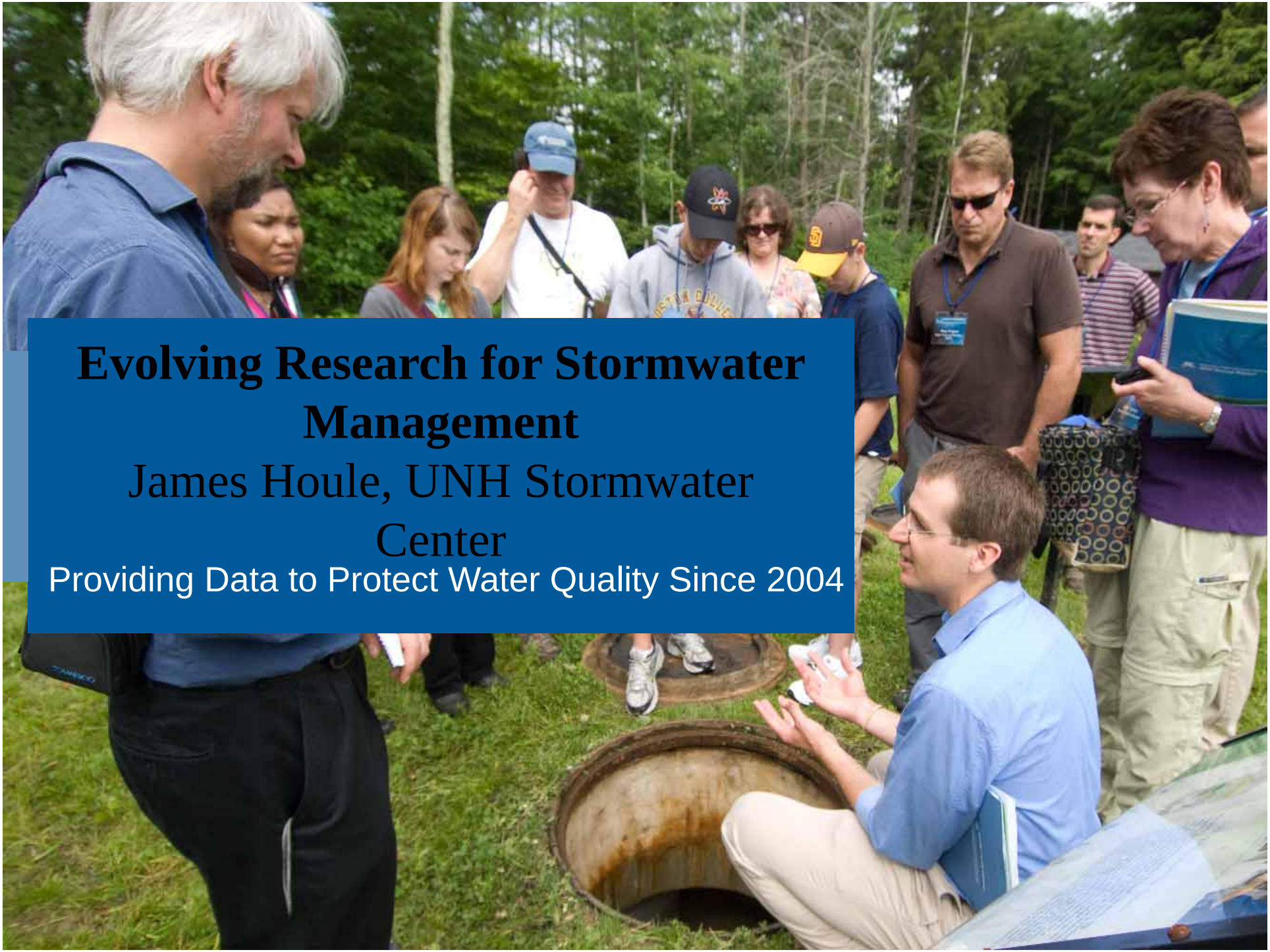


Evolving Research for Stormwater Management

James Houle, UNH Stormwater Center

Providing Data to Protect Water Quality Since 2004

Hydrodynamic Separator

Isolator Row

Subsurface Infiltration

