TRIECA CONFERENCE

IECA Great Lakes Chapter

Toronto and Region Conservation for The Living City

Thank you to all of our 2015 sponsors:

AQUATECH DEWATERING COMPANY

Lake Simcoe Region Conservation Authority

CVC Credit Valley Conservation

GEMS

RM CONSTRUCTION

DYNEX CONSTRUCTION INC Since 1989

filtrexx CANADA SUSTAINABLE TECHNOLOGIES let nature do it®

GEOSTORM

Holland. Pioneers in international business

Geosyntec consultants

NILEX CIVIL ENVIRONMENTAL GROUP Unearthing better results.

terrafix® geosynthetics inc.

UNILOCK®

VERDYOL Biotic Earth™ AN ORGANIC APPROACH TO SOIL BUILDING

York Region

Canada Green Building Council Chapter · Conseil du Bâtiment Durable du Canada · Greater Toronto

Media Partner

WATER CANADA THE COMPLETE WATER MAGAZINE

Seasonal Performance Variations for Stormwater Management Systems in Cold Climate Conditions

Robert M. Roseen, PHD, PE, DWRE, Geosyntec Consultants

Thanks to

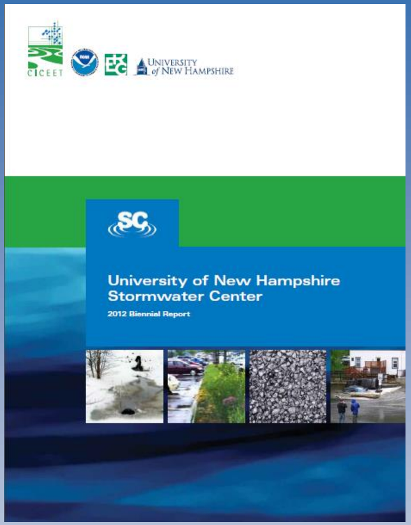
Thomas P. Ballestero, James J. Houle, Allison Watts, Tim Puls, UNH Stormwater Center

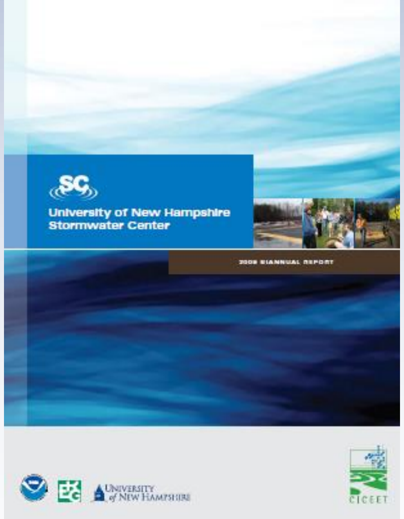
March 25,2015

Acknowledgements

Friends and Colleagues at the UNHSC

- Thomas Ballestero, PHD, PE, PG, PH
- James Houle, CPSWQ
- Alison Watts, PHD PG
- Timothy Puls,
- Robin Collins, PHD PE
- Viktor Hlas, Graduate Student, UNHSC
- Robin Stone, Graduate Student, UNHSC





Source: UNH Stormwater Center 2010 and 2012 Biennial Reports

Barriers to Implementation

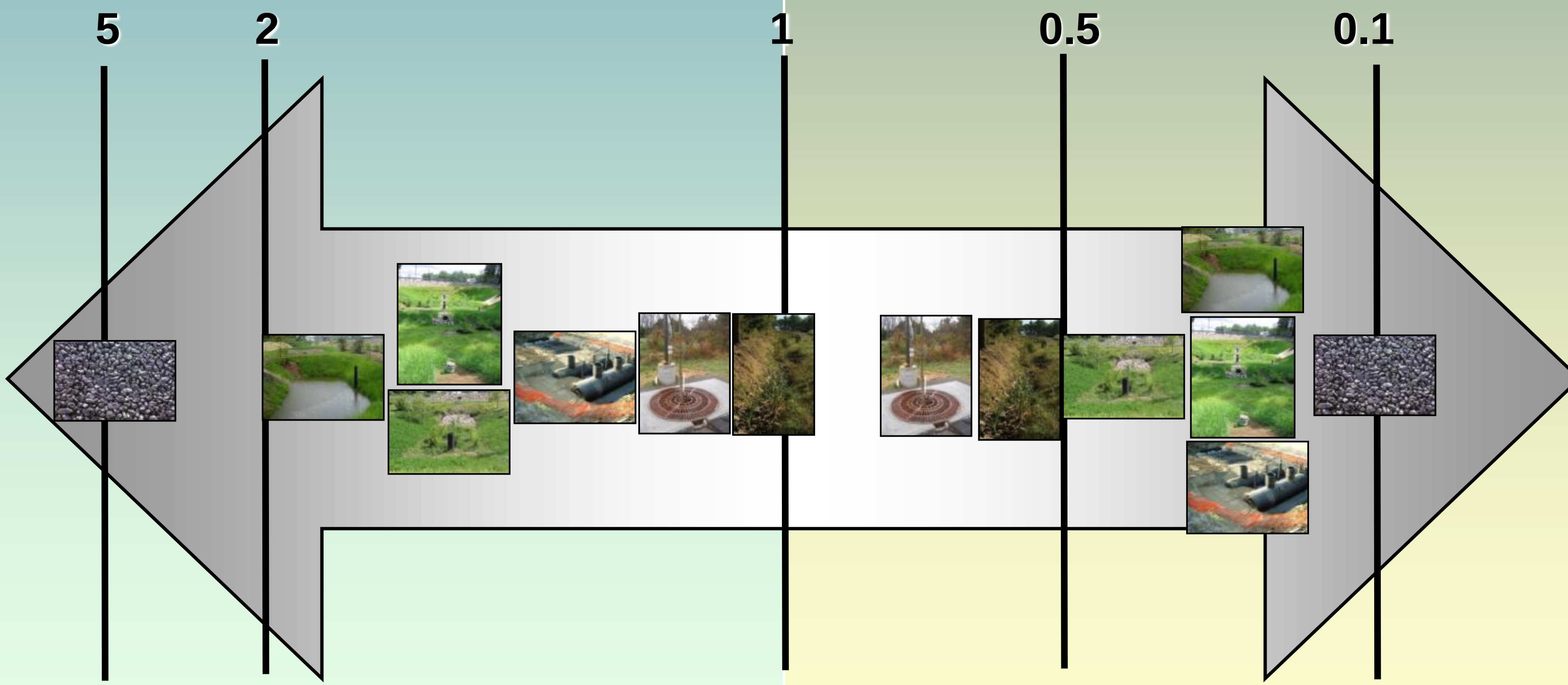
requirements

Hydrologic Performance Results

Hydrologic Performance

Lag Time (k_L)

