Maine Department of Environmental Protection
Chapter 500 Meeting
February 5, 2025

Overview: Development of a Watershed Protection Standard

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The Development of a Watershed Protection Standard

Project Name:
Holistic Watershed Management for Existing and Future Land Use Development Activities

Prepared for EPA Region 1

In Cooperation with

Taunton Watershed Municipalities and other project participants

Prepared by

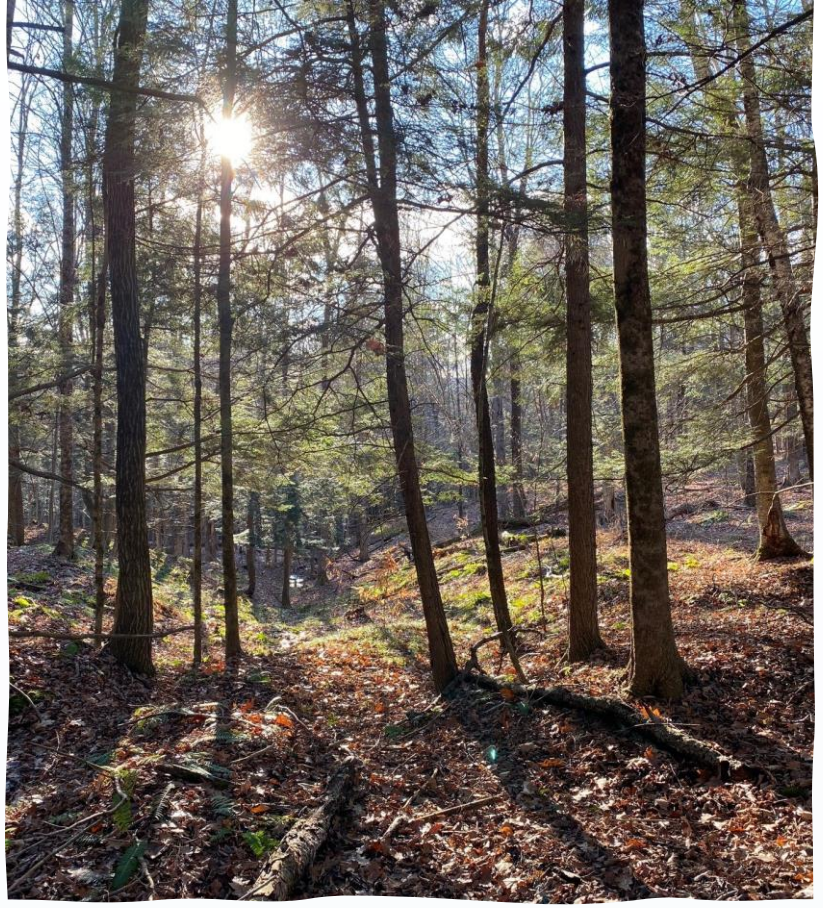
Paradigm Environmental

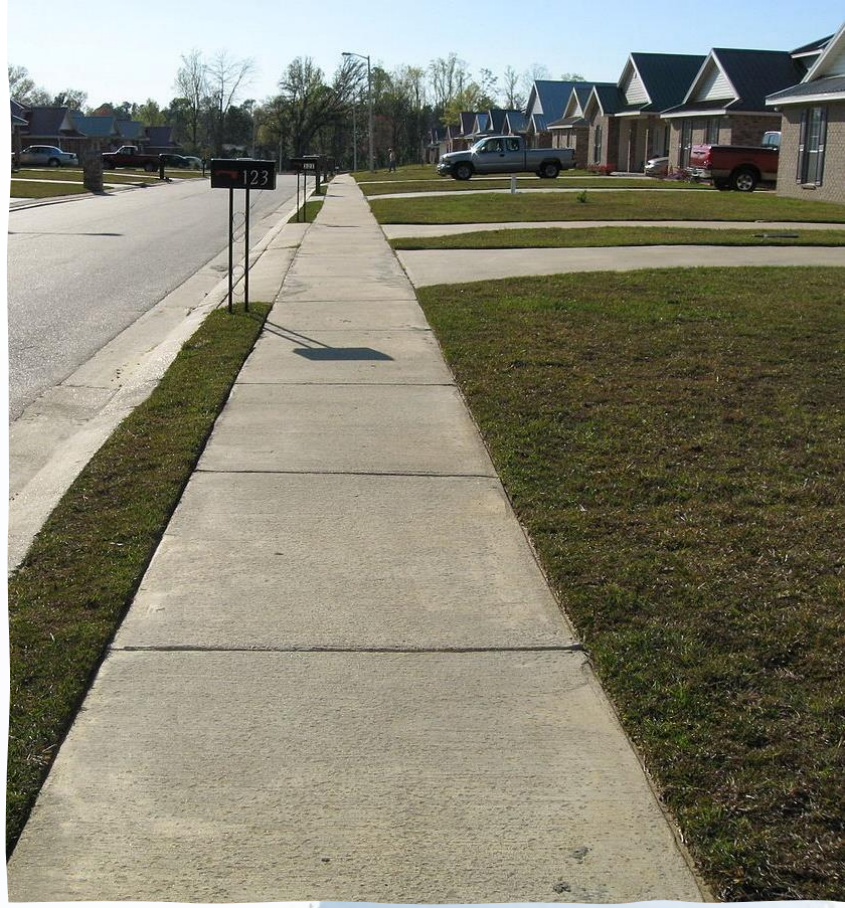
Great Lakes Environmental Center

Waterstone Engineering

JLB Planning

A Technical Direct Assistance Project funded by the USEPA Southeast New England Program (SNEP)





Applying Advances in EPA Region 1 Analytical Tools to Quantify

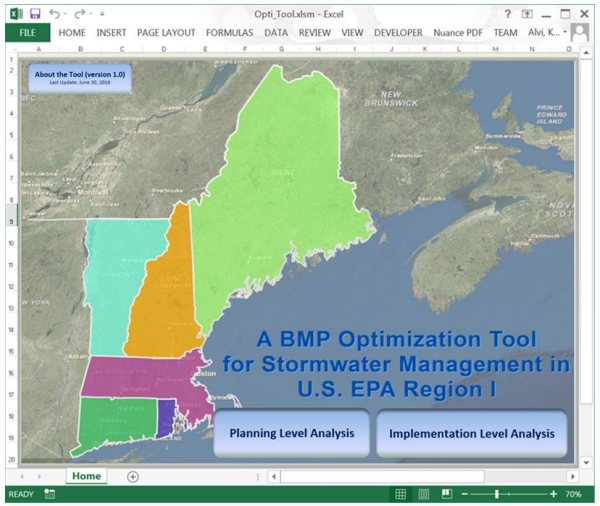
- Cumulative impacts of future IC
- Benefits of Resilient Site-Development Performance Standards
- Right sizing stormwater controls
- Future Cost Burden and Cost Avoidance Opportunities

EPA R1 Applied Research and Development of SW Tools, (2007 to 2022)