Filter Unit

Porous Asphalt

Pervious Concrete

Retention Pond

Stone Swale

Veg Swale

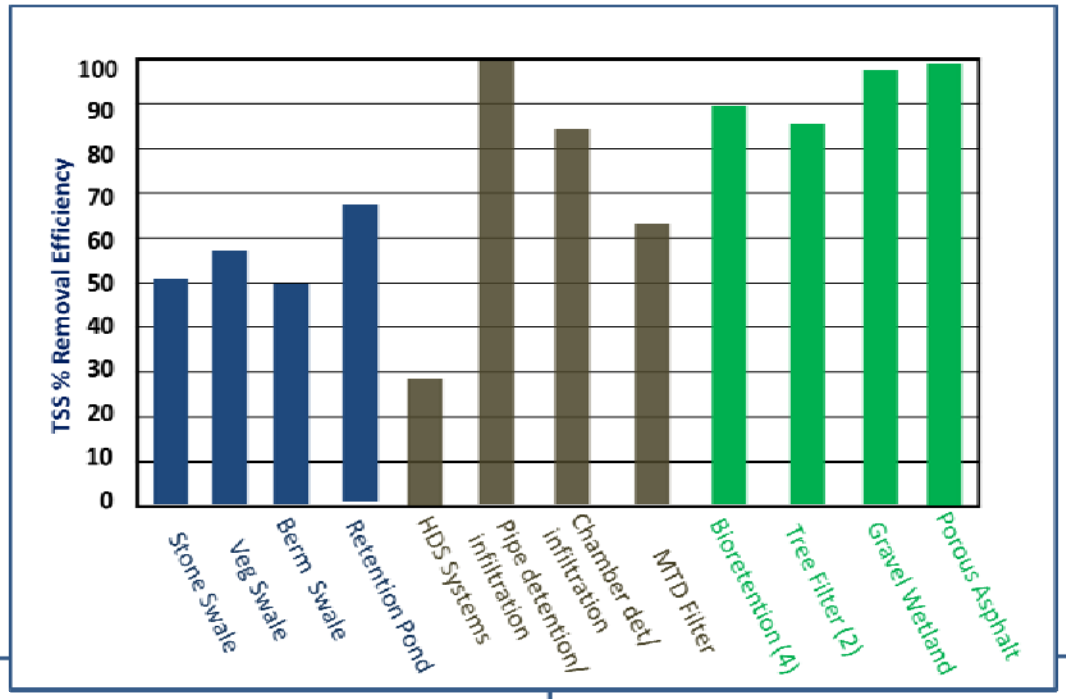
Gravel Wetland

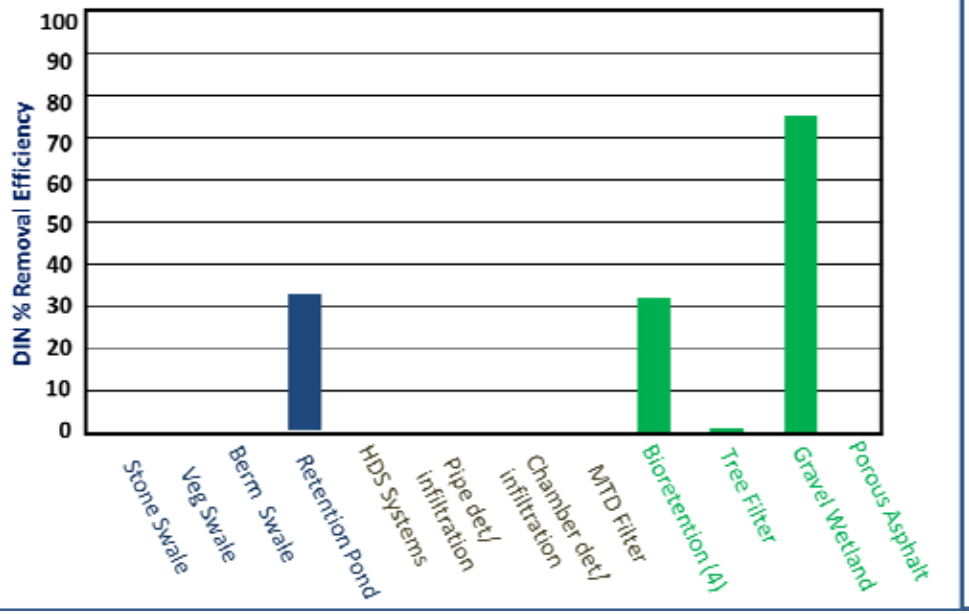
Sand Filter

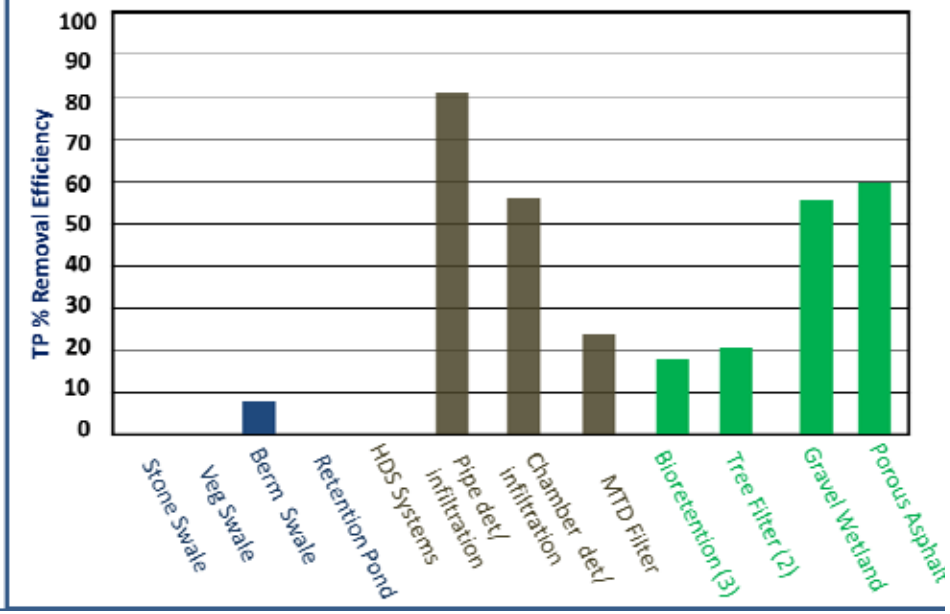
