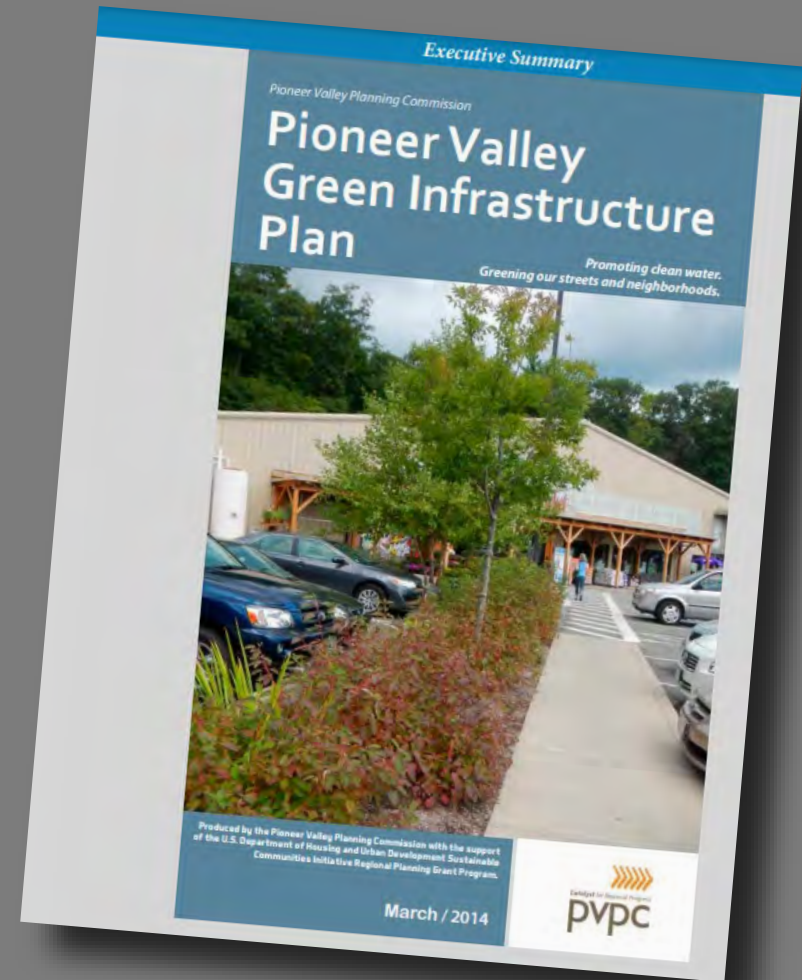
Published: Jul. 10, 2023 at 4:35 PM EDT | Updated: Jul. 10, 2023 at 6:45 PM EDT



Water Quality Assessments

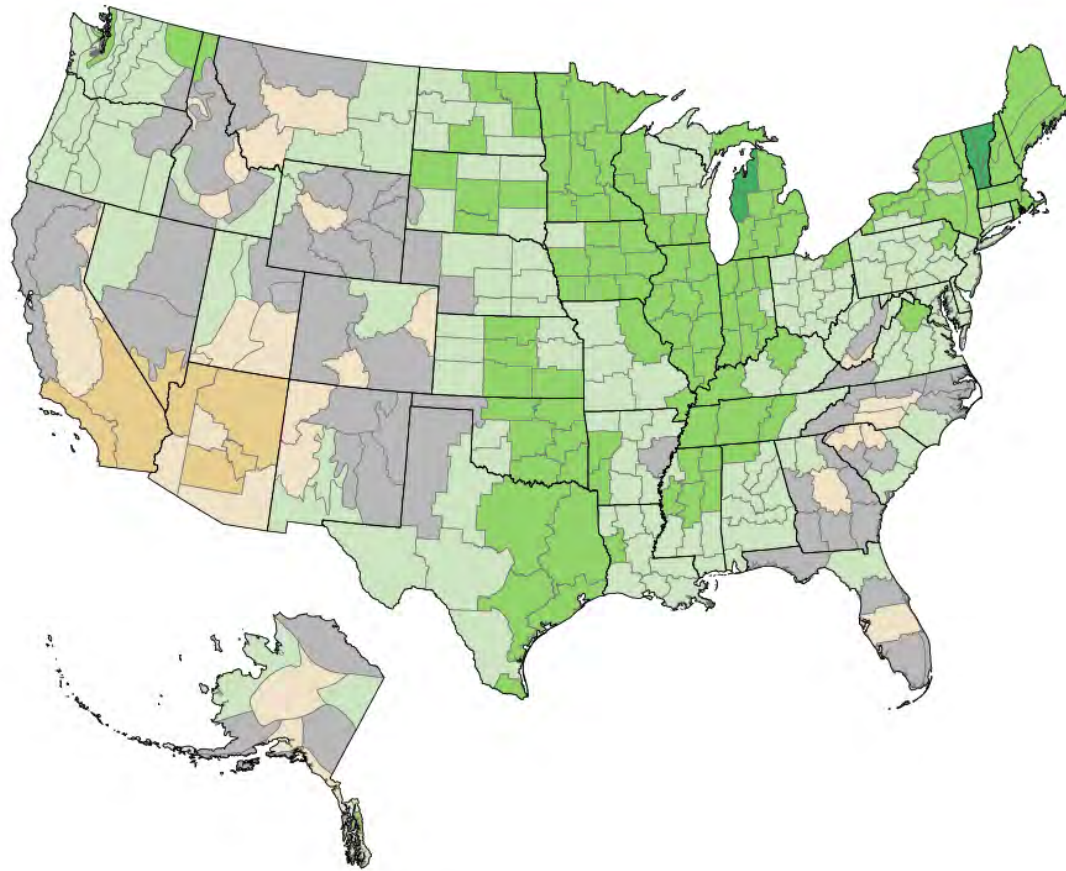


- **76 waterways** in the Pioneer Valley are “impaired” for a variety of pollutants including phosphorus;
- The **lower Connecticut River** in Massachusetts is impaired for bacteria (E-coli) and total suspended solids largely from combined sewer overflows and stormwater;
- Stormwater from the Pioneer Valley also contributes to the estimated three million pounds of nitrogen flowing into the Connecticut River to Long Island Sound annually.