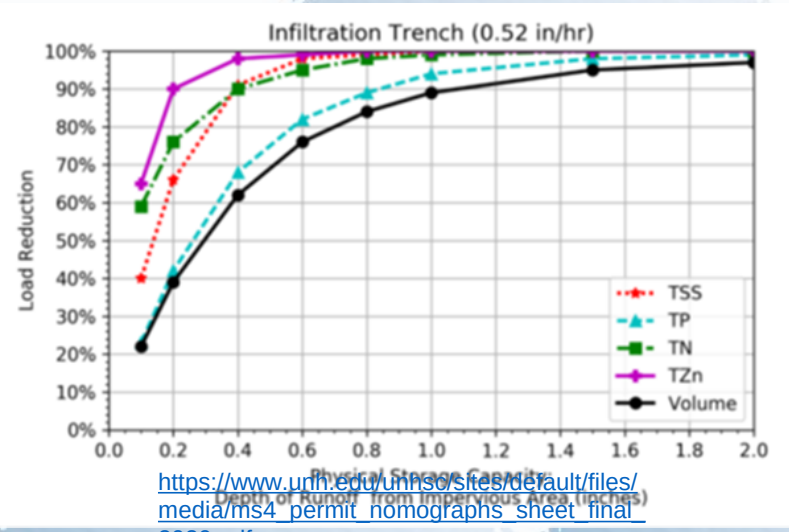
Research and Tools include:

- Regionally representative SW source pollutant load export rates by land use and cover type (e.g., IC)
- Stormwater Control Measure (SCM) Performance Curves
- Applied research validating modelling tools & SCM performance estimates
- Regional calibrated continuous simulation SWMM hydrologic source area models and SCM SUSTAIN models
- Publicly available SW Management Optimization Tool (Opti-Tool)
- Regional SCM unit cost data

Phosphorus Source Category by Land Use	Land Surface Cover	P Load Export Rate, lbs./acre/year
Commercial (COM) and Industrial (IND)	Directly connected impervious	1.78
	Pervious	See* DevPERV
Multi-Family (MFR) and High-Density Residential (HDR)	Directly connected impervious	2.32
	Pervious	See* DevPERV
Medium -Density Residential (MDR)	Directly connected impervious	1.96
	Pervious	See* DevPERV
Low Density Residential (LDR) - "Rural"	Directly connected impervious	1.52
	Pervious	See* DevPERV
Highway (HWY)	Directly connected impervious	1.34
	Pervious	See* DevPERV



https://www.epa.gov/tmdl/opti-tool-epa-region-1s-stormwater-management-optimization-tool



https://www.unh.edu/unhsc/sites/default/files/media/ms4_permit_nomographs_sheet_final_2020.pdf

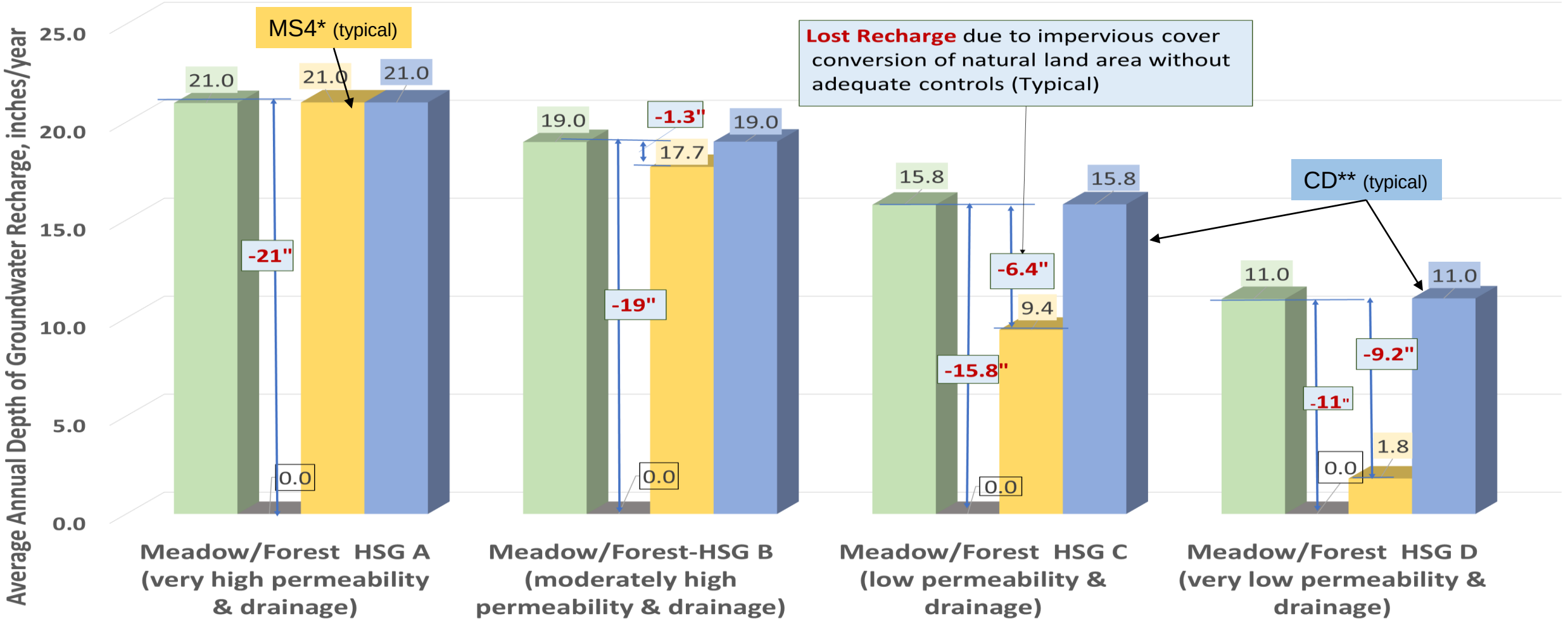
Converting Natural Land to Impervious Cover: Site Scale

- **Increased** Annual Runoff Volume
  - ~+300% to +10,000% increase (0.5 to 1.1 Million-Gallons/acre/year)
- **Lost** Annual Groundwater Recharge
  - ~0.33 to 0.56 million-gallons/acre/year
- **Increased** Annual SW **Phosphorus** Load
  - ~+330% to +6,000% (1.4 to 1.8 pounds/acre/year)
- **Increased** Annual SW **Nitrogen** Load
  - ~+240% to + 4,700% increase (10 to 14 pounds/acre/year)

Source: Mark Voorhees, EPA, retired

Change in Average Annual **Groundwater (GW) Recharge** for New Impervious Cover with & without Controls

Boston MA Climatic Conditions (1992-2020)