Bioretention Unit

Tree Filter

Common Pollutant RE's

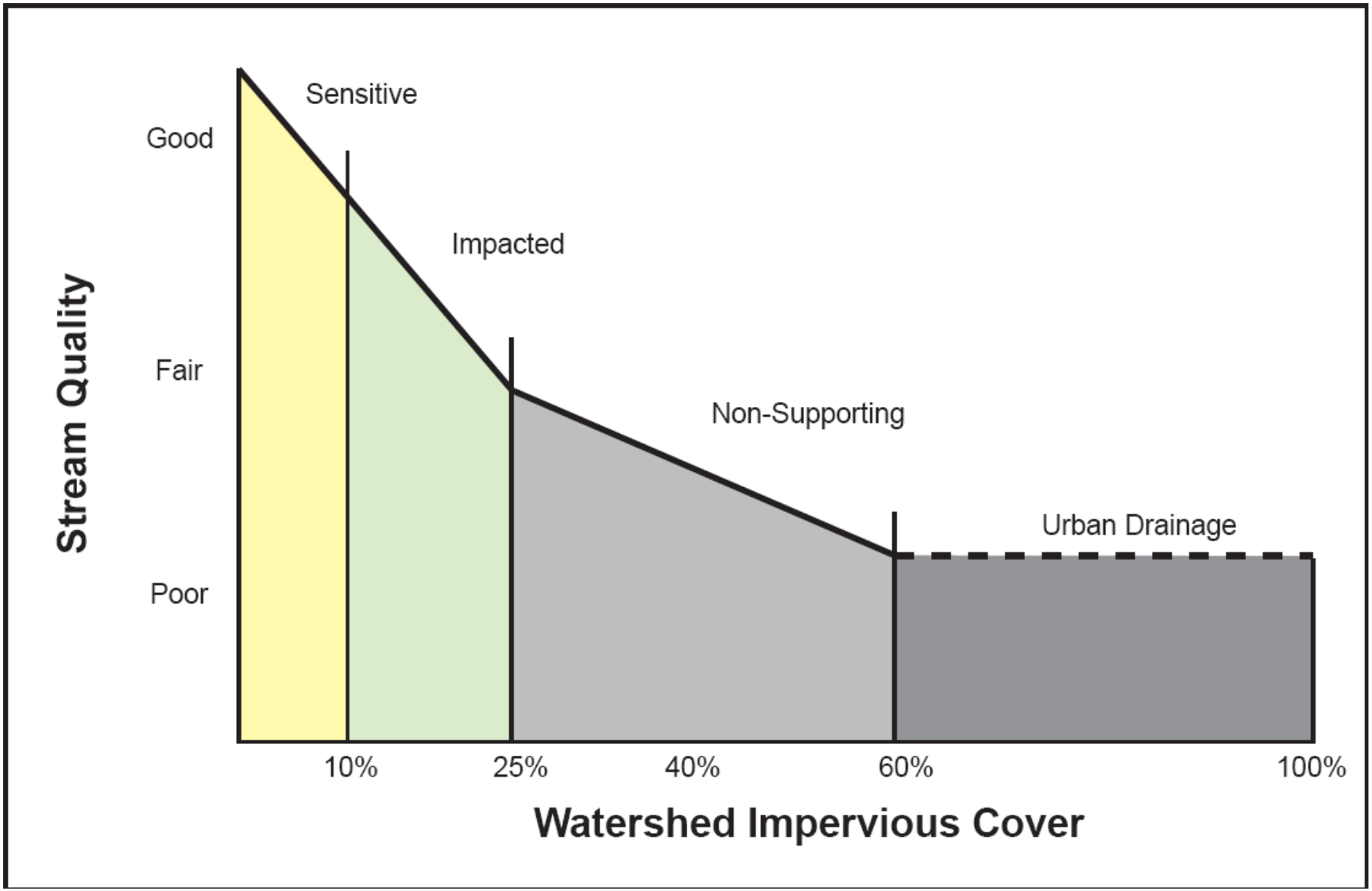




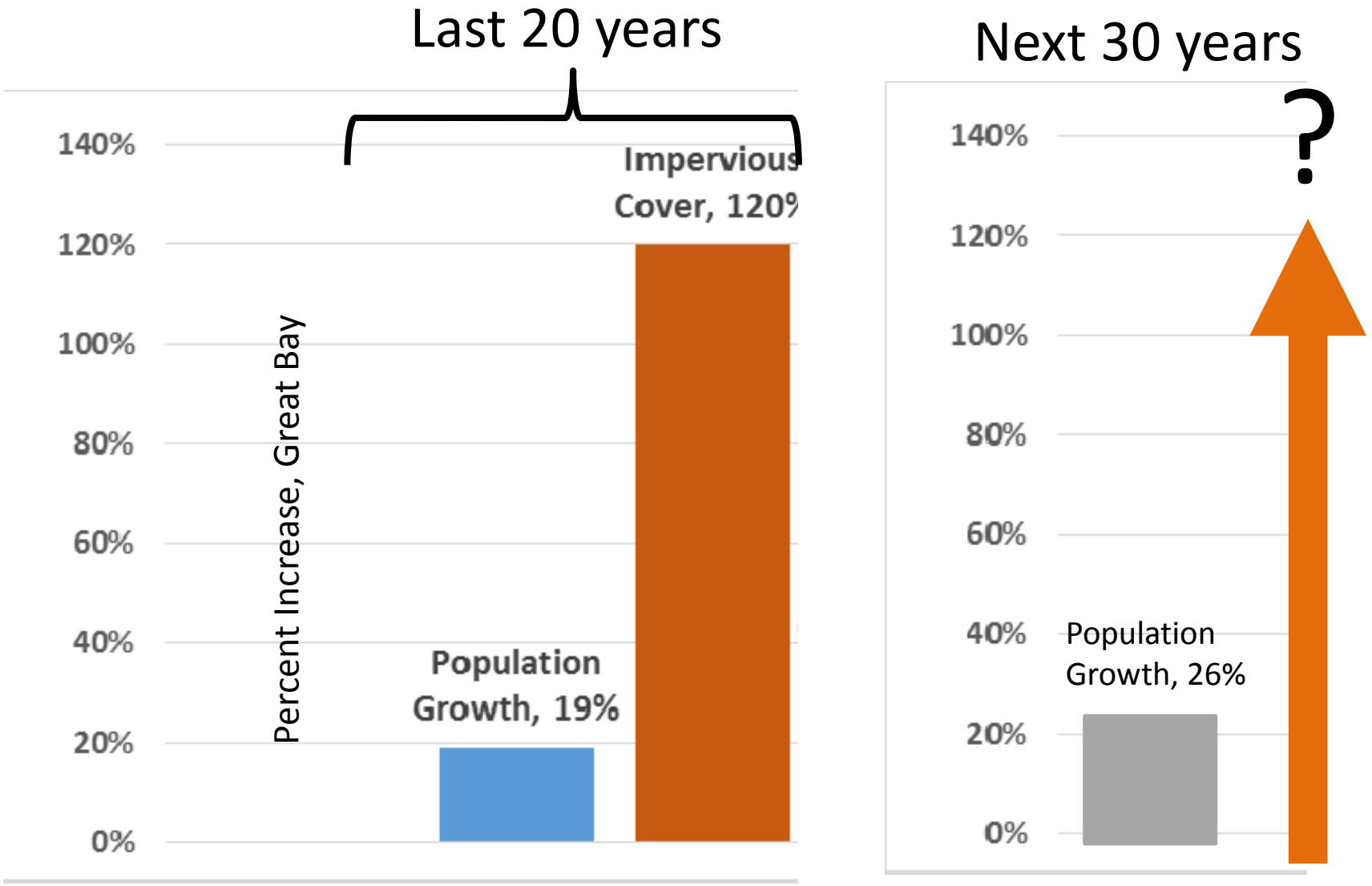


NPS is Part of the Problem and managing it is part of the solution

Impact of Impervious Cover



