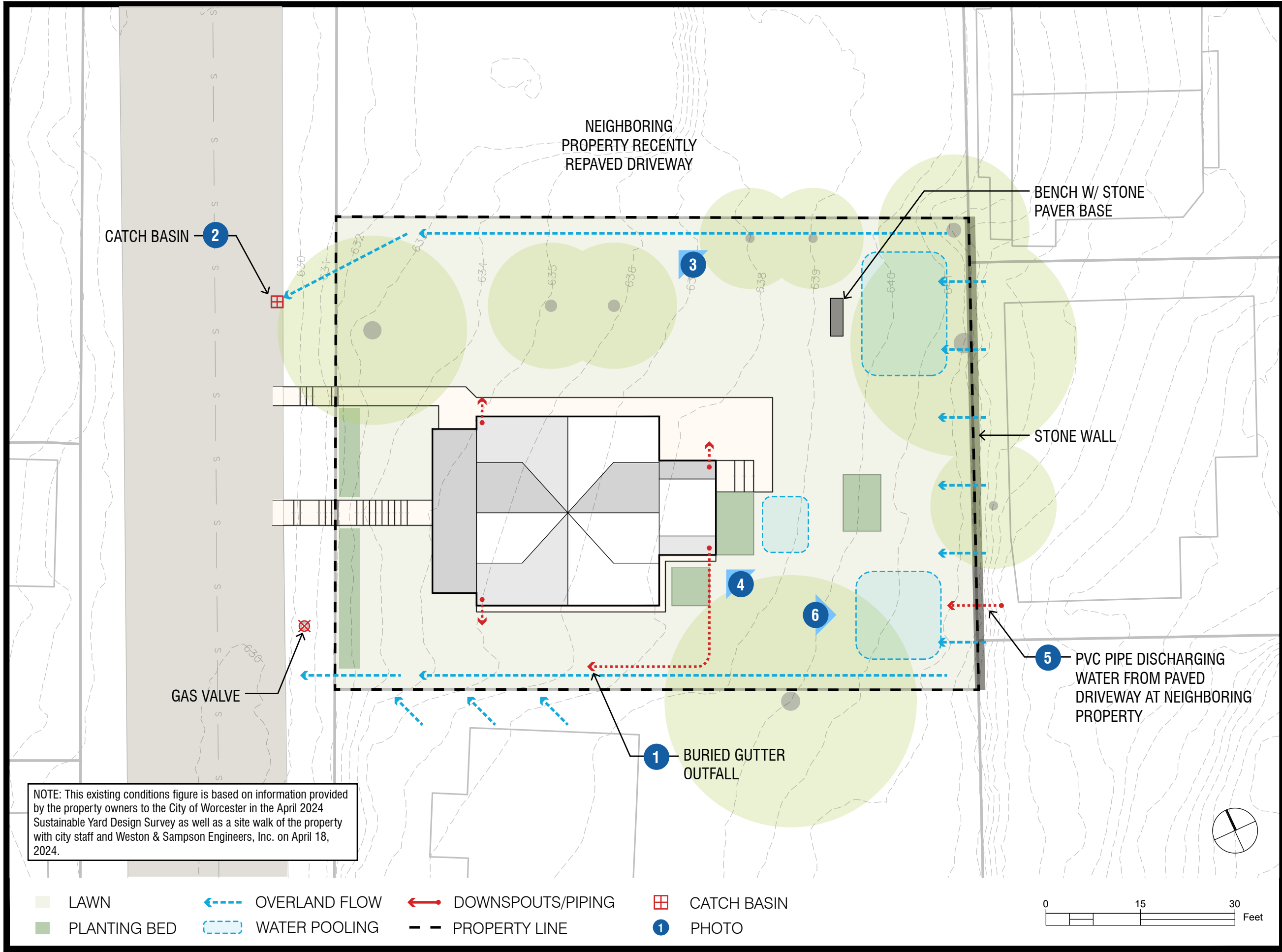


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Project:

SUSTAINABLE YARD DESIGN
CASE STUDY 1
WORCESTER, MA

Weston & Sampson[™]

Weston & Sampson Engineers, Inc.
55 Walkers Brook Drive, Suite 100
Reading, MA 01867
978.532.1900 800.SAMPSON

www.westonandsampson.com

Revisions:

No.	Date	Description

Issued For:

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Scale:

Date: 05/09/24
Drawn By: CD
Reviewed By: AS
Approved By: JM

W&S Project No.: ENG22 - 1048
W&S File No.:

Drawing Title:

EXISTING CONDITIONS
PLAN

Sheet Number:

C101

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1 GUTTER OUTLET ALONG SOUTH EDGE OF PROPERTY



2 CATCH BASIN ALONG VELANDER STREET CAPTURES WATER COMING OFF NORTH EDGE OF PROPERTY



3 WATER RUNS ALONG NORTH EDGE OF PROPERTY



4 BURIED GUTTER AT SE CORNER OF HOUSE



5 PVC PIPE DISCHARGING WATER FROM PAVED DRIVEWAY AT NEIGHBORING PROPERTY



6 POOLING IN BACK YARD

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W&S Project No.: ENG22 - 1048
W&S File No.:

Drawing Title:

EXISTING CONDITIONS
PHOTOS

Sheet Number:

C102

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NOTES:

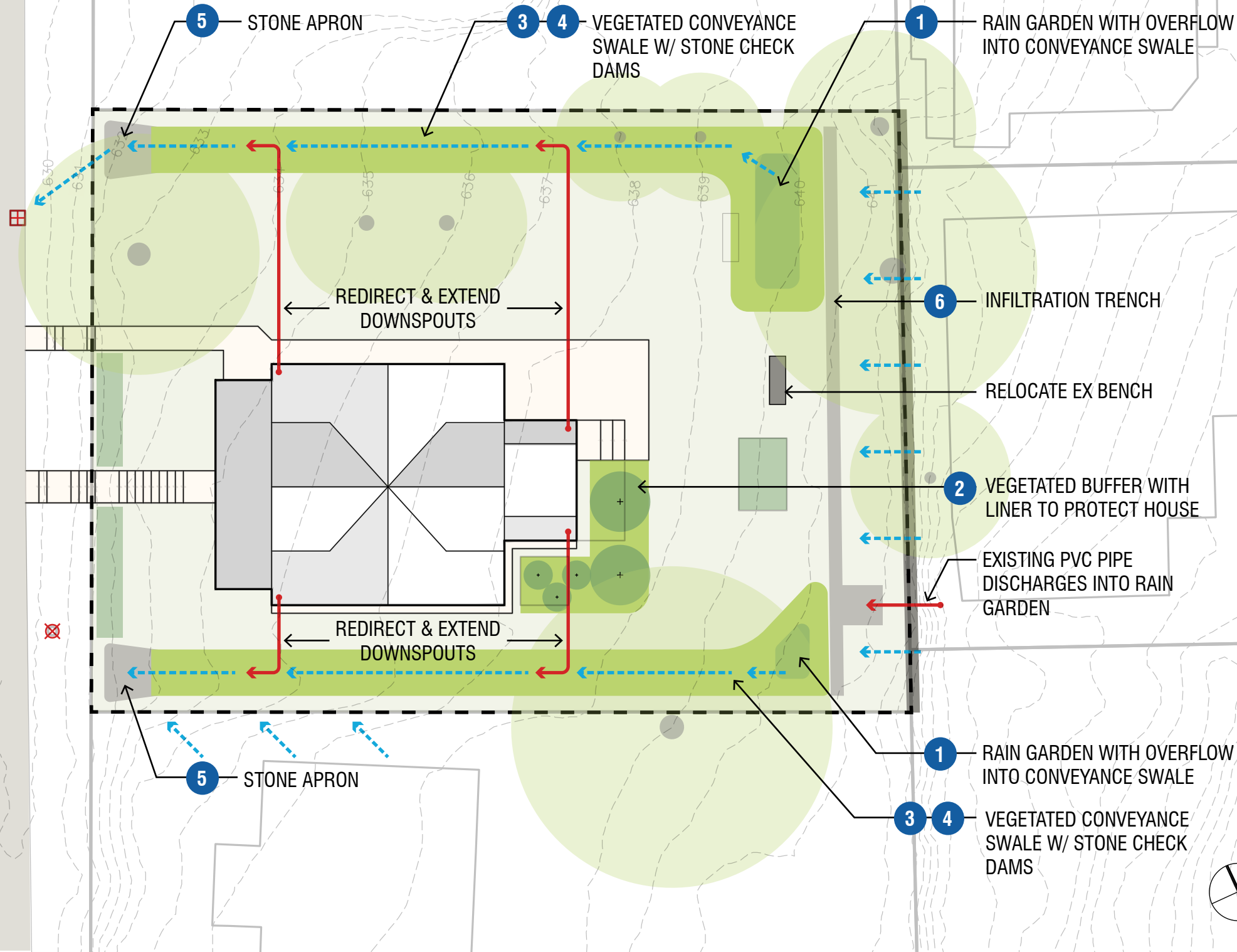
- Weston & Sampson Engineers, Inc., has prepared these concepts in a manner consistent with that degree of skill and care ordinarily exercised by practicing design professionals performing similar services in the same locality, at the same site and under the same or similar circumstances and conditions, as well as its reasonable engineering judgment consistent with generally accepted scientific, industry, municipal or governmental information concerning environmental, atmospheric and geotechnical and hydrological conditions and developments. Weston & Sampson Engineers, Inc., makes no other representations or warranties, whether expressed or implied, with respect to the services rendered hereunder.
- Contact DigSafe (call 811) before beginning any excavation work on property.