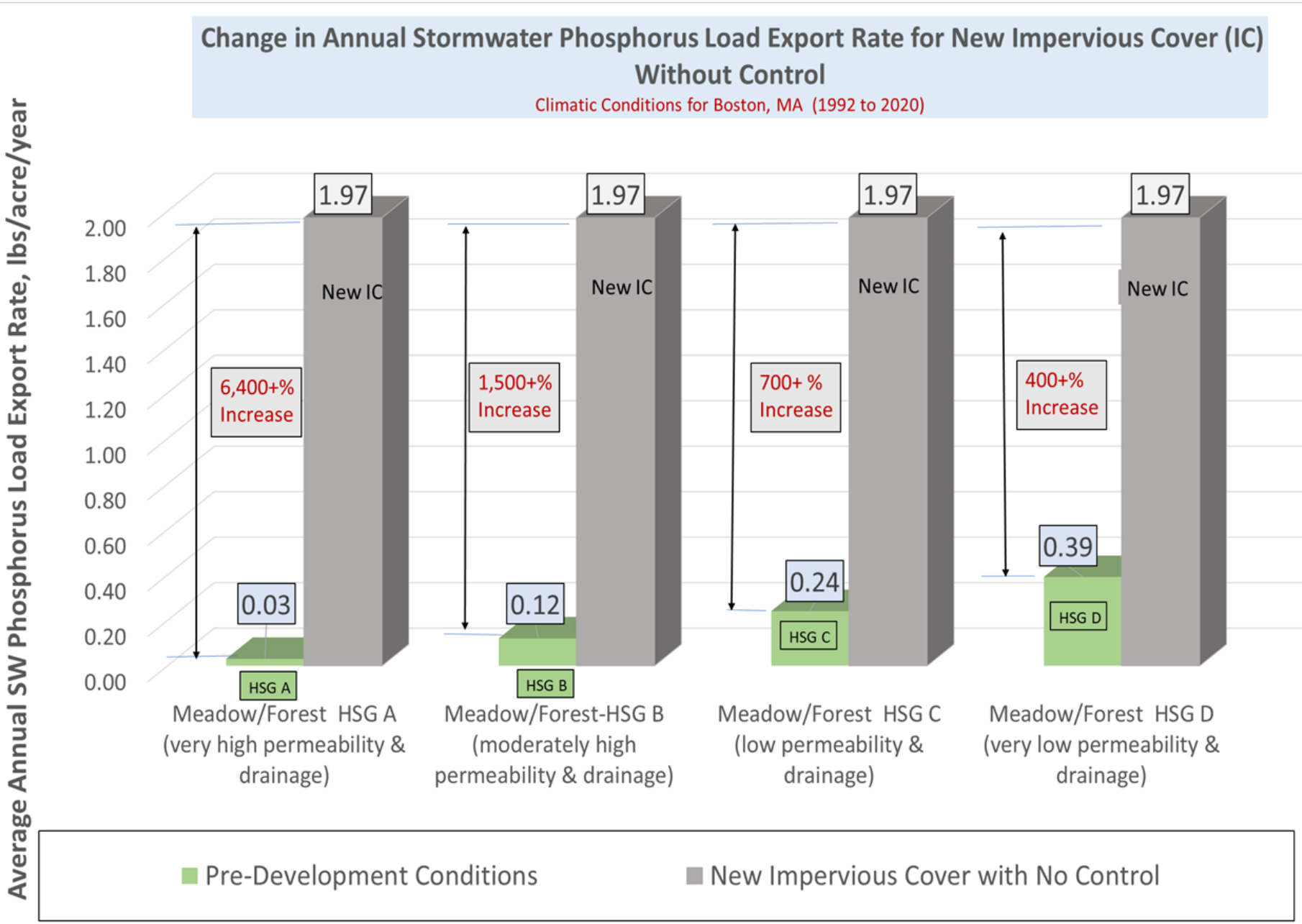
* MS4 Control level (MS4CL) = 60% TP SW Load Reduction or 2008 MassDEP Recharge standards