Population Growth & Quality Problem

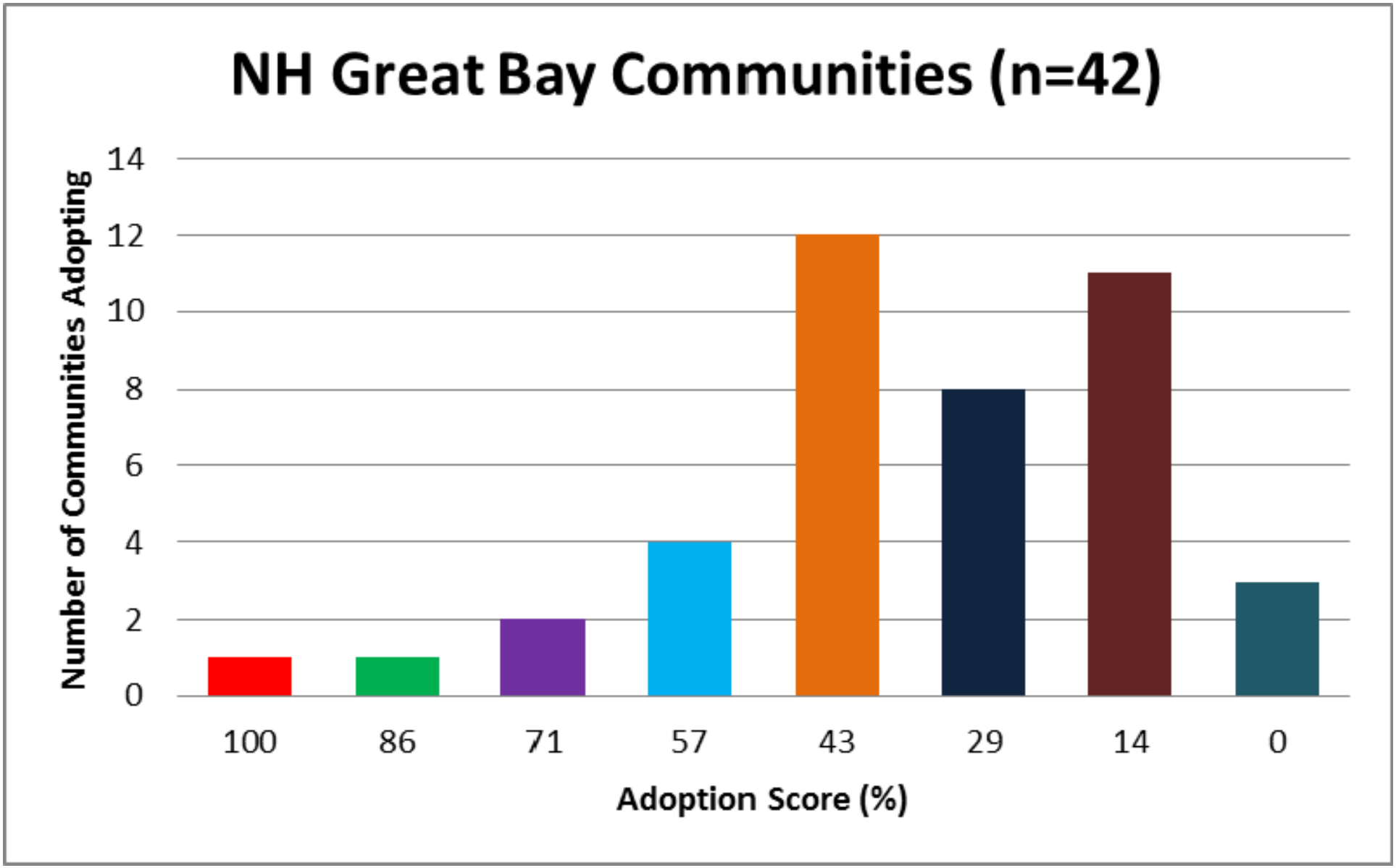


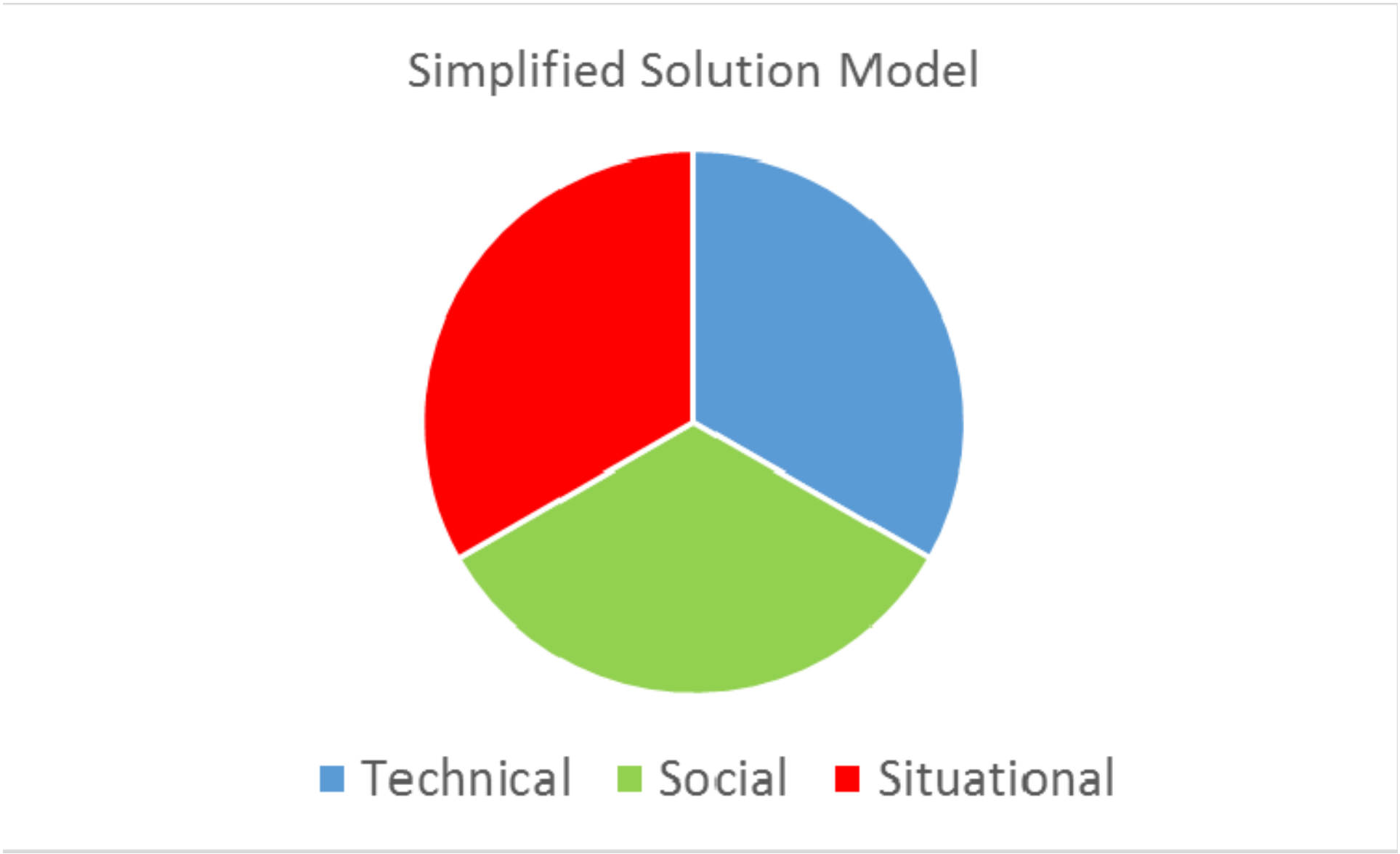
From 1990 to 2010 (Source: US Census; UNH earth systems research center; PREP; 2010-2040 Projections, UNHSC)