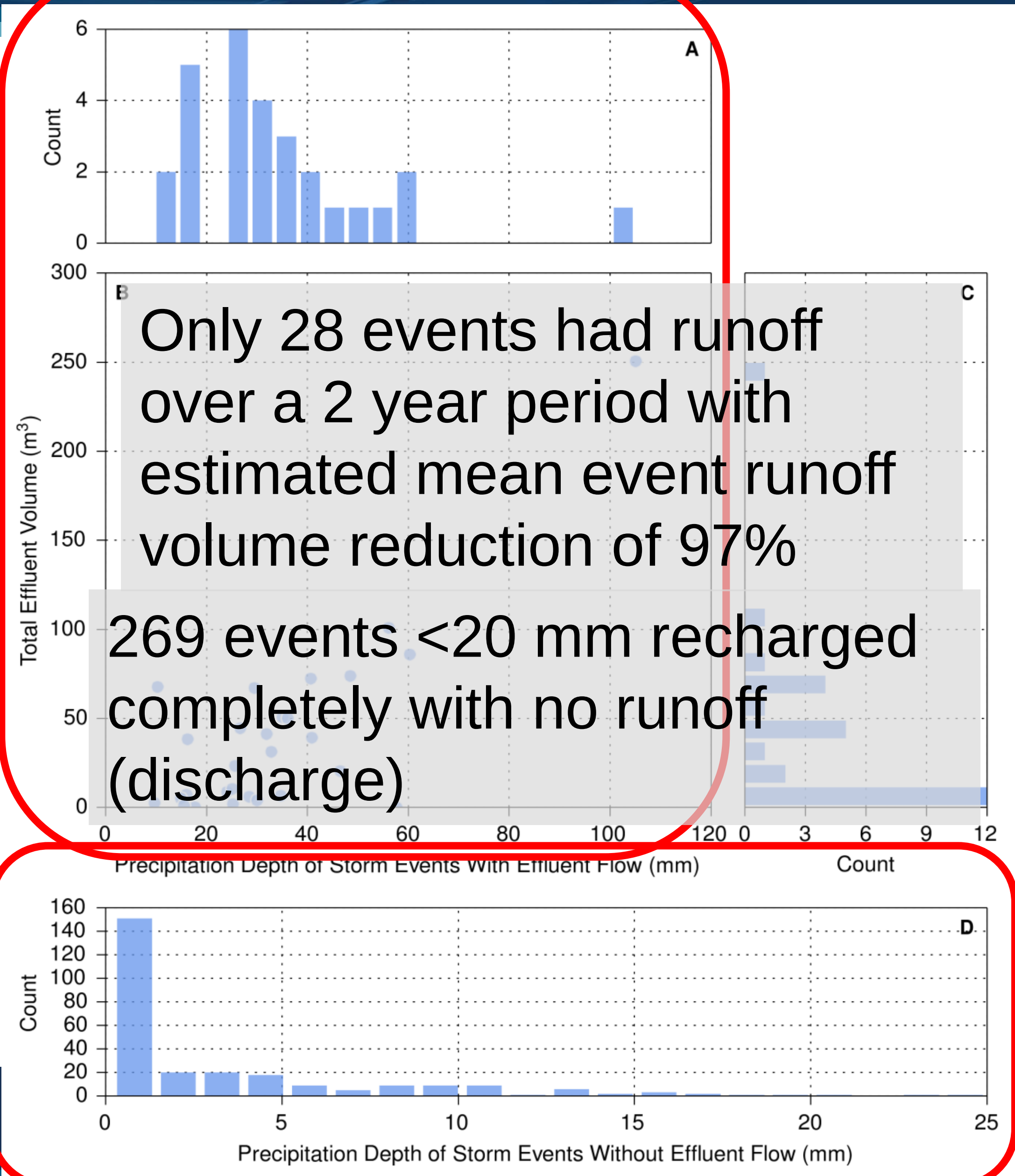
Peak Reduction (k_P)



Elm Drive--Hydrologic Performance

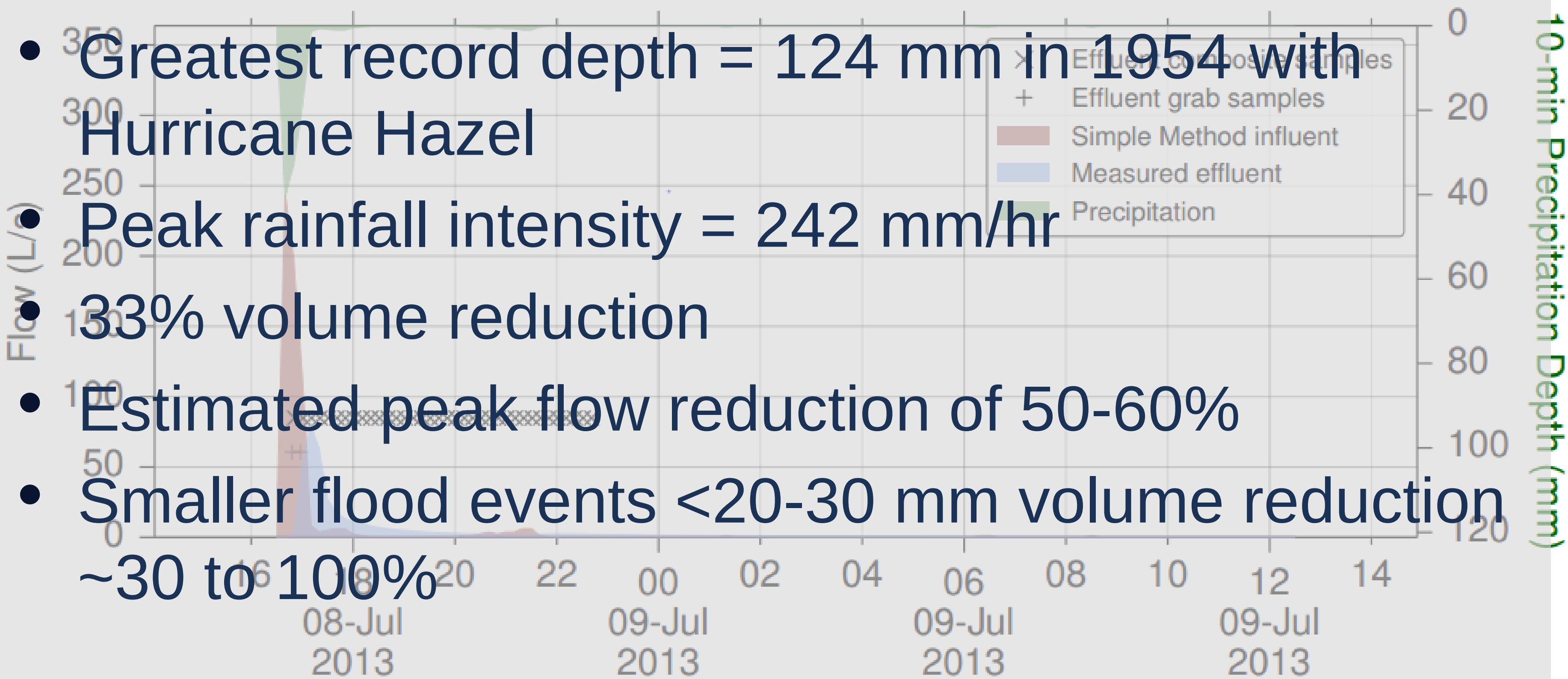
Histogram and Scatterplot of Storm Depth With and Without Effluent Flow from July 2011-July 2013;