Pioneer Valley Planning Commission Pioneer Valley Green Infrastructure Plan, 2014

Climate Change - Precipitation



1901-2015
Percent change in precipitation:



Image: EPA

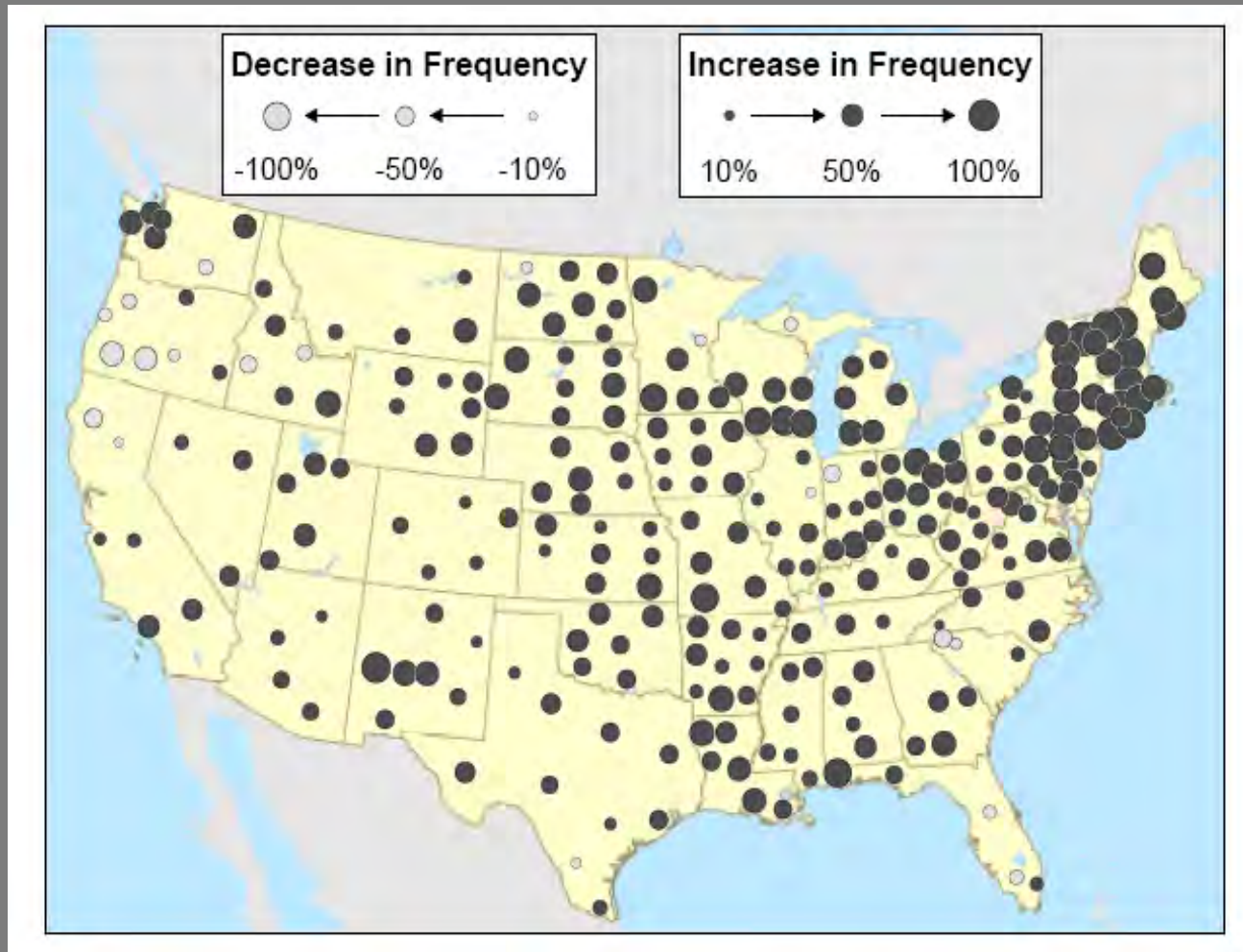


Image: LA Times/Bob Chamberlin



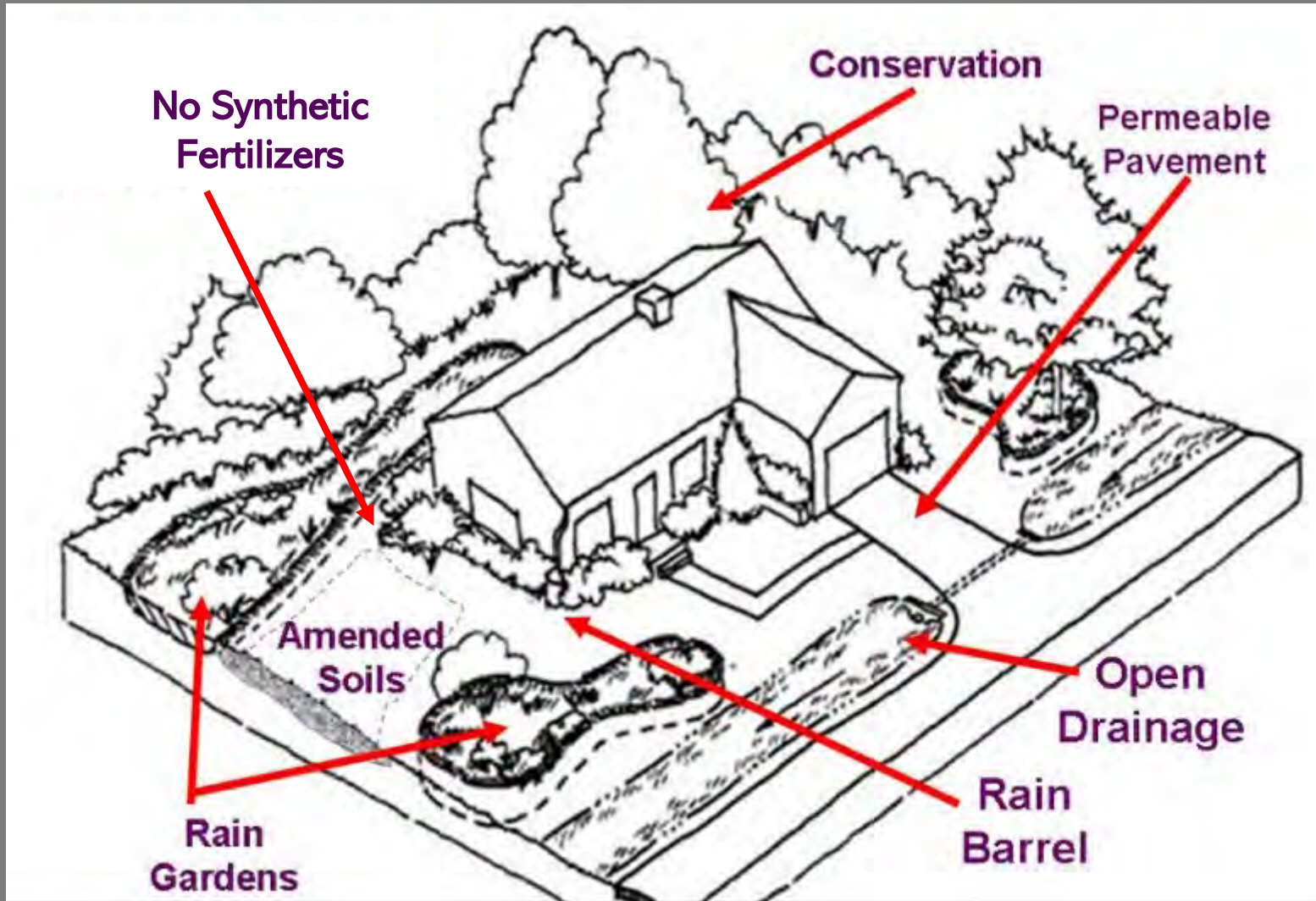
Image: MV Times/Rich Saltzberg

Frequency of extreme downpours increasing



Source: *When it Rains, It Pours* by Environment America Research and Policy Center, analysis of weather records dating from 1948 to 2011.

How We Can Help



Will it actually make a difference?

- A 100 square feet roof (10'x10') can yield 56 gallons of water from 1 inch of rain!
- Averages for Northeast U.S.
 - Rainfall +/- 3 to 4 inches a month