**Conservation Development control level (CD) = Pre-development annual GW recharge and SW load nutrient export

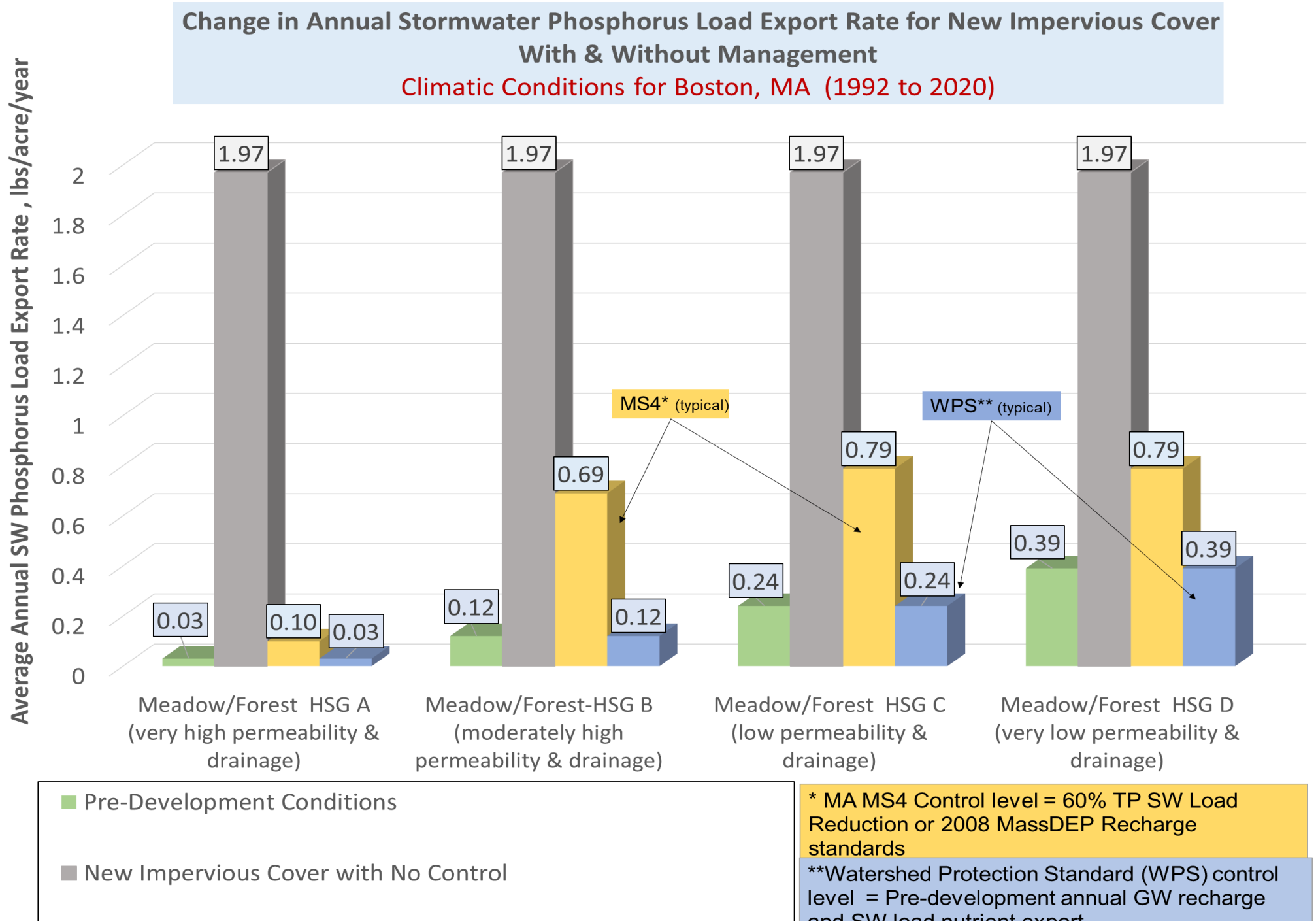
The Nutrient Challenge & SW Permitting

- **Nationally 45% to 65% of assessed waters are impaired by nutrients**
- **Stormwater is a major contributor of Phosphorus and Nitrogen**
- **Land conversion to impervious cover increases stormwater flow and nutrient delivery**
- **Changing climate leads to warmer waters and increased stormwater flow – exacerbating the issue**

Change in SW Nutrient Export Due to Impervious Cover



SW Nutrient Control for New Impervious Cover



Watershed Protection Standard

- A Watershed Protection Standard (WPS) is an alternative site development standard designed to protect and restore watershed and water resource health.
- The WPS is based on three primary elements

1. Maintain predevelopment hydrology,
2. Maintain predevelopment nutrient loads, and
3. Maintain a resilient landscape as determined by response to extreme storms.

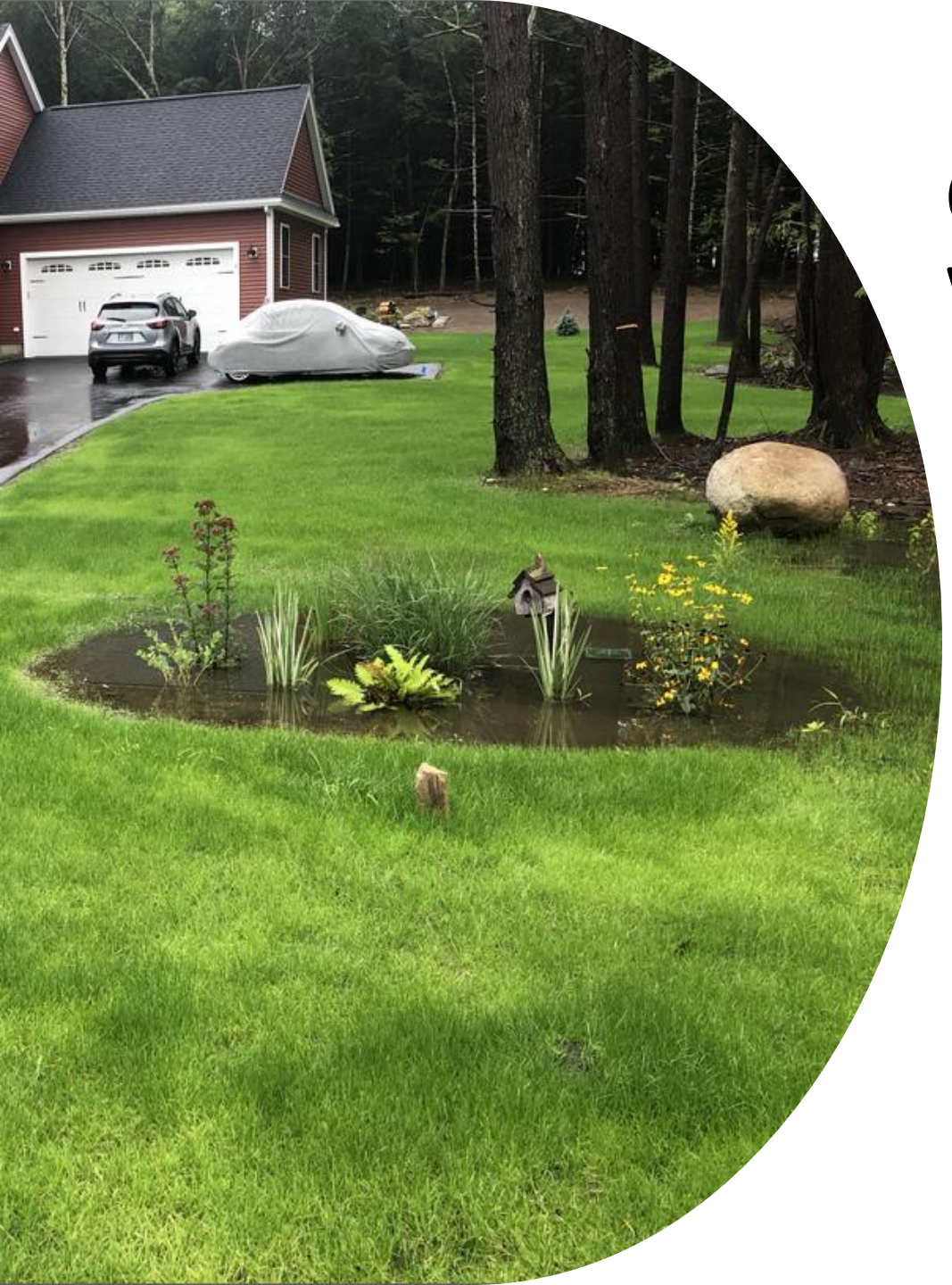
- The purpose of a WPS is to present a more protective alternative to the MA Stormwater Standards, and which could be used to reverse impacts in heavily impacted watersheds, and to prevent watershed degradation in developing watersheds.

GI Reduction of Aquatic Mortality and the Role of Green Infrastructure

A National Marine Fisheries Service study that examined the effects of stormwater on salmon.

- Salmon exposed to undiluted stormwater from a major highway were killed within hours;
- When that same stormwater was pre-filtered through soil, no fish died.
- Previous field assessments in urban stream networks have shown adult coho salmon are dying at high rates (>50%).
- The study provides direct evidence that toxic runoff is killing adult coho salmon in urban watersheds and that inexpensive mitigation measures (e.g., green infrastructure) can improve water quality and promote salmon survival.