--- OVERLAND FLOW
--- PROPERTY LINE

--- DOWNSPOUTS/CLOSED PIPING
CATCH BASIN

1 STORMWATER BEST MANAGEMENT PRACTICE (BMP)

0 15 30 Feet



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No.	Date	Description

Issued For:
NOT RELEASED FOR
CONSTRUCTION

Scale: 1" = 15'-0"

Date: 05/09/24
Drawn By: CD
Reviewed By: AS
Approved By: JM

W&S Project No.: ENG22 - 1048
W&S File No.:

Drawing Title:

SITE PLAN

Sheet Number:

C201

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STORMWATER BEST MANAGEMENT PRACTICE (BMP)



Photo Credit: Acton Wakefield Watersheds Alliance(AWWA)

1 RAIN GARDEN

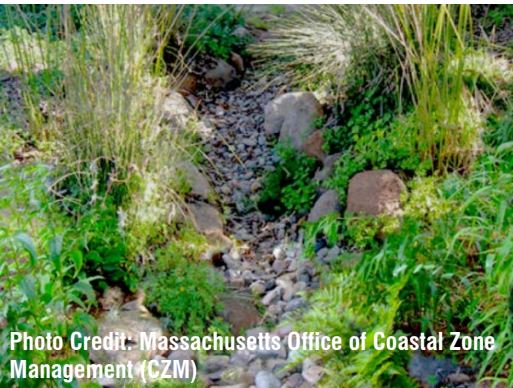


Photo Credit: Massachusetts Office of Coastal Zone Management (CZM)

3 VEGETATED CONVEYANCE SWALE



Photo Credit: Alliance for the Bay, MD

5 STONE APRON



Photo Credit: Massachusetts Office of Coastal Zone Management (CZM)

2 VEGETATED BUFFER



Photo Credit: After Wild Fire, NM

4 STONE CHECK DAM



Photo Credit: Acton Wakefield Watersheds Alliance(AWWA)

6 INFILTRATION TRENCH

NOTE: Plant suitability is not limited to the sample plant list. A professional horticulturalist, landscape designer, or landscape architect can help in exploring additional species suitable for your site.

CONSIDERATIONS FOR PLANTING

Refer to the UMASS Extension Landscape, Nursery and Urban Forestry Program “[Plant Selection for Managed Landscapes: Right plant, right place](#)” guidelines below when selecting landscape plants.

Some site conditions to keep in mind when selecting landscape plants include:

- light availability, intensity and duration (full sun to deep shade)
- water availability, both quantity and quality
- exposure to wind and temperature extremes
- soil type, drainage, compaction
- hardiness zone
- competition from existing vegetation
- below ground conditions in urban sites
- above ground wires or obstructions

Aesthetic considerations for plant selection include:

- growth habit, i.e. pyramidal, columnar, spreading, etc.
- season and color of bloom
- foliage color, texture, and shape
- winter interest of bark, fruit, or structure
- benefits to wildlife
- fall color
- longevity

PLANT SELECTION BY FUNCTION

- [Pollinator Garden](#) (massnrc.org/ppd/)
- [Rain Garden](#) (mass.gov/info-details/stormwater-solutions-for-homeowners)
- [Understory Planting for Erosion Control](#) (mass.gov/info-details/stormwater-solutions-for-homeowners)
- [Vegetated Buffer](#) (mass.gov/info-details/stormwater-solutions-for-homeowners)
- [Vegetated Swale](#) (mass.gov/info-details/stormwater-solutions-for-homeowners)