Slide 6

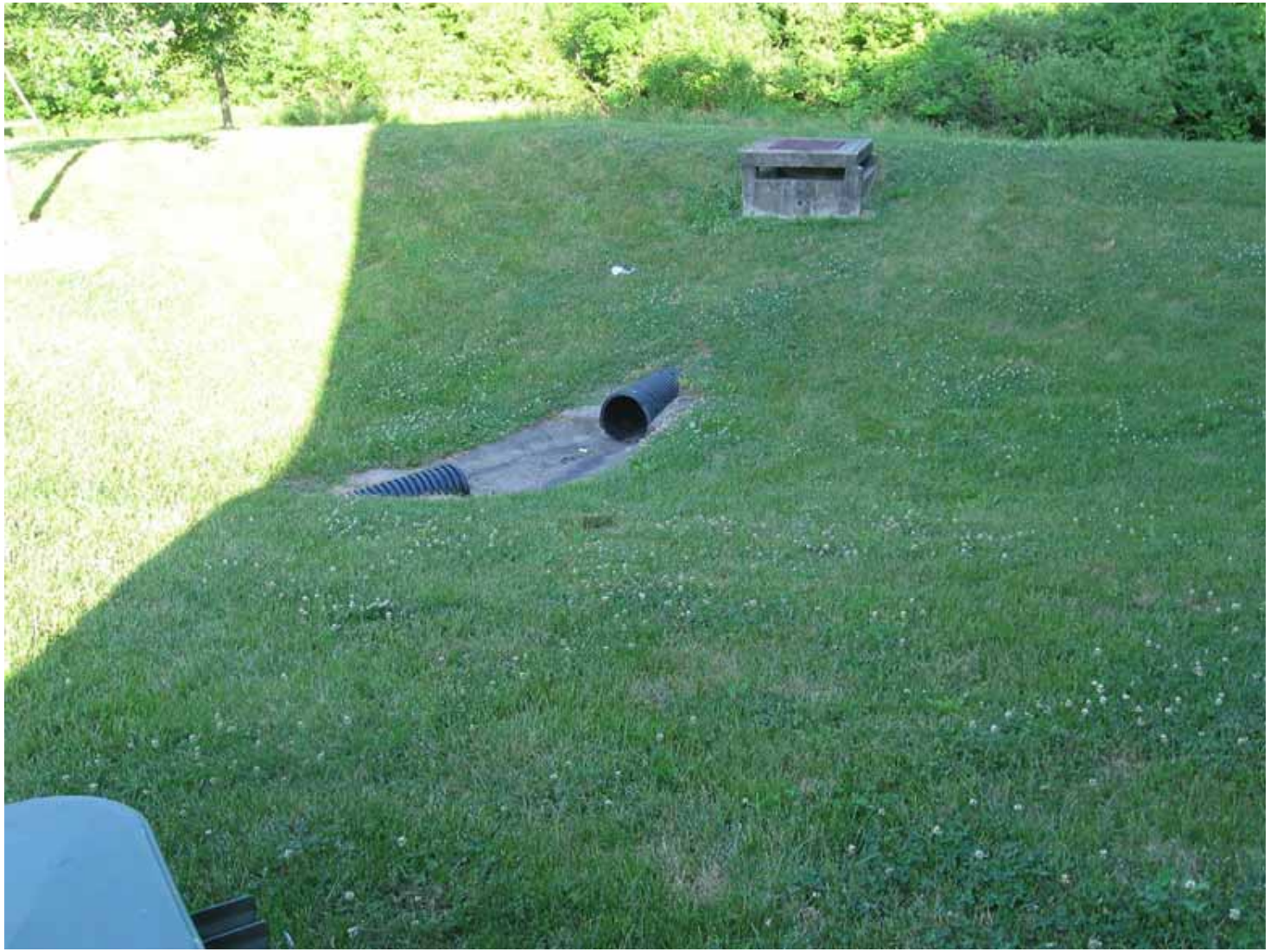
HJ1 Houle, James, 12/4/2015

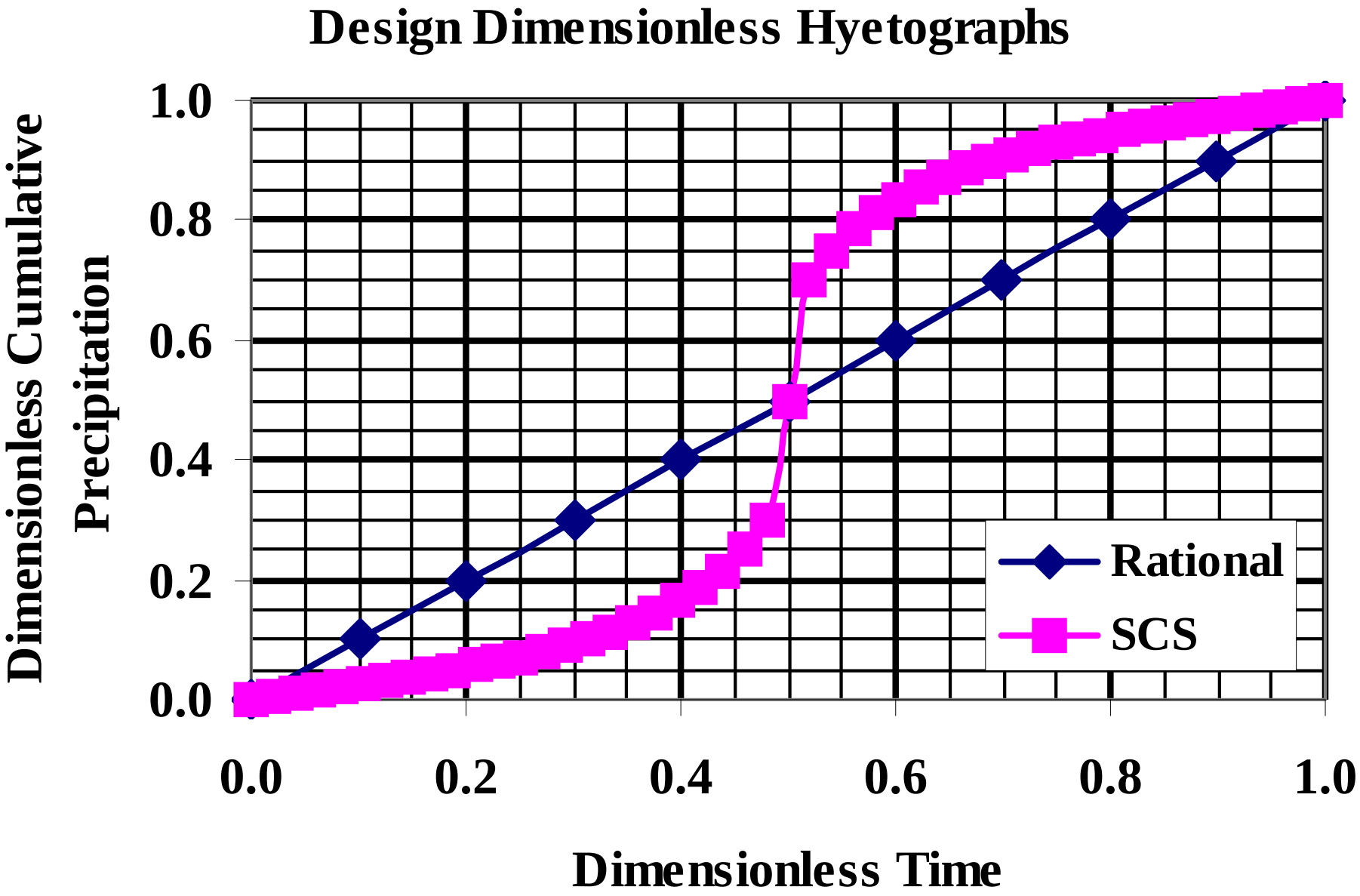
If we know what the problem is…
…and science informs us what we can do…
…Then how are we doing on implementation?