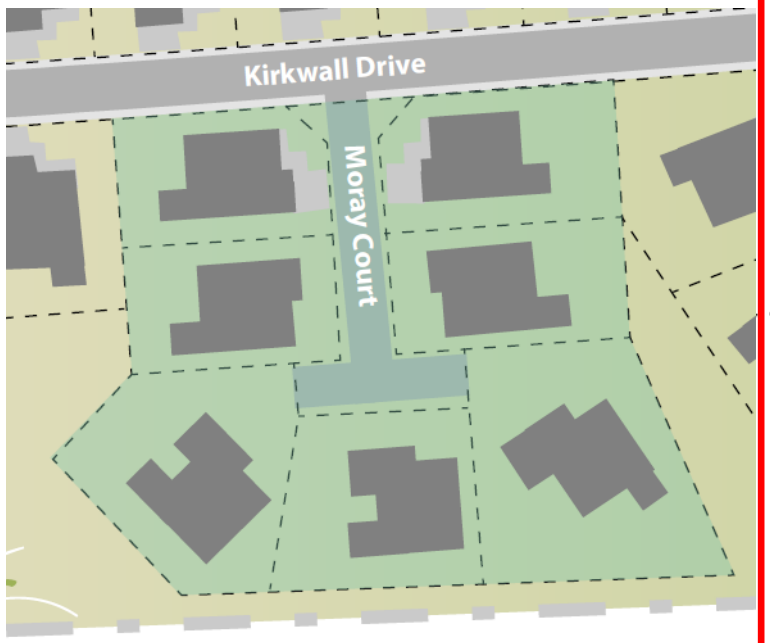
Source: Spromberg, J. A. et al. (2015). Coho salmon spawner mortality in western U.S. urban watersheds: bioinfiltration prever lethal stormwater impacts. Journal of Applied Ecology. doi: 10.1111/1365-2664.12534.



Real World Applications and Conceptual Designs for the Watershed Protection Standard

- Conservation Development designed for:
  1. Predevelopment hydrology,
  2. Predevelopment nutrient load, and
  3. landscape resiliency (peak flow controls)
- Evaluate performance and cost based on real permitted projects
- Enables the examination of the real costs and benefits for actual viable projects
- Scenario analyses done at 4 levels:
  1. Pre-development
  2. No-controls
  3. Minimum level LID per MassDEP
  4. Watershed Protection Standard and Peak Control

CONCEPT PLAN 1: HIGH DENSITY RESIDENTIAL HSG-B



CD1.2 No Controls High Density Residential

NO CONTROL

- ✗ STD 2 - PEAK FLOW CONTROL
- ✗ STD 3 - GROUNDWATER RECHARGE VOLUME
- ✗ STD 4 - TSS 80% REMOVAL (90% MS4)
  - TP 60% REMOVAL
- ✗ NO INCREASE IN NUTRIENT LOAD
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CD1.3 LID MADEP High Density Residential

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CD1.4 Watershed Protection Standard

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- NO BMPS
- COMMON FOR PROJECTS THAT DON'T TRIGGER STATE OR FEDERAL REQUIREMENTS
- AND MUNICIPALITIES WITH WEAK SWM REGULATIONS

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- 3 BMP TYPES:
  - RAIN GARDEN (DRIVEWAYS), 0.5" WQV
  - SUBSURFACE INFILTRATION TRENCH (ROOFTOP), 0.5" WQV
  - DETENTION POND (ROADWAYS)
- RAINGARDEN AND ROOFTOP INFILTRATION TO SATISFY STDS 3 (GRV) AND STD 4 (NITROGEN AND PHOSPHOROUS)
- DETENTION POND TO SATISFY STD 2 (Q-PEAK)

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- 2 BMP TYPES:
- SUBSURFACE INFILTRATION FOR ROADWAYS AND DRIVEWAYS
- ROOFTOP INFILTRATION TO SATISFY STDS 3 (GRV) AND STD 4 (NITROGEN AND PHOSPHOROUS) , 1" WQV
- ROADWAY INFILTRATION TO SATISFY STD 2 (Q-PEAK), STRUCTURAL DESIGN

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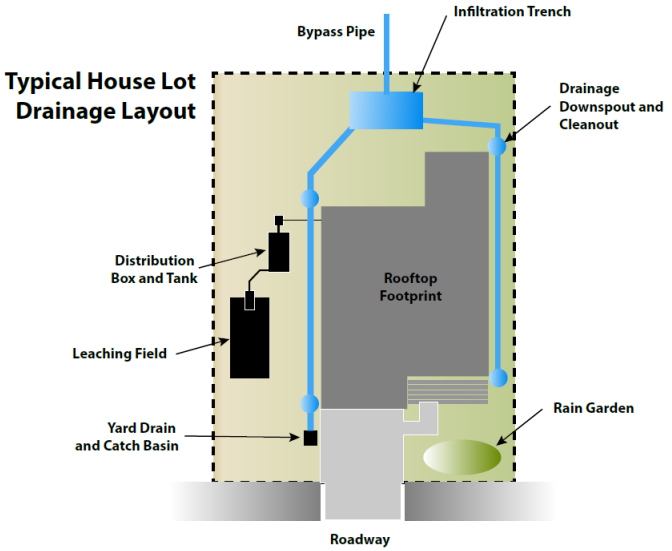
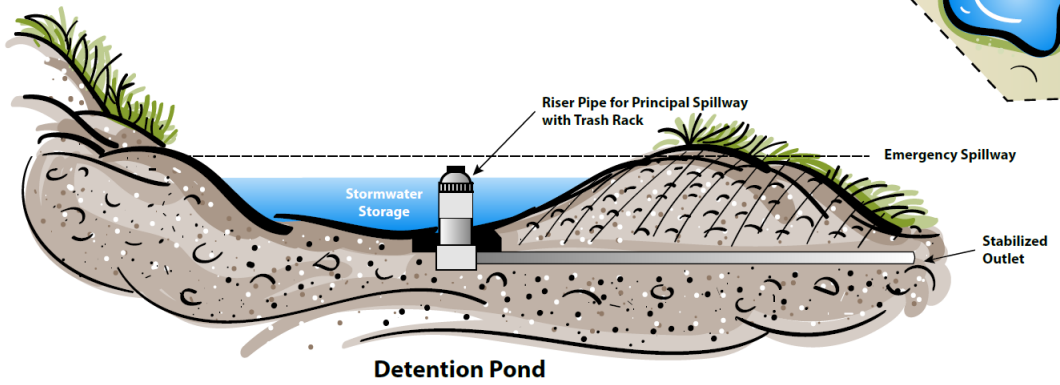
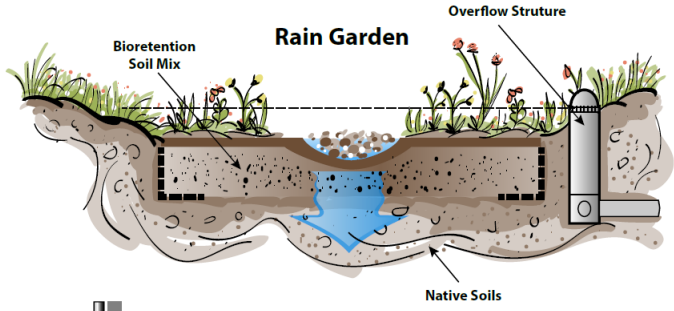
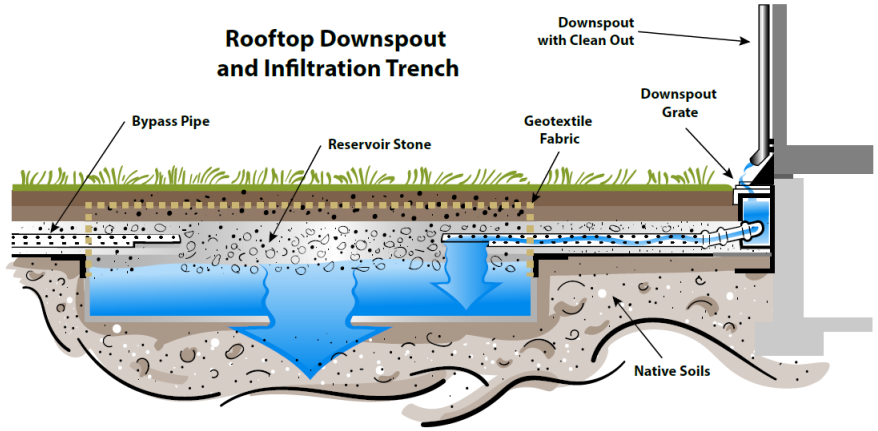