WHERE TO PURCHASE NATIVE PLANTS

- [Grow Native Massachusetts](#) (grownativemass.org/Great-Resources/nurseries-seed)
- [Native Plant Trust](#) (nativeplanttrust.org)
- [Native Plant Initiative](#) (apcc.org/our-work/education/native-plant-initiative/)
- [Blue Stem Natives](#) (bluestemnatives.com)
- [New England Wetland Plants](#) (newp.com)
- [Tree Talk Natives](#) (treetalknatives.com)
- [American Beauties Native Plants](#) (abnativeplants.com)
- Lady Bird Johnson Wildflower Center (wildflower.org)
- [National Nursery and Seed Directory](#) (nnp.rngr.net/resources/directory)
- [Arbor Day Foundation](#) (arborday.org)

SAMPLE PLANT LIST

RAIN GARDEN

Grasses, Perennials & Ferns

- Little Bluestem (Schizachyrium scoparium)
- Tussock Sedge (Carex stricta)
- Cardinal Flower (Lobelia cardinalis)
- White Turtlehead (Chelone glabra)
- Great blue lobelia (Lobelia siphilitica)
- Cinnamon fern (Osmundastrum cinnamomeum)

VEGETATED BUFFER

Grasses & Perennials

- Pennsylvania Sedge (Carex pensylvanica)
- Green-Headed Coneflower (Rudbeckia laciniata)
- Cardinal Flower (Lobelia cardinalis)
- White Turtlehead (Chelone glabra)
- New England Aster (Symphyotrichum novae-angliae)

Shrubs & Trees

- Oakleaf Hydrangea (Hydrangea quercifolia)
- Serviceberry (Amelanchier canadensis)

VEGETATED CONVEYANCE SWALE

Grasses & Perennials

- Blue Flag Iris (Iris versicolor)
- Canada Bluejoint (Calamagrostis canadensis)
- Cardinal Flower (Lobelia cardinalis)
- Marsh Marigold (Caltha palustris)
- Swamp Milkweed (Asclepias incarnata)
- Sweet Joe-Pye Weed (Eutrochium purpureum)
- Tussock Sedge (Carex stricta)

NATURE-BASED SOLUTIONS RESOURCES

- [Easthampton Homeowner's Guide to Do-it-Yourself Stormwater Management Solutions that Improve Community Resilience](#) (easthamptonma.gov/DocumentCenter/View/3891/Residential-Guide-to-Stormwater-Management---English?bidId=)
- [National Fish and Wildlife](#) (www.stormwaterguide.org/static/HomeownersGuide.pdf)

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Date: 05/09/24
Drawn By: CD
Reviewed By: AS
Approved By: JM

W&S Project No.: ENG22 - 1048
W&S File No.:

Drawing Title:

SITE PLAN

Sheet Number:

C202



Prepared by Weston & Sampson, May 2024

Item Description	Quantity	Unit	Unit Price	Total Price	Notes	Reference Link
Downspout Extensions						
Aluminum Downspout	7	10 FT	\$16.50	\$115.50	Downspout piping typically sold in 10-ft segments. ~\$16.50 for 2"x3"x10' segment, per Home Depot. Larger size (3"x4"x10') is ~\$18.	https://www.homedepot.com/p/Amerimax-Home-Products-2-in-x-3-in-x-10-ft-White-Aluminum-Downspout-2601000120/100016183
Aluminum Downspout B-Elbow	3	EA	\$4.25	\$12.75	B-Elbows allow for horizontal turns on the ground. 2"x3" ~\$4.25, 3"x4" ~\$5.25, per Home Depot.	https://www.homedepot.com/p/Amerimax-Home-Products-2-in-x-3-in-White-Aluminum-Downspout-B-Elbow-27065/100011647
River Stone Apron at Downspout Outlet	10	CF	\$10.00	\$100.00	Assume 10 sf x 3" deep per apron. 4 aprons needed. Per home depot, one 0.5-cf bag costs ~\$5. Alternatively could use the same crushed stone as the infiltration trench.	https://www.homedepot.com/p/Vigoro-0-5-cu-ft-Bagged-River-Pebble-Landscape-Rock-54250V/100558618
Contingency	20%	Subtotal		\$228.25		
				\$45.65		
		Total		\$273.90		
Infiltration Trench						
Crushed Stone for Infiltration Trench	100	CF	\$28.00	\$2,800.00	Assume 140 sf x 8" deep trench (~93 cf). 25 cf pallet of 3/8" crushed stone/gravel is ~\$700, per home depot. Assume 4 pallets are needed.	https://www.homedepot.com/p/Southwest-Boulder-Stone-25-cu-ft-3-8-in-Crushed-Gravel-Bulk-Landscape-Rock-and-Pebble-for-Gardening-Landscaping-Driveways-and-Walkways-02-0095/312642186
Geotextile Fabric Liner for Infiltration Trench	255	SF	\$0.10	\$25.50	Assume ~140 sf trench footprint, plus an additional 1.5 ft along the entire ~75-ft length to cover both sides. Assume \$0.10 per sf based on multiple Home Depot Options.	
Contingency	20%	Subtotal		\$2,825.50		
				\$565.10		
		Total		\$3,390.60		
North Improvements - Conveyance Swale & Rain Garden						
Mulch - 3"	170	CF	\$2.00	\$340.00	3" depth over entire ~675 sf total planting area (585 sf swale, 90 sf rain garden).	https://www.homedepot.com/p/Vigoro-2-cu-ft-Bagged-Premium-Black-Wood-Mulch-52050197/205606445
Bioretention Soil Mix	41	CY	\$30.00	\$1,230.00	18" depth for swale (585 sf) and 30" depth for rain garden (90 sf)	Other projects
Coarse Sand - 1"	2	CY	\$55.00	\$110.00	1" depth over entire ~675 sf total planting area (585 sf swale, 90 sf rain garden).	Other projects
Pea Gravel - 3"	7	CY	\$86.00	\$602.00	3" depth over entire ~675 sf total planting area (585 sf swale, 90 sf rain garden).	Other projects
3/4" Crushed Stone - 8"	17	CY	\$50.00	\$850.00	8" depth over entire ~675 sf total planting area (585 sf swale, 90 sf rain garden). ~90 sf total area of rain gardens, plus assume an additional 3.5 ft along the perimeter of gardens (~42 ft) to line the sides. ~585 sf of swale, plus assume an additional 2.5 ft along perimeter of swale (~210 ft) to line the sides. Assume \$0.10 per sf based on multiple Home Depot options.	https://www.aawillmaterials.com/store/3-4-Crushed-Stone-p281934456
Geotextile Fabric	1350	SF	\$0.10	\$135.00		
Stone Check Dams	1	CY	\$100.00	\$100.00	Assume 5' x 1' x 2' check dams. Assume 1 dam per swale. Larger stones needed for check dam.	https://www.aawillmaterials.com/store/3%E2%80%9D-8%E2%80%9D-Riverbed-Tan-p362094617
Stone Aprons	10	CF	\$10.00	\$100.00	One ~40 sf apron. Assume 3" depth. Assume same river stone as the aprons for downspout outlets (\$5 per 0.5-cf bag)	https://www.homedepot.com/p/Vigoro-0-5-cu-ft-Bagged-River-Pebble-Landscape-Rock-54250V/100558618
Erosion Control/Restoration Mix for Moist Sites	3	LBS	\$39.00	\$117.00	1250 sf per lb, minimum order 3 lbs. ~675 sf planting area.	https://newp.com/product/new-england-erosion-control-restoration-mix-for-detention-basins-and-moist-sites/
Contingency	20%	Subtotal		\$3,584.00		
				\$716.80		
		Total		\$4,300.80		
South Improvements - Conveyance Swale & Rain Garden						
Mulch - 3"	137	CF	\$2.00	\$274.00	3" depth over entire ~545 sf total planting area (520 sf swale, 25 sf rain garden).	https://www.homedepot.com/p/Vigoro-2-cu-ft-Bagged-Premium-Black-Wood-Mulch-52050197/205606445
Bioretention Soil Mix	32	CY	\$30.00	\$960.00	18" depth for swale (520 sf) and 30" depth for rain garden (25 sf)	Other projects
Coarse Sand - 1"	2	CY	\$55.00	\$110.00	1" depth over entire ~545 sf total planting area (520 sf swale, 25 sf rain garden).	Other projects
Pea Gravel - 3"	5	CY	\$86.00	\$430.00	3" depth over entire ~545 sf total planting area (520 sf swale, 25 sf rain garden).	Other projects
3/4" Crushed Stone - 8"	14	CY	\$50.00	\$700.00	8" depth over entire ~545 sf total planting area (520 sf swale, 25 sf rain garden). ~25 sf total area of rain garden, plus assume an additional 3.5 ft along the perimeter of garden (~19 ft) to line the sides. ~520 sf of swale, plus assume an additional 2.5 ft along perimeter of swale (~190 ft) to line the sides. Assume \$0.10 per sf based on multiple Home Depot options.	https://www.aawillmaterials.com/store/3-4-Crushed-Stone-p281934456
Geotextile Fabric	1090	SF	\$0.10	\$109.00		
Stone Check Dams	1	CY	\$100.00	\$100.00	Assume 5' x 1' x 2' check dams. Assume 1 dam per swale. Larger stones needed for check dam.	https://www.aawillmaterials.com/store/3%E2%80%9D-8%E2%80%9D-Riverbed-Tan-p362094617
Stone Aprons	10	CF	\$10.00	\$100.00	One ~40 sf apron. Assume 3" depth. Assume same river stone as the aprons for downspout outlets (\$5 per 0.5-cf bag)	https://www.homedepot.com/p/Vigoro-0-5-cu-ft-Bagged-River-Pebble-Landscape-Rock-54250V/100558618
Erosion Control/Restoration Mix for Moist Sites	3	LBS	\$39.00	\$117.00	1250 sf per lb, minimum order 3 lbs. ~545 sf planting area.	https://newp.com/product/new-england-erosion-control-restoration-mix-for-detention-basins-and-moist-sites/
Contingency	20%	Subtotal		\$2,900.00		
				\$580.00		
		Total		\$3,480.00		