- **Figure A histogram illustrates the number of events occurring with respect to runoff depth;**
- **Figure B scatterplot illustrates the total effluent volume with respect to the storm depth;**
- **Figure C histogram illustrates the number of events with respect to total effluent volume;**
- **Figure D illustrates the number of storms for which no runoff occurred with respect to storm depth.**

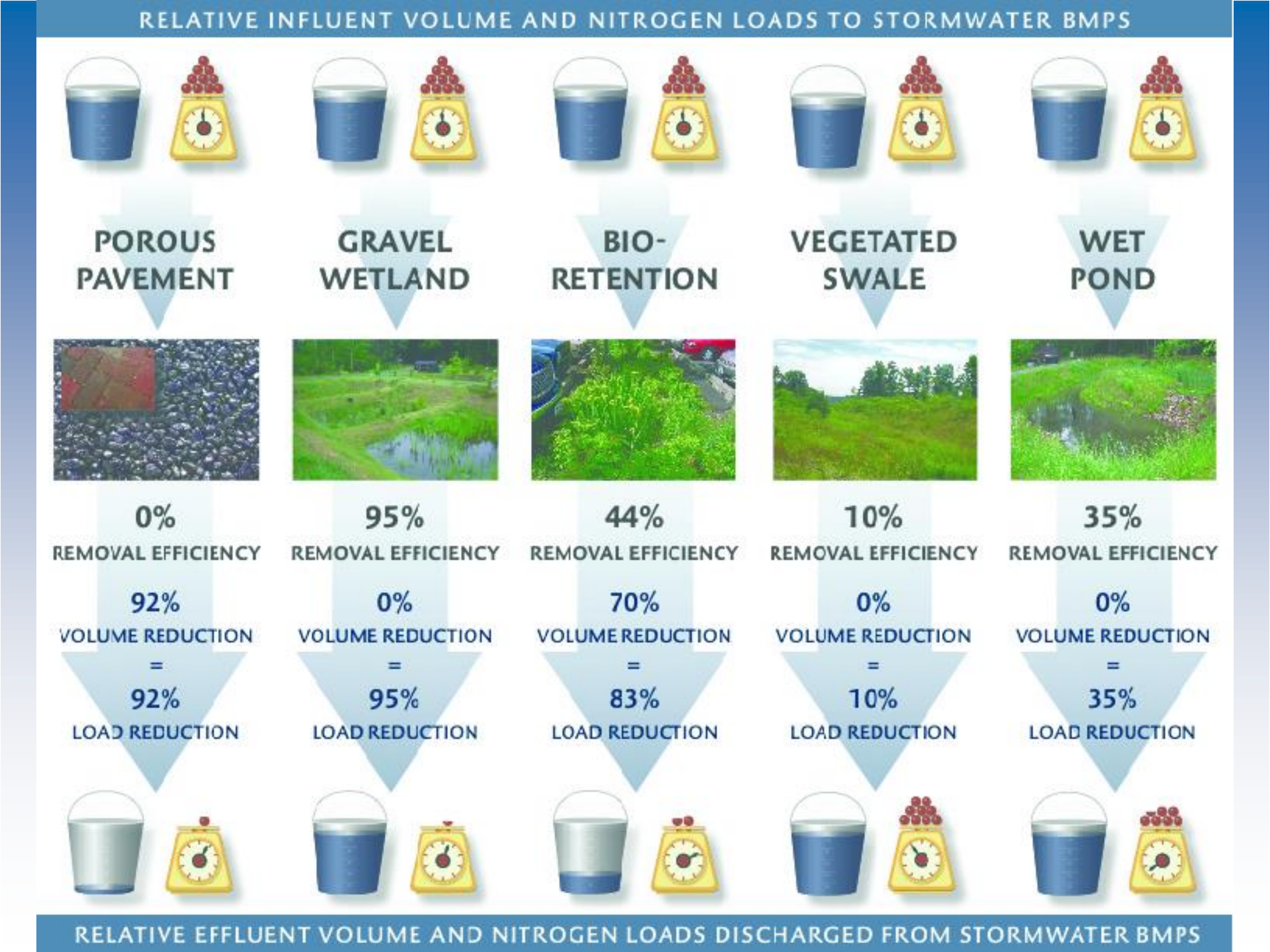


Elm Drive-- July 8, 2013 Performance

- Rainfall depth = 105 mm, July avg= 74 mm,
- Greatest record depth = 124 mm in 1954 with Hurricane Hazel
- Peak rainfall intensity = 242 mm/hr
- 33% volume reduction
- Estimated peak flow reduction of 50-60%
- Smaller flood events <20-30 mm volume reduction ~30 to 100%