NH Great Bay Communities (n=42)
Number of Communities Adopting
14
12
10
8
6
4
2
0
100
86
71
57
43
29
14
0
Adoption Score (%)

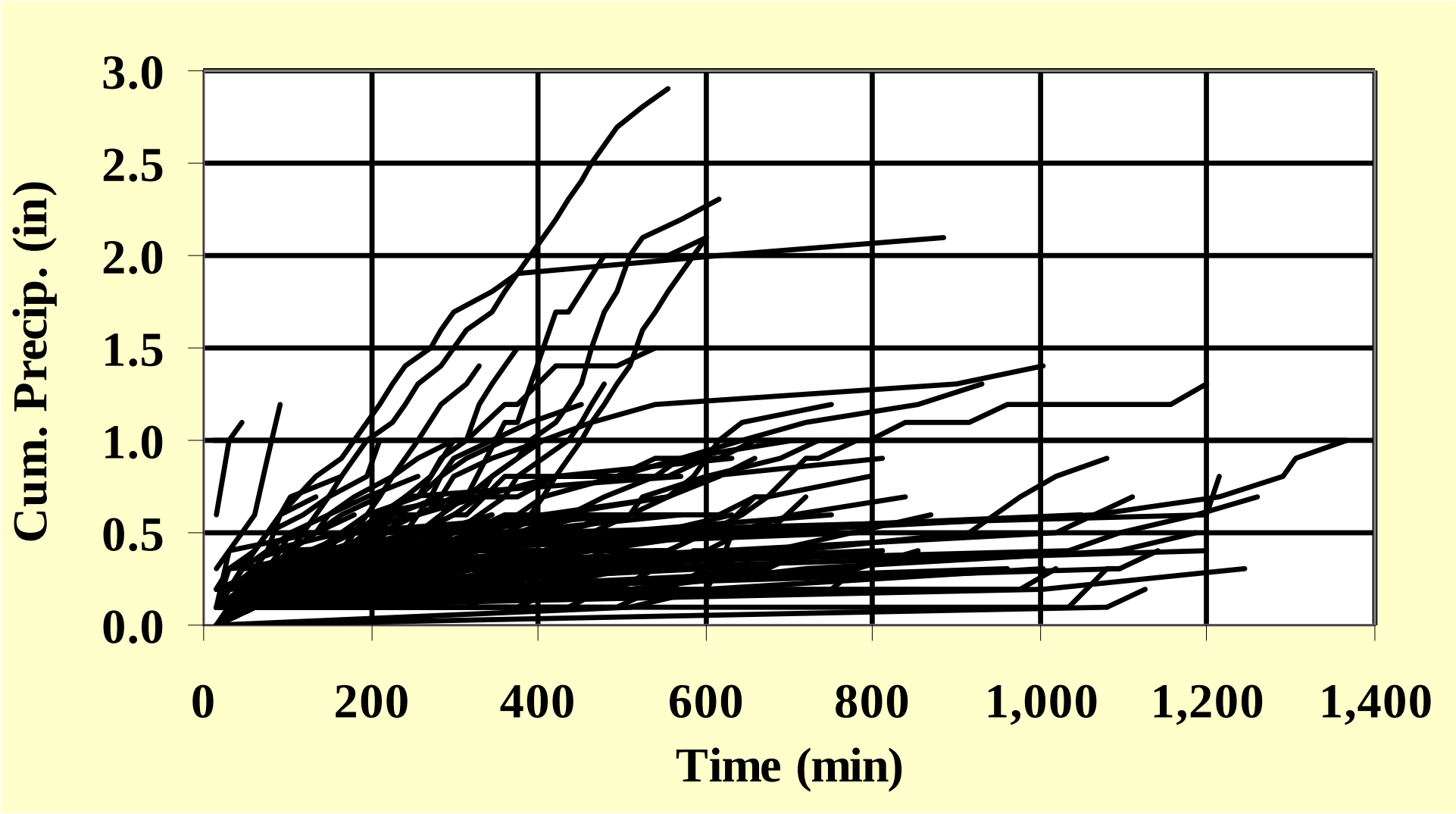

Simplified Solution Model
Technical
Social
Situational

Technical: Elements pertaining to efforts that require technical expertise and understanding