 - Home Size 2,000 s.f.
 - Stormwater from roof = 3,925 ga. each month.

That's more than 47,000 gallons per year !



x 80



x 940

Why build Rain Gardens?



- To intercept or divert water to where it should be filtered and infiltrated before entering a stormwater drain or water body.
- Rain Gardens are designed to help **improve water quality**, not make standing water go away.
- Rain Gardens are not wetlands.

Is this a problem?

Rain Gardens won't solve
this



Steps for creating a rain garden

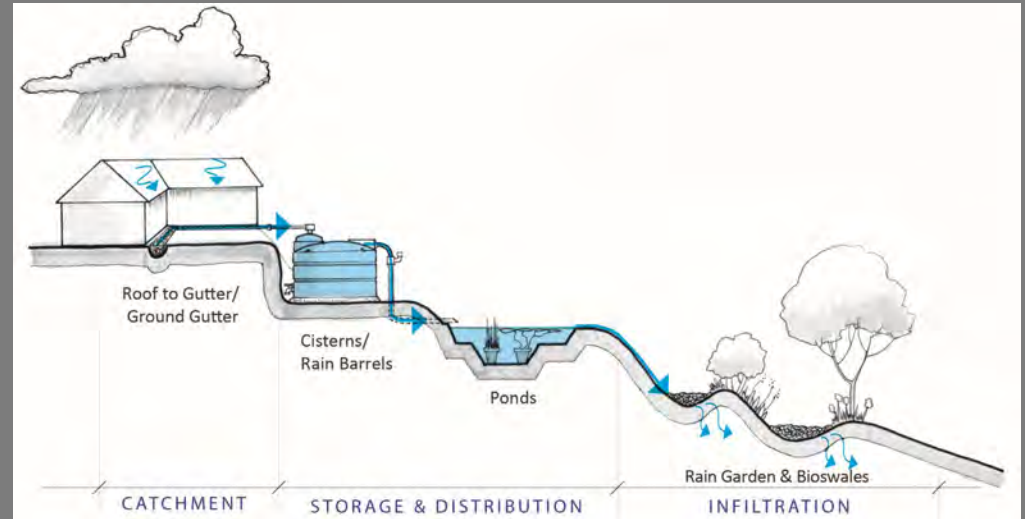
- PART ONE
 - Know the Problem You Are Addressing
 - Site Analysis
 - Soil
 - Catchment Area
 - Volume Calculations
 - Design
 - Garden Size & Shape
 - Amendments
- PART TWO
 - Installation