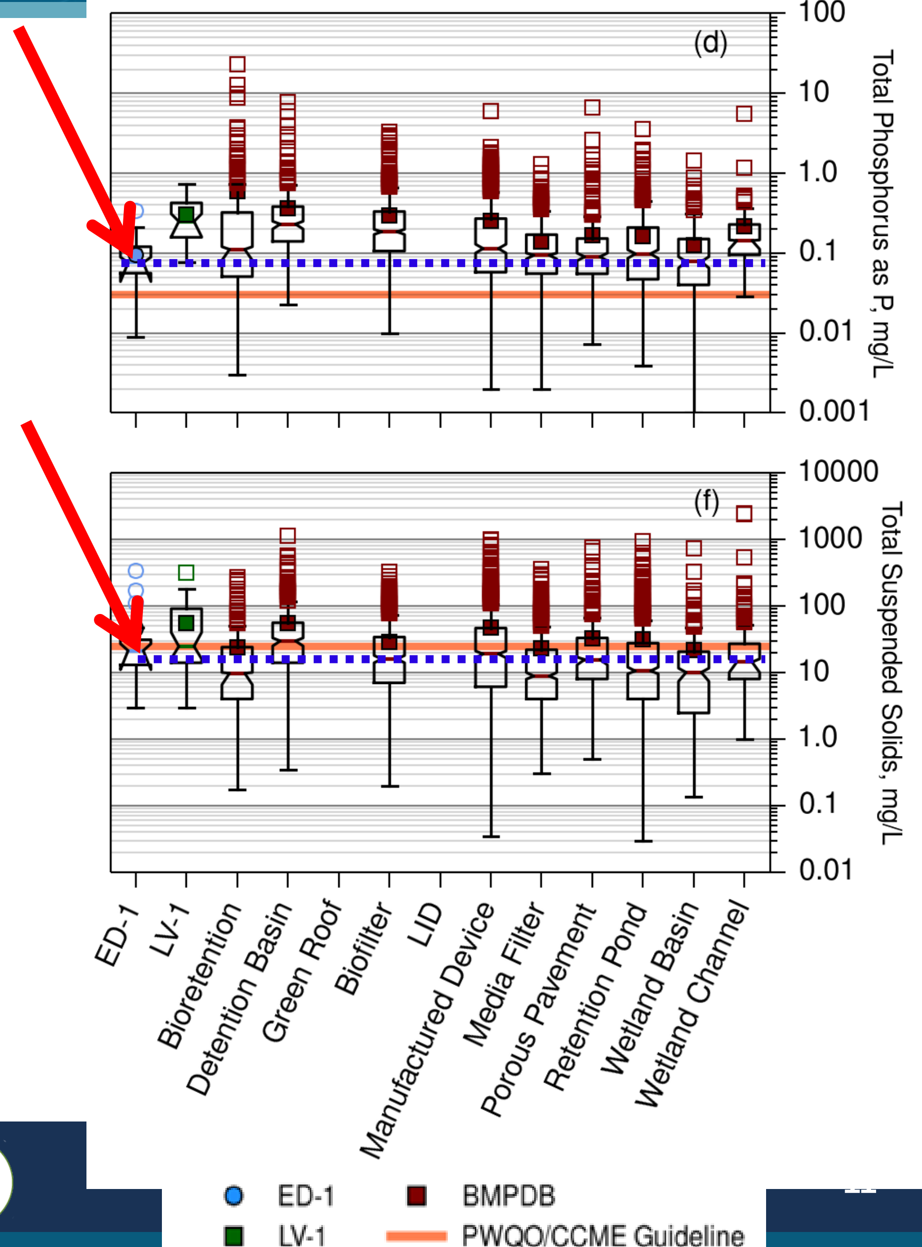


WATER QUALITY PERFORMANCE

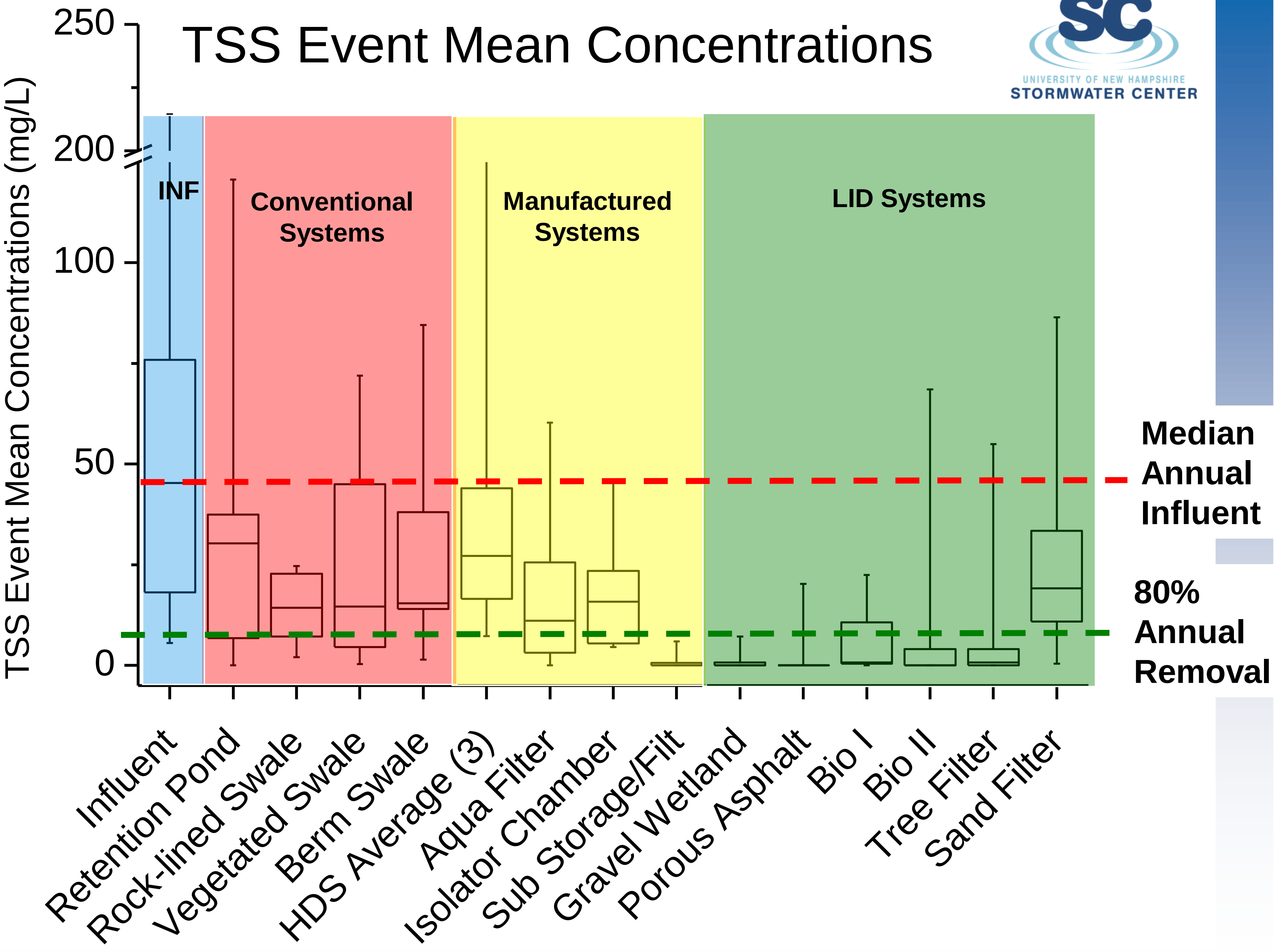

RELATIVE INFLUENT VOLUME AND NITROGEN LOADS TO STORMWATER BMPS
POROUS PAVEMENT
GRAVEL WETLAND
BIO-RETENTION
VEGETATED SWALE
WET POND
0%
REMOVAL EFFICIENCY
92%
VOLUME REDUCTION
=
92%
LOAD REDUCTION
95%
REMOVAL EFFICIENCY
0%
VOLUME REDUCTION
=
95%
LOAD REDUCTION
44%
REMOVAL EFFICIENCY
70%
VOLUME REDUCTION
=
83%
LOAD REDUCTION
10%
REMOVAL EFFICIENCY
0%
VOLUME REDUCTION
=
10%
LOAD REDUCTION
35%
REMOVAL EFFICIENCY
0%
VOLUME REDUCTION
=
35%
LOAD REDUCTION
RELATIVE EFFLUENT VOLUME AND NITROGEN LOADS DISCHARGED FROM STORMWATER BMPS