Prepared by Weston & Sampson, May 2024

Item Description	Quantity	Unit	Unit Price	Total Price	Notes	Reference Link
Vegetated Buffer - Adjacent to House						
Mulch - 3"	50	CF	\$2.00	\$100.00	~200 sf vegetated buffer, 3" depth	https://www.homedepot.com/p/Vigoro-2-cu-ft-Bagged-Premium-Black-Wood-Mulch-52050197/205606445
Bioretention Soil Mix - 18"	11	CY	\$30.00	\$330.00	~200 sf vegetated buffer, 18" depth	Other projects
Coarse Sand - 1"	1	CY	\$55.00	\$55.00	~200 sf vegetated buffer, 1" depth	Other projects
Geotextile Fabric	60	SF	\$0.10	\$6.00	Fabric liner needed along the 32-ft length that abuts the house, down the entire 22" depth. Assume \$0.10 per sf based on multiple Home Depot options.	
Tree Plantings	2	EA	\$350.00	\$700.00		Assume 2-2.5" caliper.
Shrub Plantings	3	EA	\$12.00	\$36.00	1 gal buckets ~\$12 per NEWP, other plant size options available, see links to right	NEWP: https://newp.com/catalog/shrubs/ NPT: https://newfs-society.s3.amazonaws.com/documents/2024-05-02_NPT_2024_Plants_Price_Availability_List.pdf
Erosion Control/Restoration Mix for Moist Sites	3	LBS	\$39.00	\$117.00	1250 sf per lb, minimum order 3 lbs. Vegetated buffer ~200 sf; swales and rain gardens ~1200 sf total.	https://newp.com/product/new-england-erosion-control-restoration-mix-for-detention-basins-and-moist-sites/
Contingency	20%	Subtotal		\$1,344.00		
				\$268.80		
		Total		\$1,612.80		
TOTAL COST				\$13,058.10		

Notes:

- Costs are for materials only and exclude labor costs (contractor).
- Costs are presented in 2024 US dollars and include a 20% contingency.
- Costs are based on pricing from Home Depot, New England Wetland Plants, Inc., Native Plant Trust, and reference pricing from other projects
- Weston & Sampson Engineers, Inc. makes cost estimates using its best judgement as an experienced and qualified professional engineer generally familiar with the construction industry. Weston & Sampson Engineers, Inc. has no control over the cost of labor, materials, equipment or services furnished by others, or any methods of determining prices, or competitive bidding or market conditions when the project will be constructed. Weston & Sampson Engineers, Inc. cannot and does not guarantee that a contractor’s bids or actual construction costs will not vary from cost estimates prepared. If property owner desires greater assurance as to probable construction cost, property owner should obtain a quote from a contractor.