Design Process: Springfield Museums



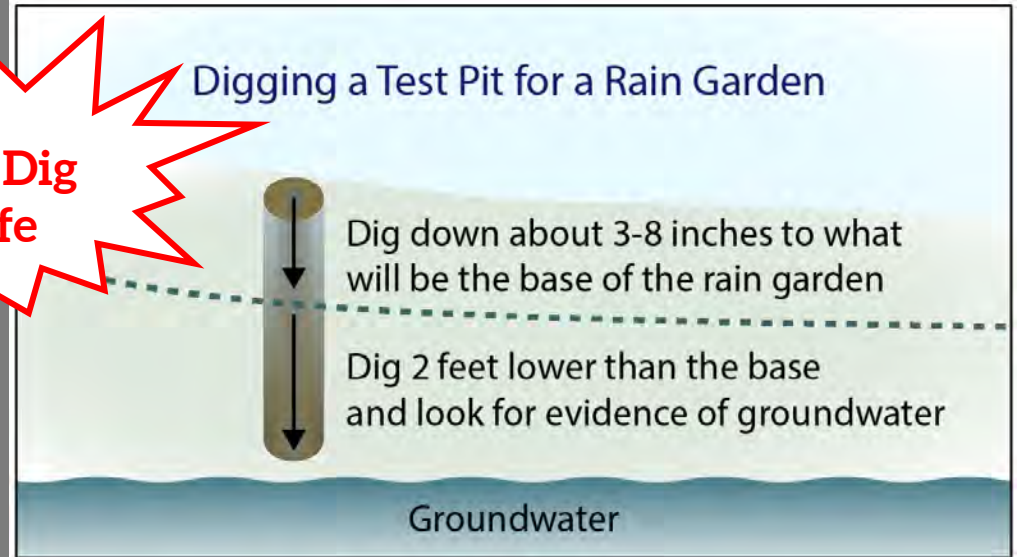
Site Analysis

1. Slope – can you get the water to the garden?
 - **At least 10 feet** from a building
 - **50 feet** from septic systems or wells
2. Soil Infiltration – will the water seep into the soil?
 - Dig a hole 1-2 feet deep
 - If water seeps in, there may be high groundwater.
 - If it stays dry, fill the whole with water. If it drains fully within 24 hours there is adequate infiltration capacity.



**Call Dig
Safe**

Digging a Test Pit for a Rain Garden



Calculate the Catchment Area



- Length x Width
 - $78' \times 46' = 3588 \text{ sq. ft.}$
- Locate Gutters
- Roof Area x Percent Captured by Gutters
 - $3588 \times 50\% = 1749 \text{ sq.ft.}$



Identify the Garden Area



- 10' from buildings, roads or pavement
- Soils drain 1-3" hour
- Overflow area

2100 ft²
Area



Calculating Rainwater Volume



Roof Area x Rain x Loss =
Catchment

CALCULATE

Roof Area (ft²) * Rain Event
(in.) * 0.623 (unit conversion to
gallons) * 0.90 (Loss factor) =
Catchment (gallons)

1749 ft² (AREA) * 3 in (RAIN). *
0.623 * 0.90 = **2,941 gallons**

Surface	Runoff Range
ROOF	0.80 - 0.95 (Metal: 0.95, Concrete/asphalt: 0.90, Built up tar/gravel: 0.85 - 0.80)
PAVING (concrete, asphalt)	0.90 - 1.00
BARE SOIL (flat)	0.20 - 0.75
SOIL WITH VEGETATION (flat)	0.10 - 0.60
GRASS/LAWN	0.05 - 0.35
GRAVEL	Use the coefficient of the ground below the gravel

Table from: Lancaster, Brad. 2006. *Rainwater Harvesting for Drylands*, Vol.1. Rainsource Press.

Calculating Rain Garden Volume



6" Average
Depth of the
garden

CALCULATE:

Garden Area
(ft²) * Average
Depth (in.)*0.623
(Unit
Conversion to
Gallons



$$2100 \text{ ft}^2 * 6 \text{ in} * 0.623 \\ = 7849 \text{ gallons}$$

Planting Plan



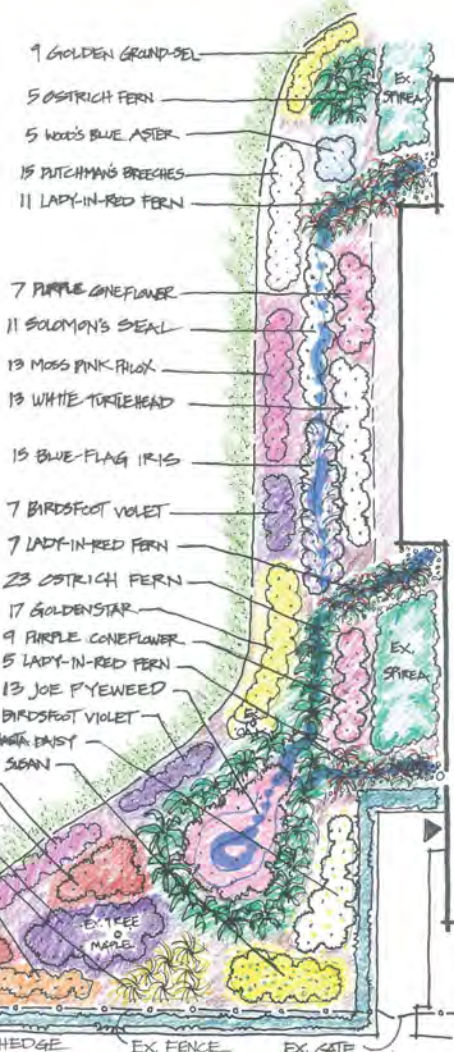
SRGP Springfield Rain Garden Project REGENERATIVE DESIGN GROUP