Elm Drive--Solids and Nutrients Performance

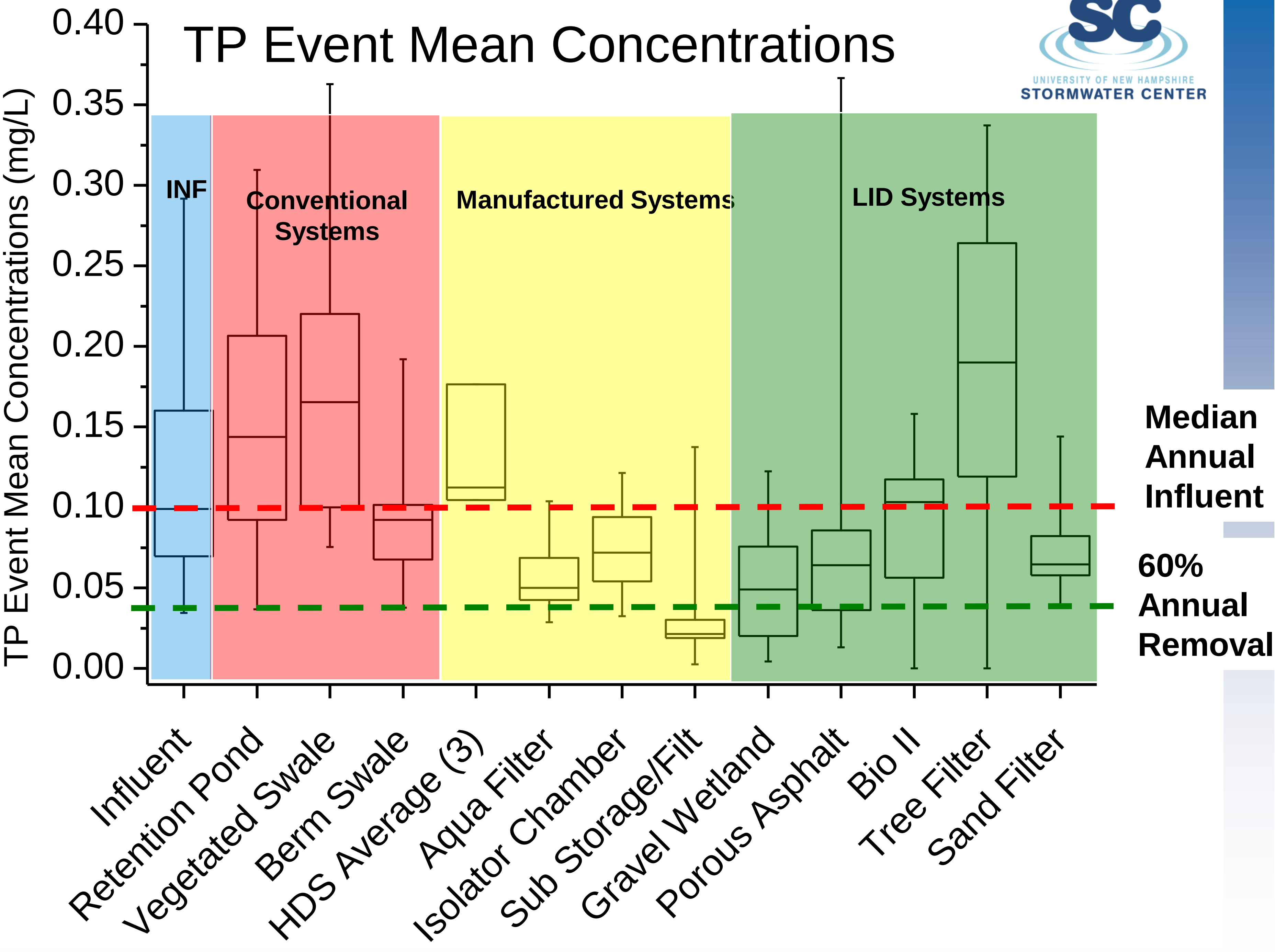
- Load reduction is largely due to the substantial estimated volume reduction
- Mean estimated load reductions ranged from 84 to 97% for the various contaminants
- TSS removal was generally ranged from 82-99% removal
- Estimated nutrient load removal ranged from 57-91%