Detention Pond





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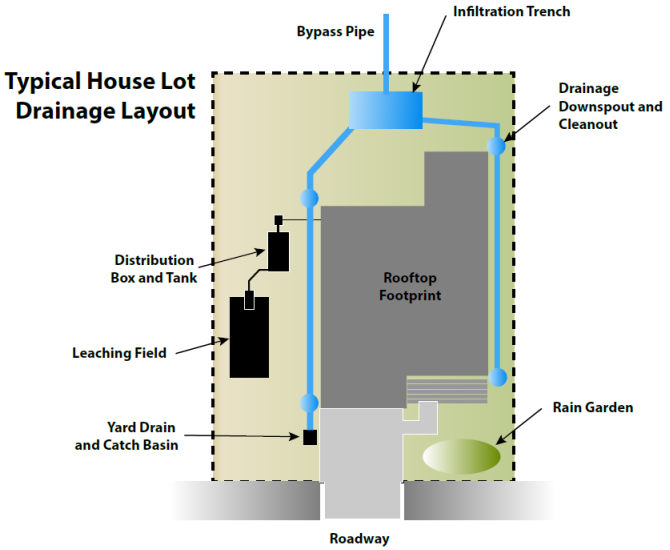
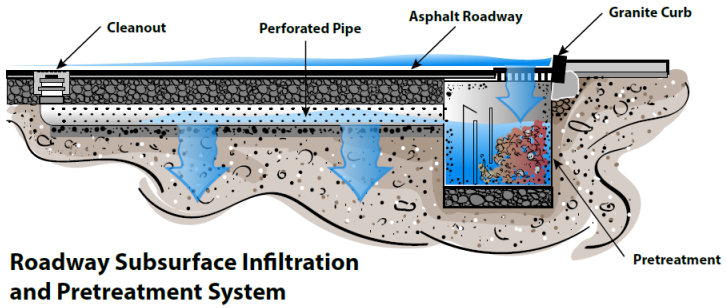
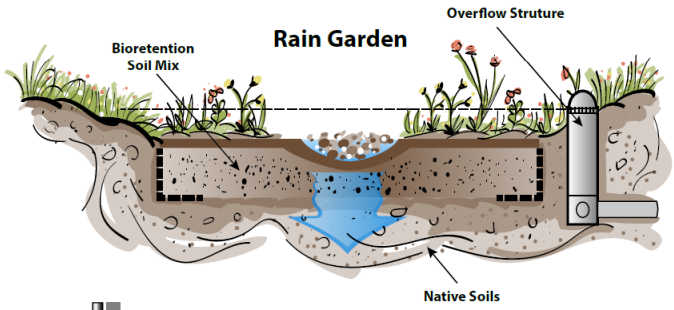
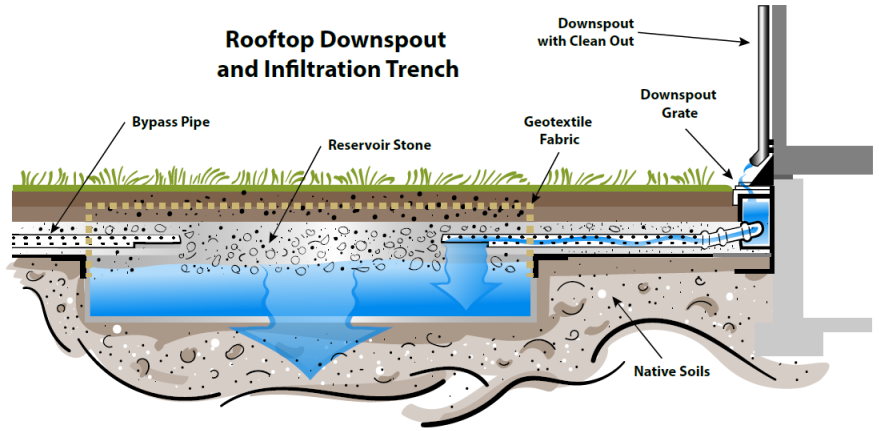




Roadway Subsurface Infiltration and Pretreatment System





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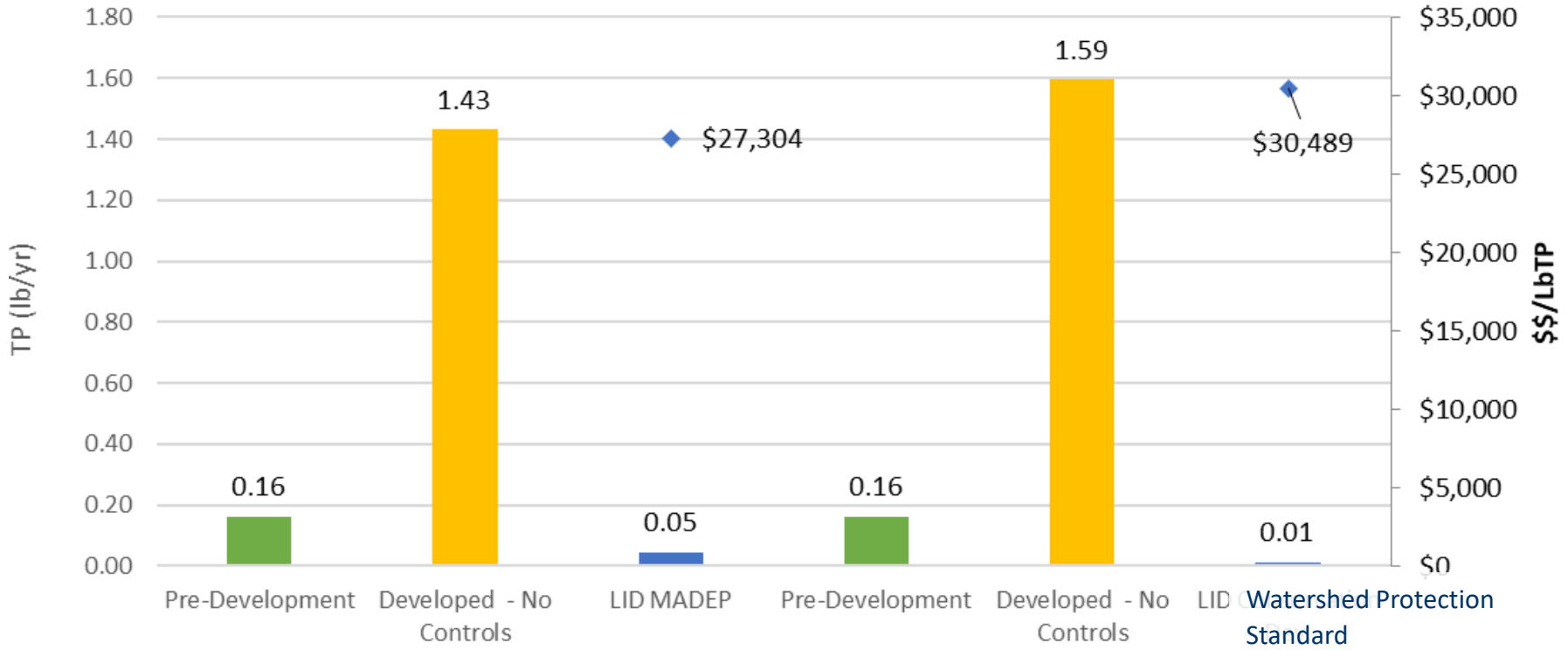