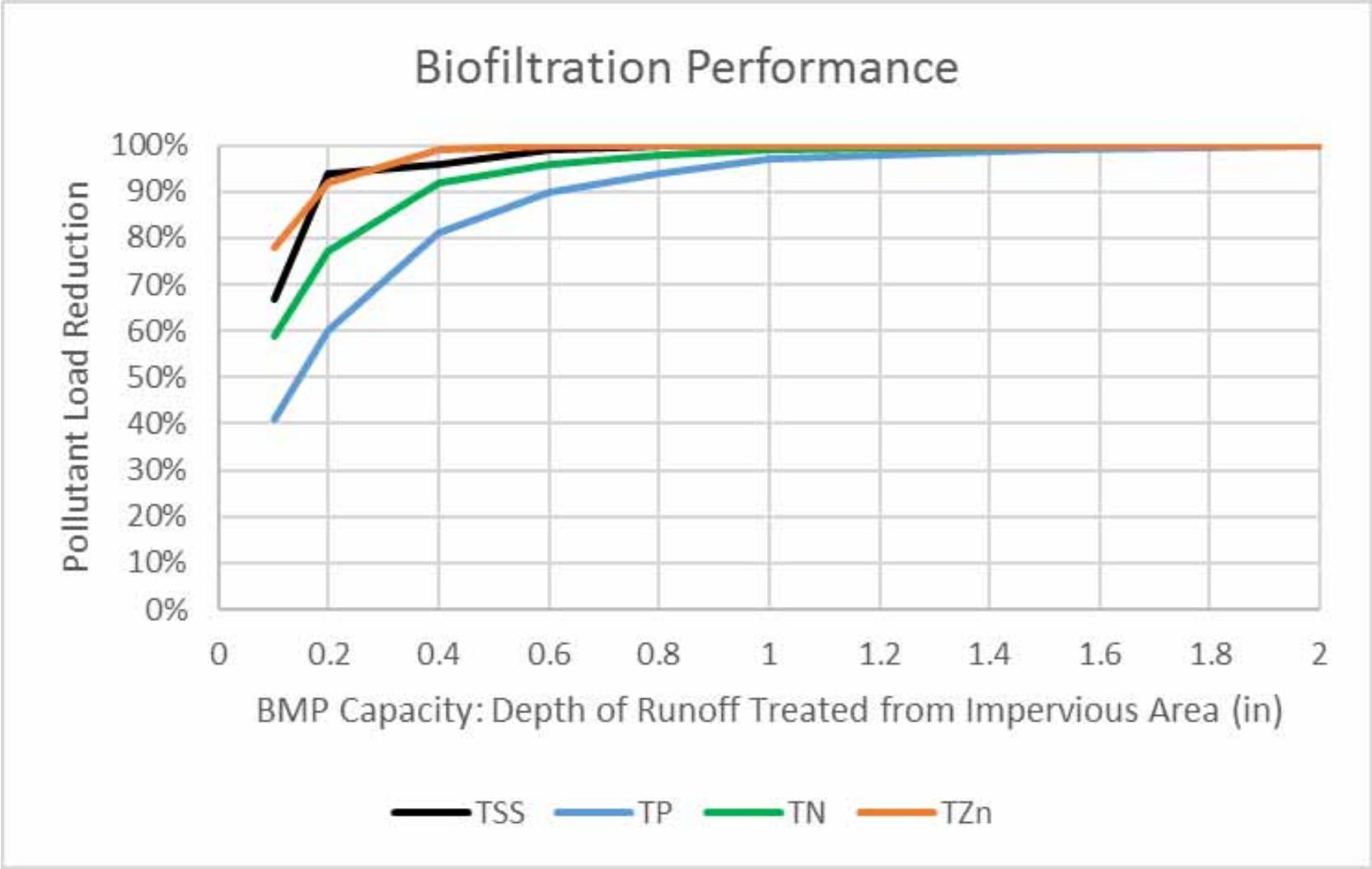



Design Dimensionless Hyetographs
Dimensionless Cumulative Precipitation
1.0
0.8
0.6
0.4
0.2
0.0
0.0
0.2
0.4
0.6
0.8
1.0
Dimensionless Time
Rational
SCS

Sampling of Observed Hyetographs
Durham, NH NOAA Gage



Pollutant Reduction Curves



Sizing Details

System	WQV ft^3 (m^3)	Actual WQV ft^3 (m^3)	% of normal design	Rain Event in (mm)	Sizing Method
SGWSC	7,577 (214.6)	720 (20.4)	10%	0.10 (2.5)	Static
IBSCS	1,336 (37.8)	310 (8.8)	23%	0. 23 (5.8)	Dynamic

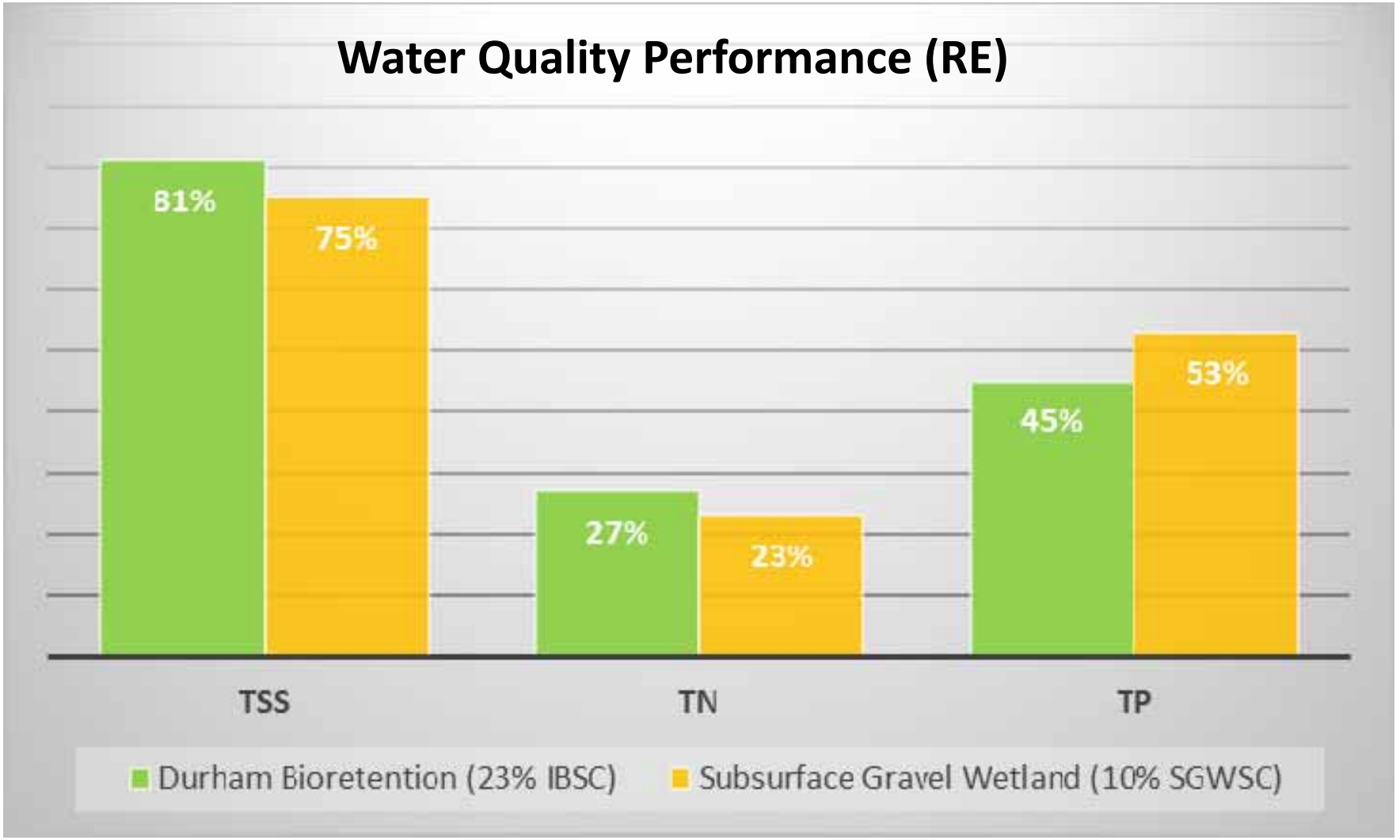
$$WQV = \left(\frac{P}{12}\right) x\ IA$$