RDG

Planting Plan

Rain Garden Plants

full sun 
part to full shade 



Type	Symbol	Botanical Name	Common Name	Size/Form	Spacing
Tall Grasses (to 72" Height):					
14	CKF	<i>Calamagrostis x. acutiflora</i> 'Karl Foerster'	Feather Reedgrass	#3 Pot	12" o.c.
14					
Ferns (12-36" Height):					
23	ALR	<i>Athyrium felix-femina</i> 'Lady-in-Red'	Lady in Red Fern	5" Plugs or 1 Qt. Pots	18-30" o.c.
28	MS	<i>Matteuccia struthiopteris</i>	Ostrich Fern	5" Plugs or 1 Qt. Pots	3-4' o.c.
51					
Flowering Groundcover/Ferns/Ephemerals (6-24" Height, Primarily for Part-Full Shade):					
17	CV	<i>Chrysogonum virginianum</i>	Goldenstar	5" Plug or #1 Pot	12-18" o.c.
15	DE	<i>Dicentra eximia</i>	Dutchman's Breeches	5" Plug or #1 Pot	12-18" o.c.
13	NM	<i>Nepeta mussini</i> 'Walker's Low'	Walker's Low Catmint	5" Plug or #1 Pot	18-30" o.c.
9	PAU	<i>Packera aurea</i>	Golden Ground-sel	5" Plug or #1 Pot	18-30" o.c.
24	PSP	<i>Phlox subulata</i> 'Moss Pink'	Moss Pink Creeping Phlox	5" Plug or #1 Pot	12-18" o.c.
14	VPE	<i>Viola pedata</i>	Birdsfoot Violet	5" Plugs or 1 Qt. Pots	12-18" o.c.
92					
Flowering Perennials (24-72" Height, Primarily for Sunny-Part Shade Beds):					
9	AT	<i>Asclepias tuberosa</i>	Butterfly Weed	5" Plug or #1 Pot	18-30" o.c.
13	ANA	<i>Aster novae-angliae</i>	New England Aster	5" Plug or #1 Pot	2-3' o.c.
5	AWB	<i>Aster 'Wood's Blue'</i>	Wood's Blue Aster	5" Plug or #1 Pot	18-30" o.c.
13	CG	<i>Chelone glabra</i>	White Turtlehead	5" Plug or #1 Pot	18-30" o.c.
16	EBS	<i>Echinacea Big Sky</i> 'After Midnight'	After Midnight Purple Coneflower	5" Plug or #1 Pot	18-30" o.c.
13	EM	<i>Eupatorium maculatum purpureum</i>	Joe Pyeweed	5" Plug or #1 Pot	18-30" o.c.
15	IV	<i>Iris versicolor</i>	Blue Flag Iris	Bulbs or #1 Pot	12-18" o.c.
9	LM	<i>Leucanthemum superbum</i> 'Becky'	Becky Shasta Daisy		
7	MDJ	<i>Monarda didyma</i> 'Jacob Kline'	Jacob Kline Bee Balm	5" Plug or #1 Pot	2-3' o.c.
13	PRR	<i>Penstemon</i> 'Red Riding Hood'	Red Riding Hood Beardtongue	5" Plug or #1 Pot	18-30" o.c.
11	PB	<i>Polygonatum biflorum</i>	Solomon's Seal	5" Plug or #1 Pot	18-30" o.c.
13	RFG	<i>Rudbeckia fulgida</i> 'Goldsturm'	Goldsturm Black-eyed Susan	5" Plug or #1 Pot	2-3' o.c.
11	SN	<i>Salvia nemorosa</i> 'Blue Hill'	Blue Hill Sage	5" Plug or #1 Pot	12-18" o.c.
148					