TSS Event Mean Concentrations



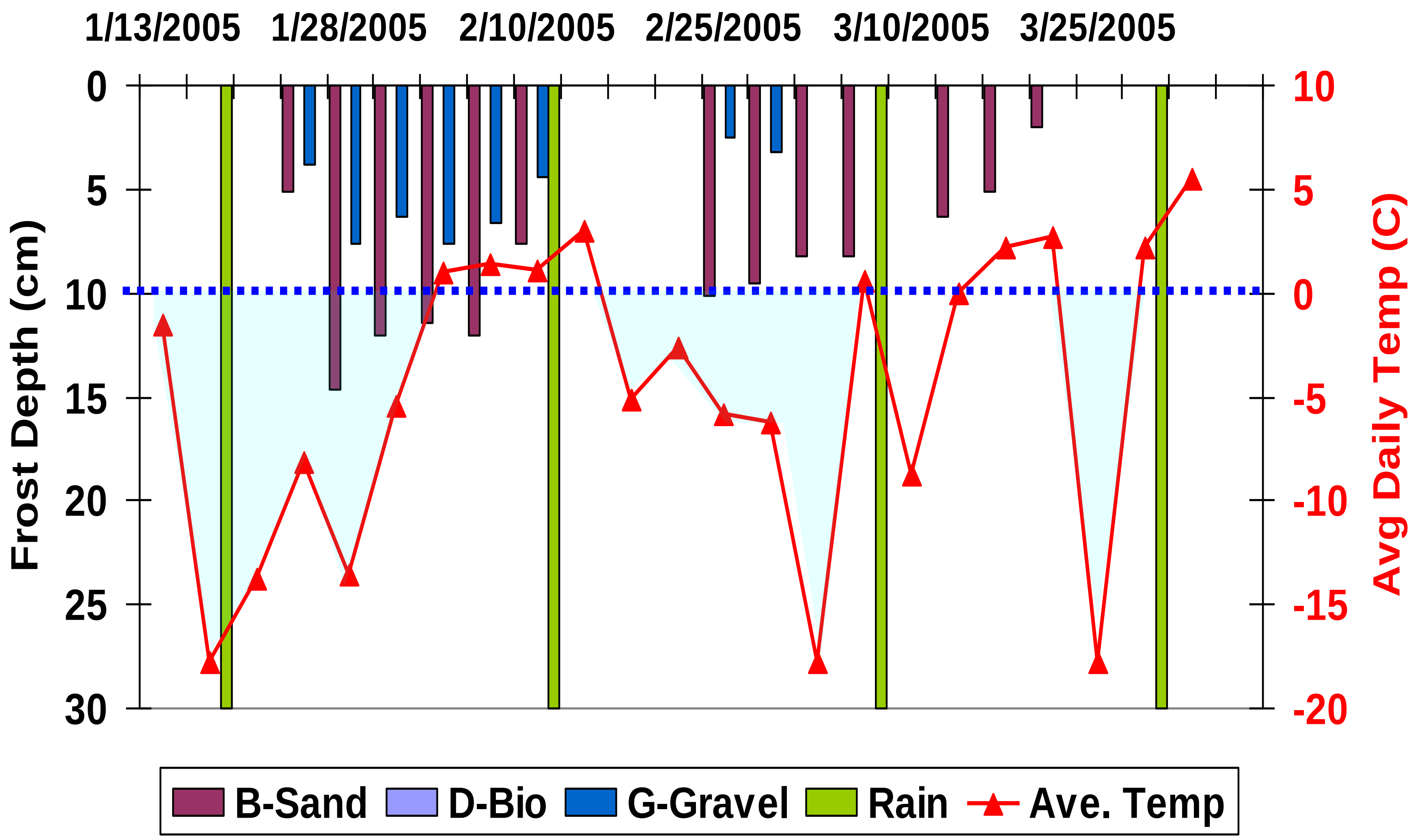
TP Event Mean Concentrations



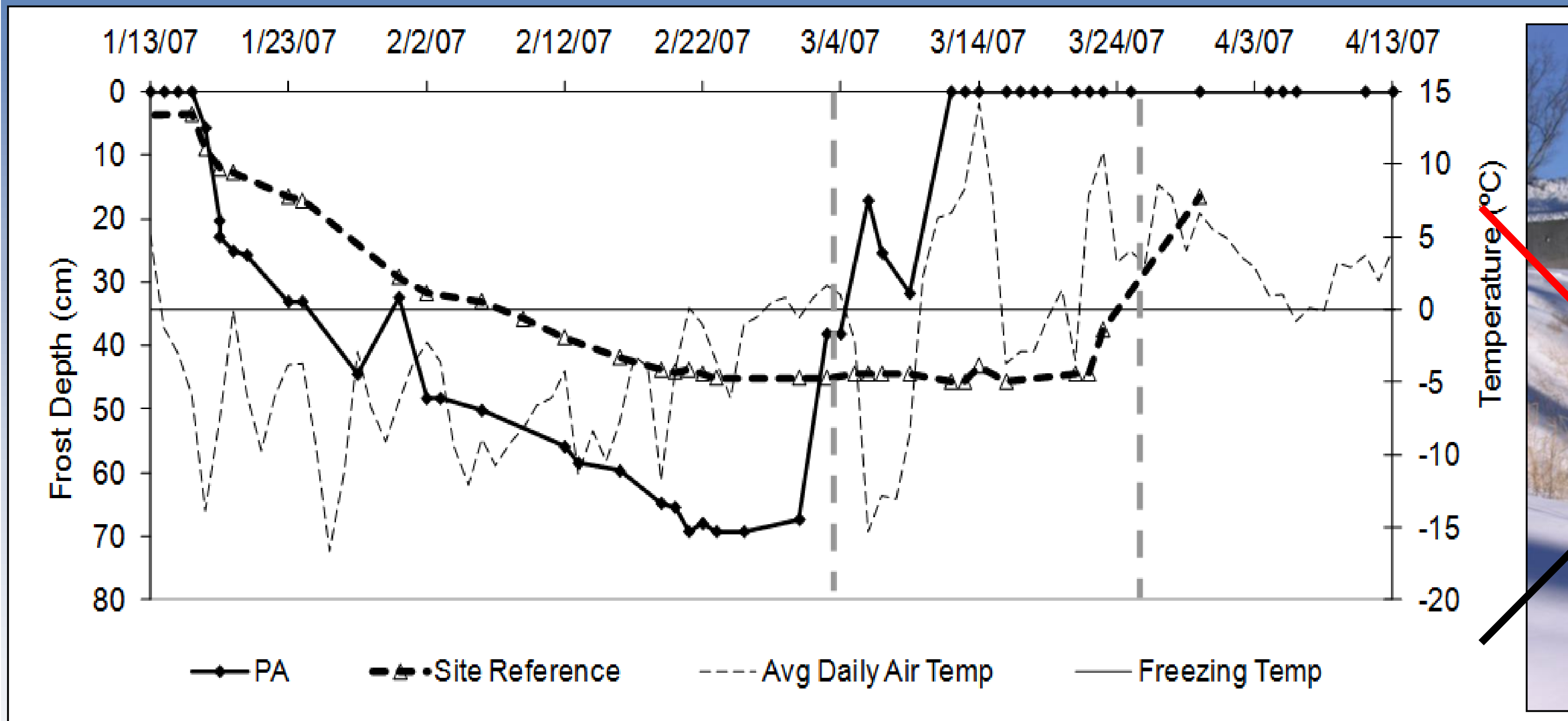
UNIVERSITY OF NEW HAMPSHIRE STORMWATER CENTER