Watershed Protection Standard

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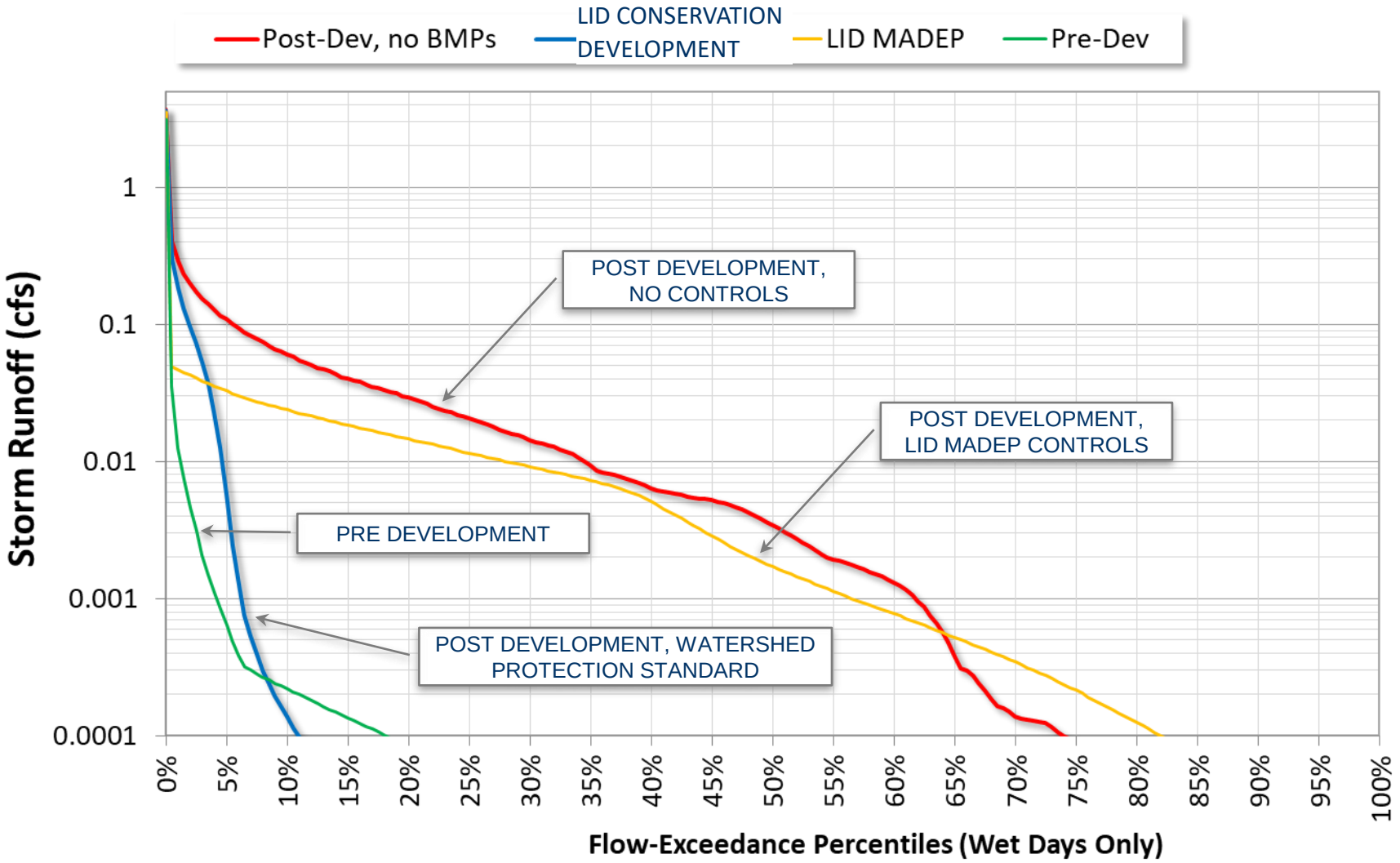