305 Total Plants

GOLDSTURM BLACK-EYED SUSAN



OSTRICH FERN



NEW ENGLAND ASTER



Right plant for the right place



High and Dry

Moderate

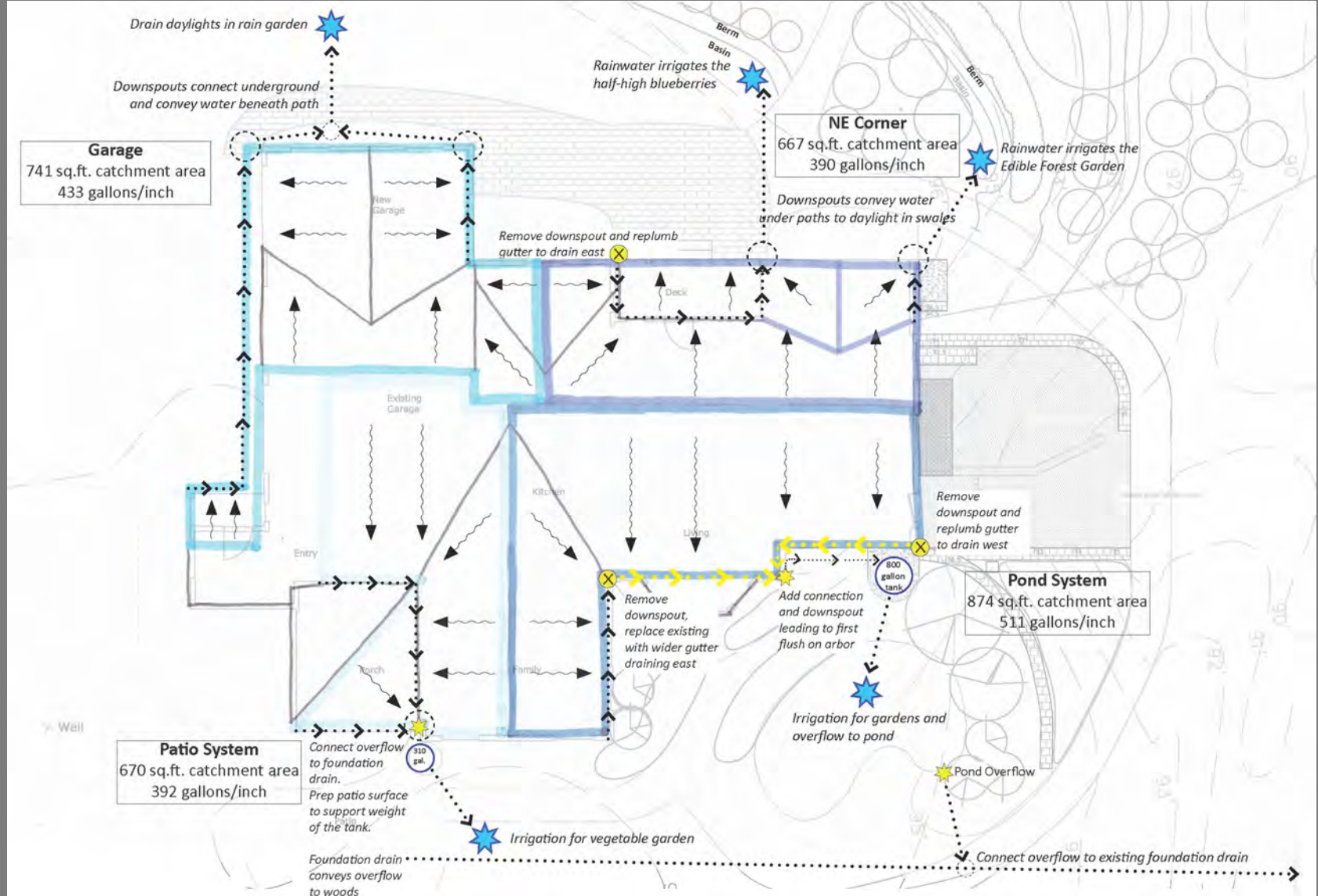
Low and Wet



Case Study

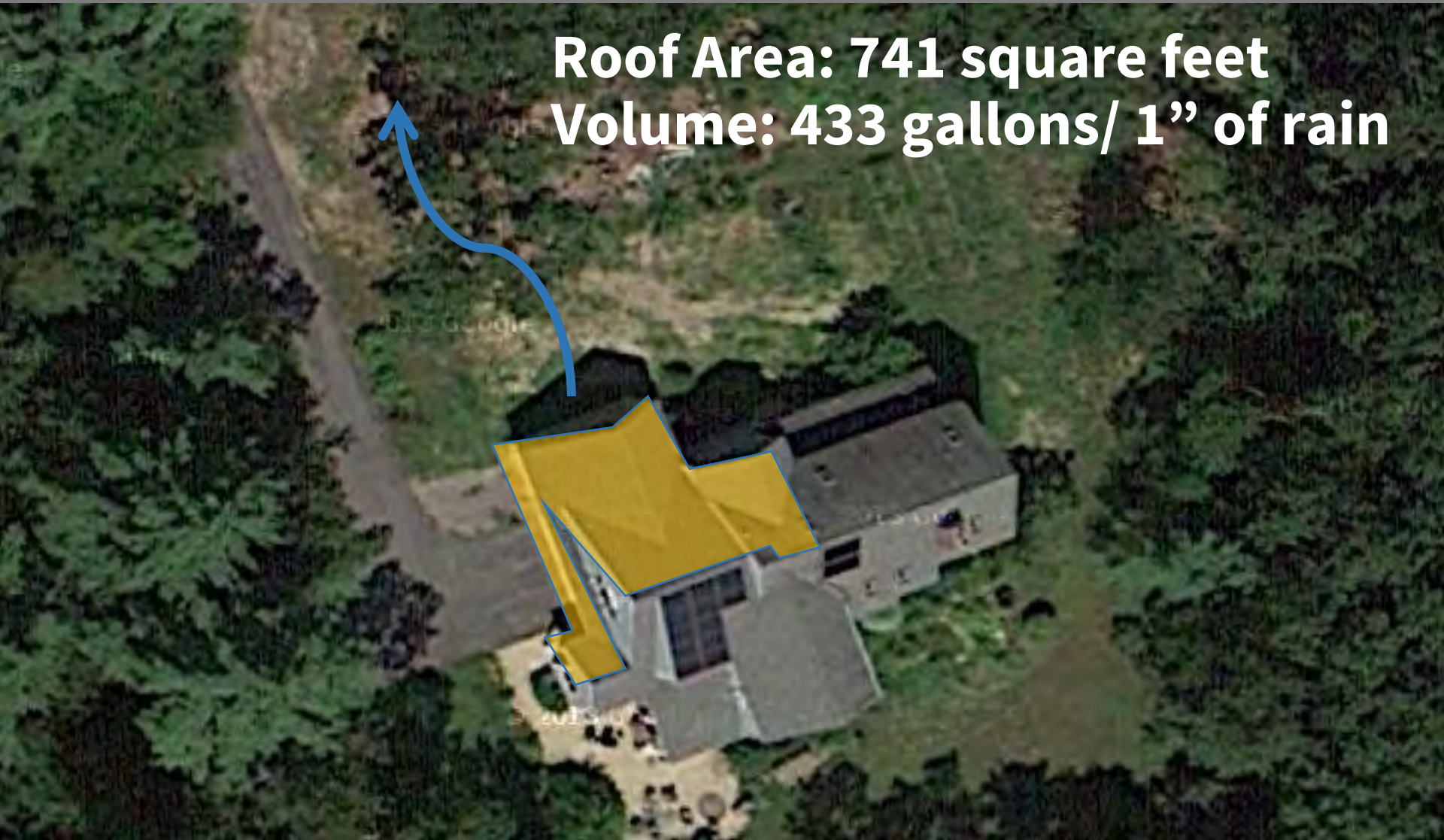


Calculating the Catchment Area

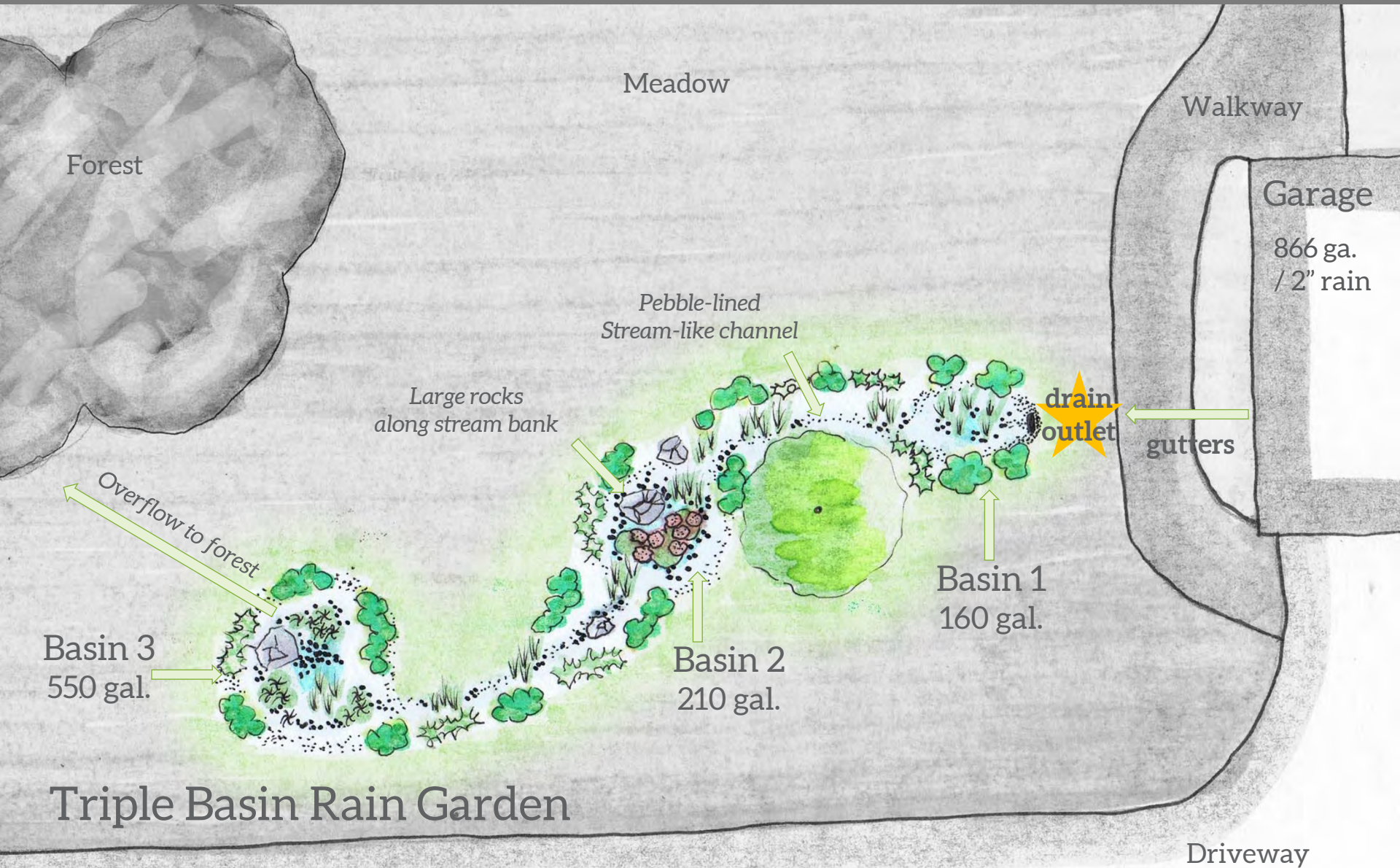


Rain Gardens: Contribution Area

Roof Area: 741 square feet
Volume: 433 gallons/ 1" of rain



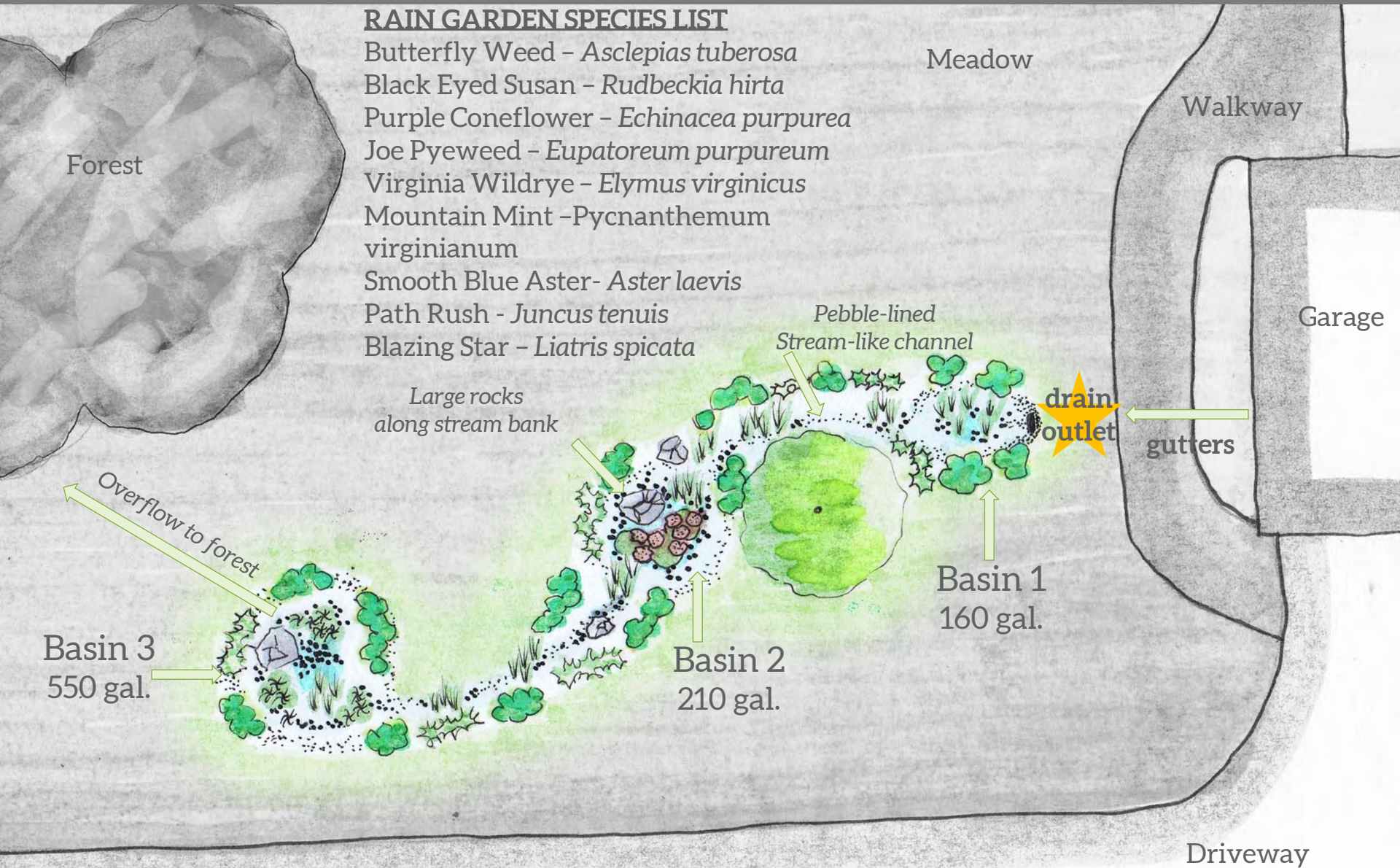
Rain Garden Design





RAIN GARDEN SPECIES LIST

Butterfly Weed - *Asclepias tuberosa*
Black Eyed Susan - *Rudbeckia hirta*
Purple Coneflower - *Echinacea purpurea*
Joe Pyeweed - *Eupatorium purpureum*
Virginia Wildrye - *Elymus virginicus*
Mountain Mint - *Pycnanthemum virginianum*
Smooth Blue Aster - *Aster laevis*
Path Rush - *Juncus tenuis*
Blazing Star - *Liatris spicata*



Meadow

Walkway

Forest

Garage

Pebble-lined
Stream-like channel

Large rocks
along stream bank

drain
outlet

gutters

Basin 1
160 gal.

Basin 2
210 gal.

Basin 3
550 gal.

Overflow to forest

Driveway











One year later



Pitfalls to Avoid

Too high on
the slope

Bare mulch
will move

Insufficient
ponding
volume

Unprotected
Overflow =
Erosion

Sand and
Gravel as
Mulch





Inadequate
Drainage =
Constructed
Wetland

Resources



www.mass.gov

Stormwater Solutions for Homeowners Fact Sheet:
Rain Gardens