Cold Climate Performance Results

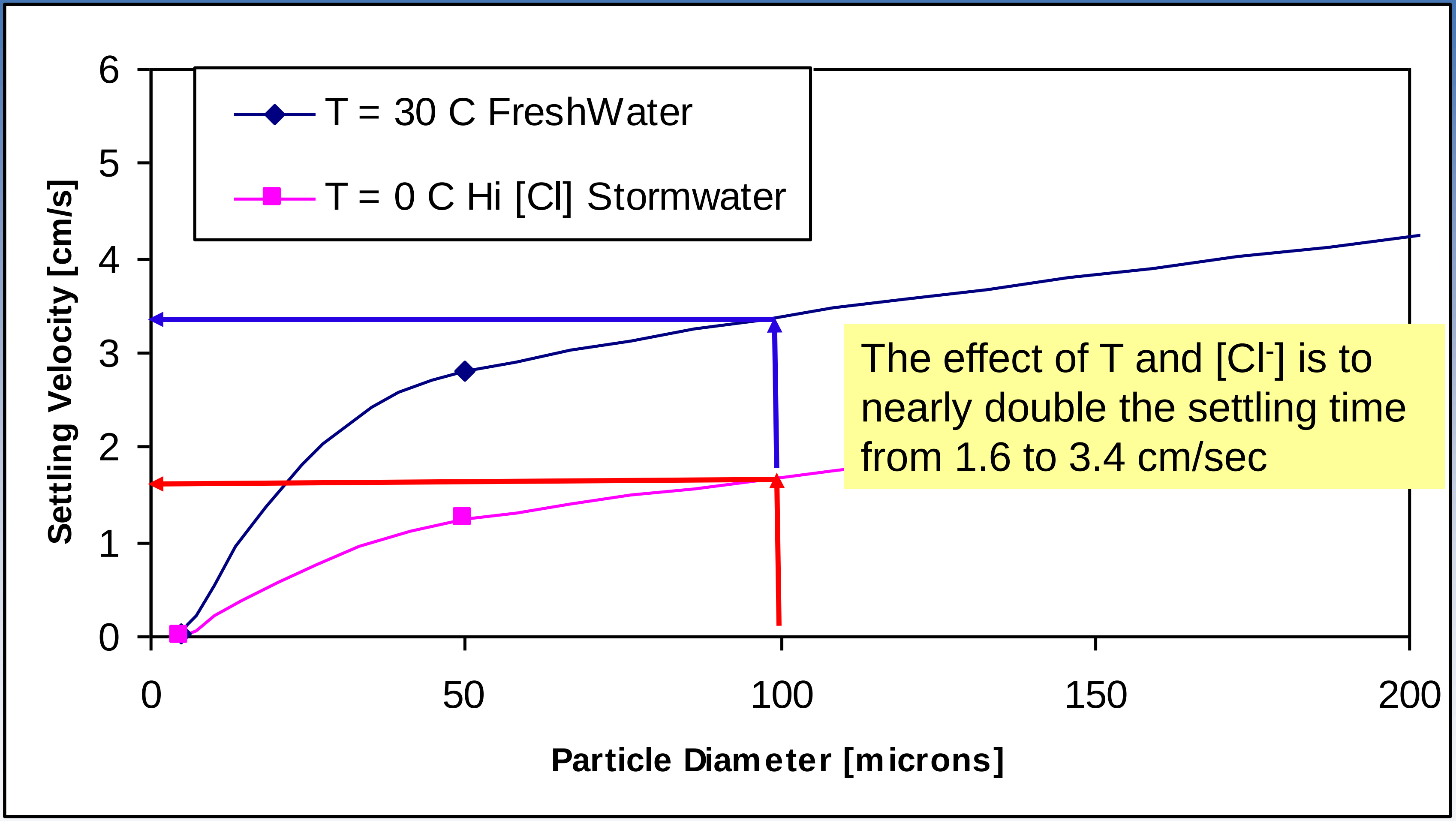
Filter Media Frost Penetration



Porous Asphalt Frost Penetration

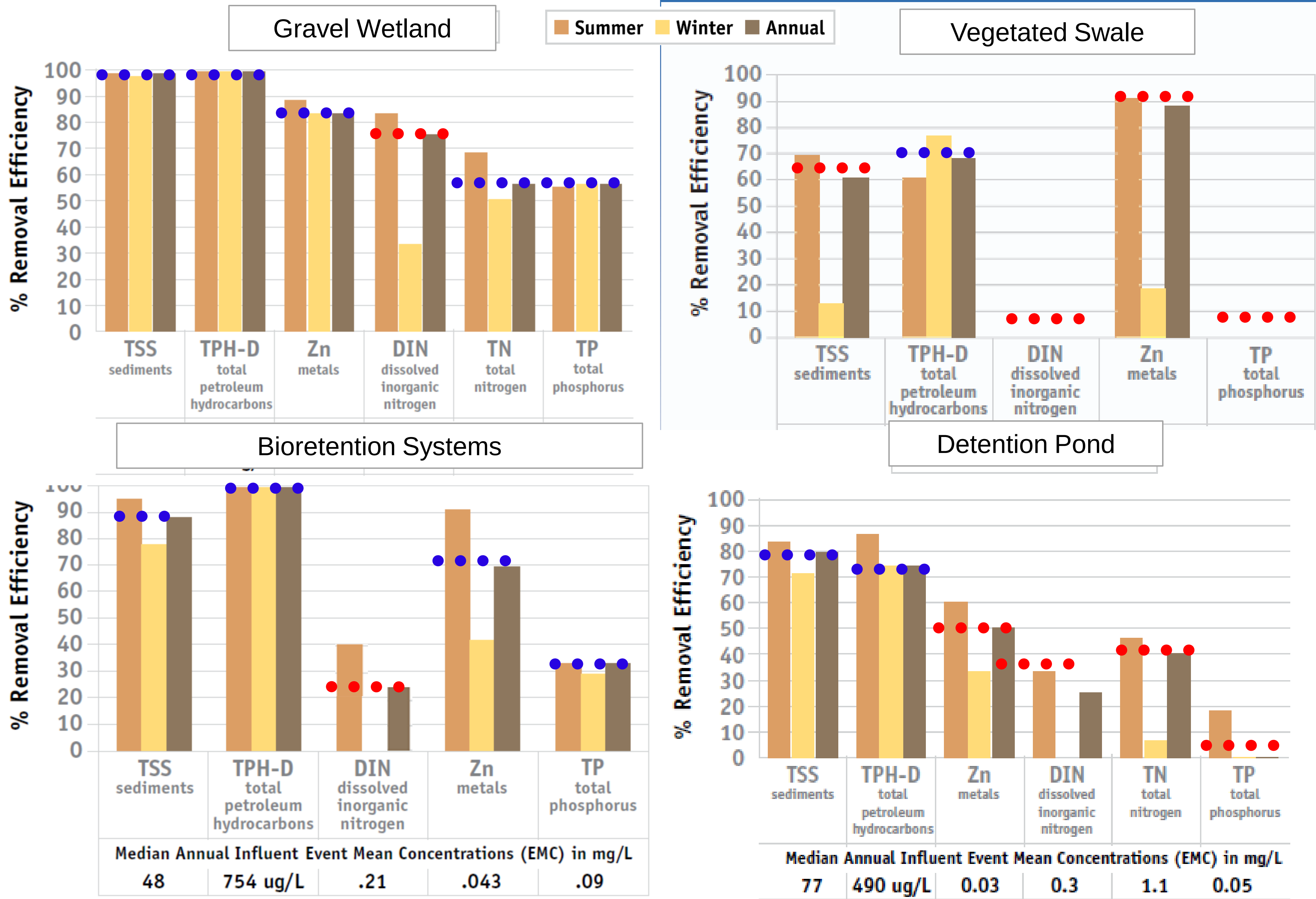


Seasonal Variations in Performance

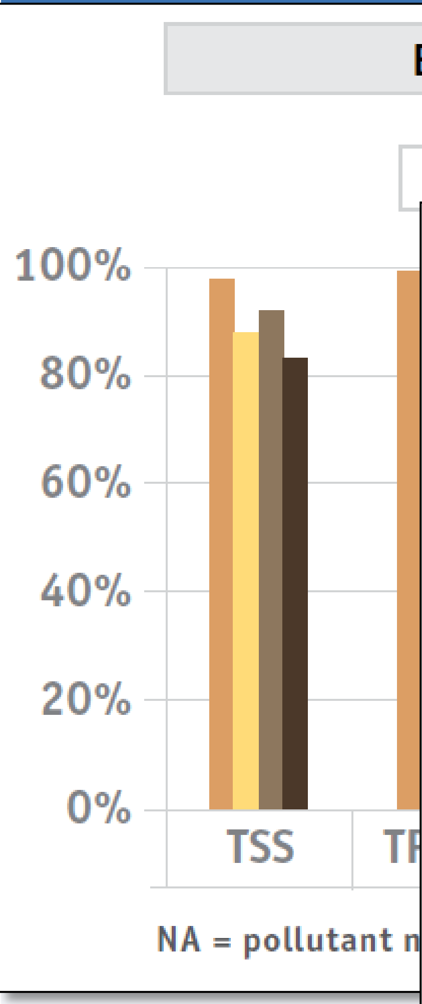


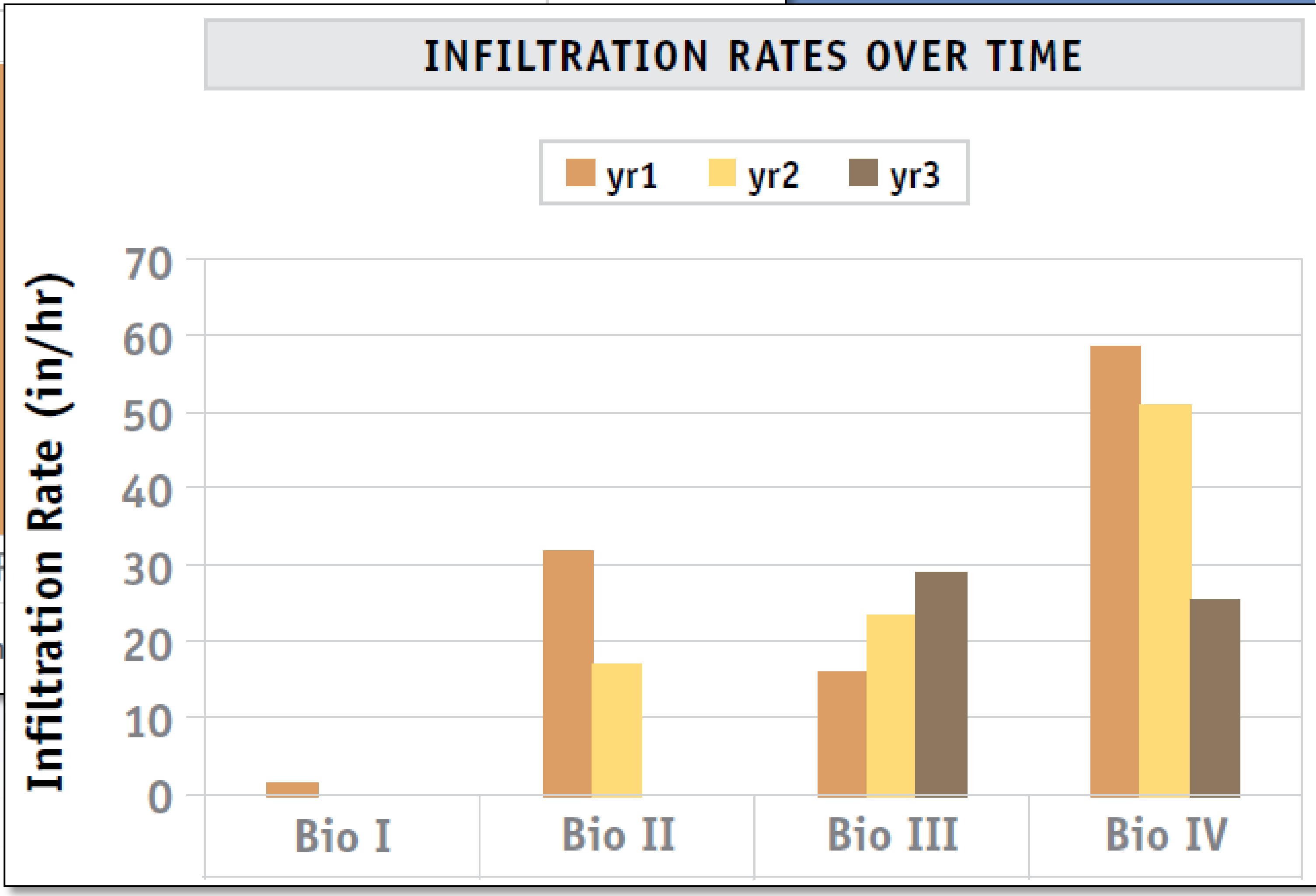
The UNH Stormwater Center
2007

Seasonal Variations in Performance



Long Term and System Variations





Source: UNH Stormwater Center 2012 Biennial Report

6 years post installation, November 17, 2014

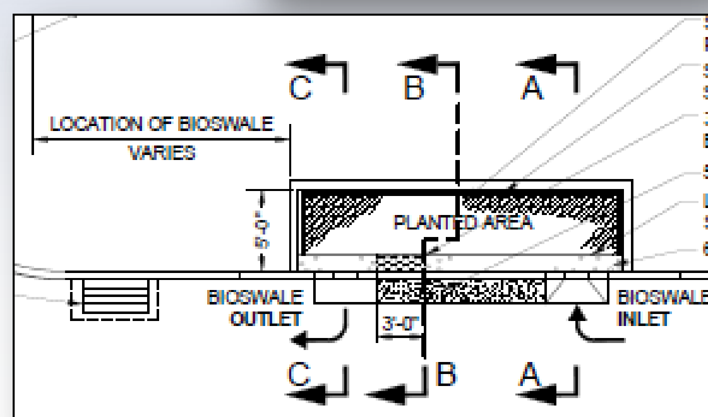
Winter Performance and Black Ice

Standard Asphalt HEAVY salt usage and black ice formation, Jan 23, 2011

Porous asphalt modest salt and very little black ice , Jan 23, 2011; *note use of PA as snow dump because of positive drainage

Winter Design Considerations

- Inlets and bypass external to system for ease of clearing
- Concerns about snow stockpile and bypass
- Pretreatment for grit and sand
- Simplicity and adapting to municipal standards



Questions?

Robert Roseen, PHD, PE, DWRE
rroseen@geosyntec.com 617-992-9067

Funded by:

Summary Conclusion

- The Power of Redevelopment relies upon strong regulations
- No silver bullets. A range of strategies are needed.
- LID systems function well in cold climates, seasonal variations are observed for conventional BMPs and Manufactured systems
- Infiltration and filtration systems have the highest performance systems
- LID can have flood reduction and mitigation benefits and can be reasonable adaptation strategy
- Cost of advanced SWM can often be balanced with related savings

DIN Event Mean Concentrations