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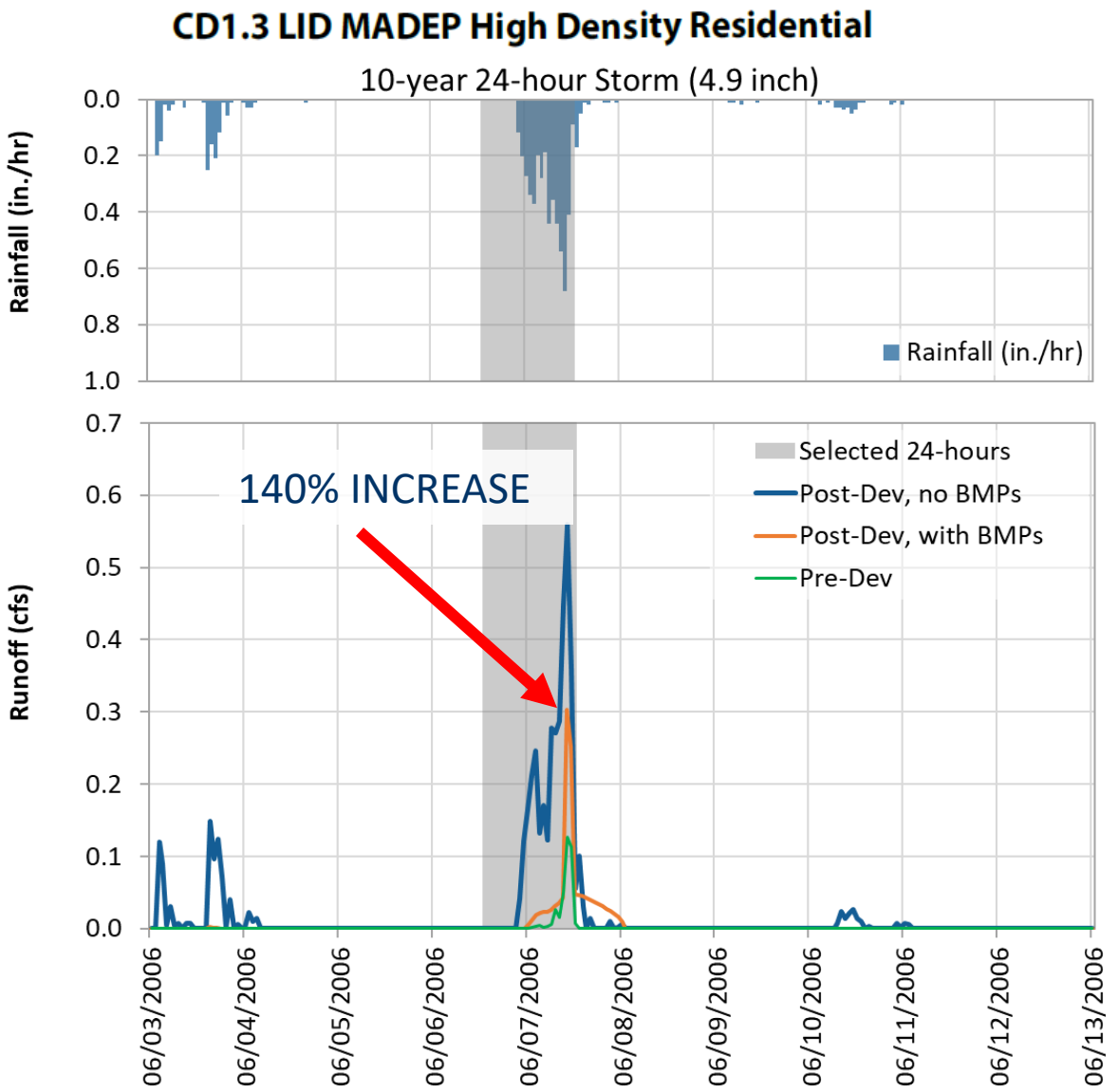

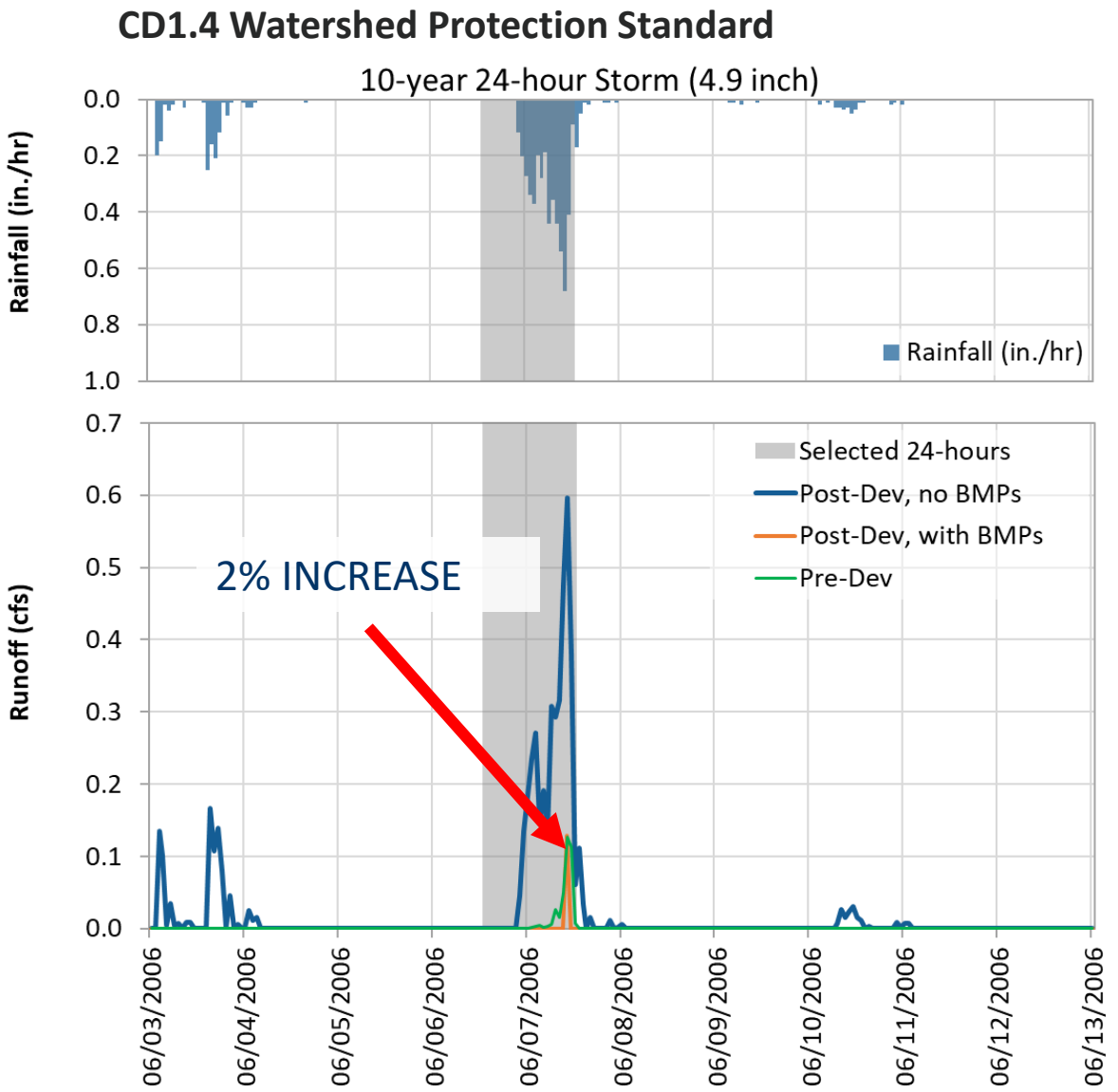

PROJECT TEAM

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- Mark Voorhees, Environmental Engineer, Stormwater Permits Section, Water Division, EPA Region 1
- Michelle Vuto, Stormwater Permits Section, Water Division, EPA Region 1
- Khalid Alvi, Water Resources Engineer, Paradigm Environmental
- Robert Roseen, PHD., D.WRE, PE, Waterstone Engineering
- Julie LaBranche, JLB Planning
- Greg Smith, Great Lakes Environmental Center

Project Webpage:
https://www.epa.gov/snep/holistic-watershed-management-existing-and-future-land-use-development-activities

Google: "EPA SNEP FDC"
SNEP: https://www.epa.gov/snep

THANK YOU FOR YOUR TIME

Phipps Center for Sustainable Landscapes