Stormwater is rainwater and snowmelt that runs over the ground, picking up pollutants along the way—such as oil from roadways, silt and sand from exposed soil, nutrients from fertilizers, bacteria from pet waste, and pesticides from lawns. These pollutants are not treated or removed when the stormwater flows through a storm drain or directly to the nearest body of water, resulting in stormwater pollution that can contaminate shellfish beds and swimming areas, cause algae blooms and fish kills, and otherwise impact people, wildlife, and ecosystems. This runoff can also cause flooding and erosion on your property and beyond. To help address these problems, the Massachusetts Office of Coastal Zone Management (CZM) has developed Stormwater Solutions for Homeowners, a series of fact sheets on techniques to control runoff on your property and reduce stormwater contamination of local waters.

Introduction

Rain gardens are specially designed and planted depressions in the ground that collect, filter, and treat stormwater. These slightly sunken gardens allow collected water to be taken up by plants or slowly infiltrated (i.e., filtered into the ground), reducing the amount of water running off site. Rain garden soils—which are typically amended with mulch and sand to promote proper moisture levels and drainage properly—also remove pollutants (including metals, nutrients, sediments, oils/grease, and organic



<https://www.mass.gov/info-details/stormwater-solutions-for-homeowners-fact-sheet-rain-gardens>



[Rain Gardens Home](#)

[Rain Gardens 101](#)

[Siting & Sizing](#)

[Design & Installation](#)

[Plants](#)

[Maintenance](#)

[Cost Calculator](#)

What is a Rain Garden?

A rain garden is a depression (about 6 inches deep) that collects stormwater runoff from a roof, driveway or yard and allows it to infiltrate into the ground. Rain gardens are typically planted with shrubs and perennials (natives are ideal), and can be colorful, landscaped areas in your yard. [{learn more}](#)



UConn Middlesex County Extension Center, Haddam, CT.



Why a Rain Garden?

Every time it rains, water runs off impervious surfaces such as roofs, driveways, roads and parking lots, collecting pollutants along the way. This runoff has been cited by the United States Environmental Protection Agency as a major source of pollution to our nation's waterways. By building a rain garden at your home, you can reduce the amount of pollutants that leave your yard and enter nearby lakes, streams and ponds. [{read more}](#)

[Can I Build a Rain Garden?](#)

[Environmental Benefits](#)

You Can Make A Difference!



Rain Garden App

A Mobile App for designing, installing, and maintaining a Rain Garden

[LEARN MORE](#)

Springfield Museums



Springfield Museums



Residential



Walnut Street Farm, Garden the Community



Design with a professional, install in community

Rain Gardens



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Thank you