Dynamic Bioretention Sizing

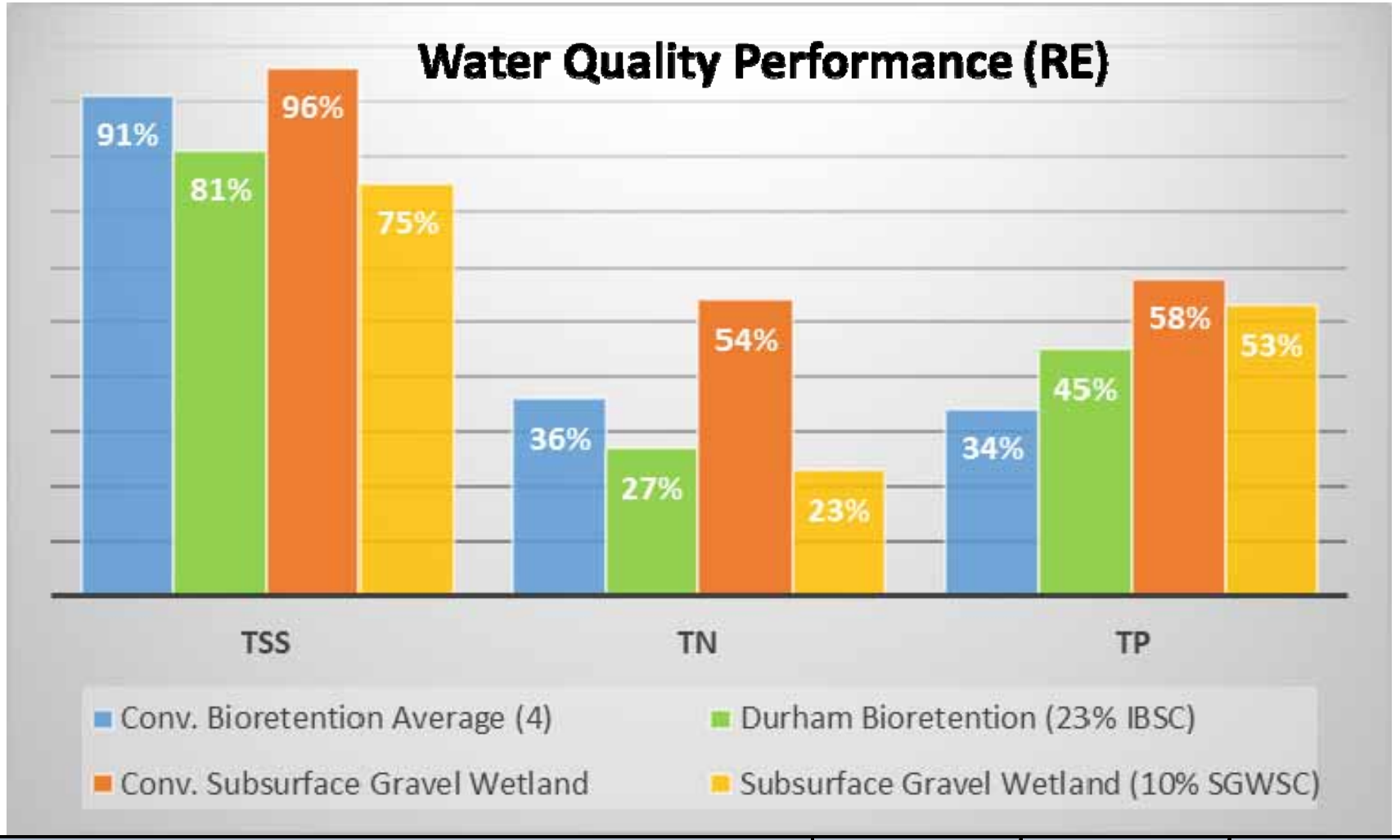
$$Af = Vwq * \frac{df}{(i(hf + df)tf)}$$

Static SGW System Sizing

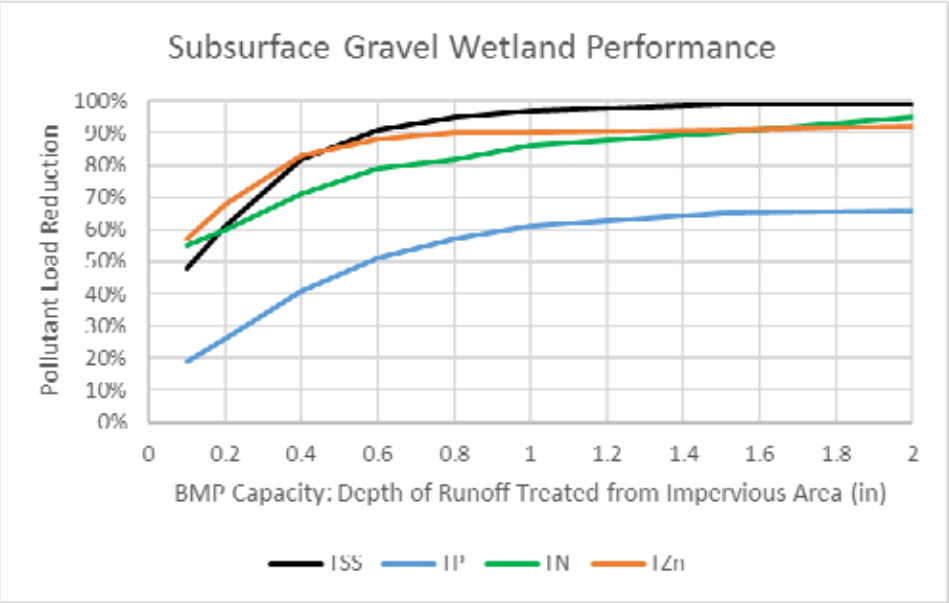
$$Q = CdA\sqrt{2gh}$$

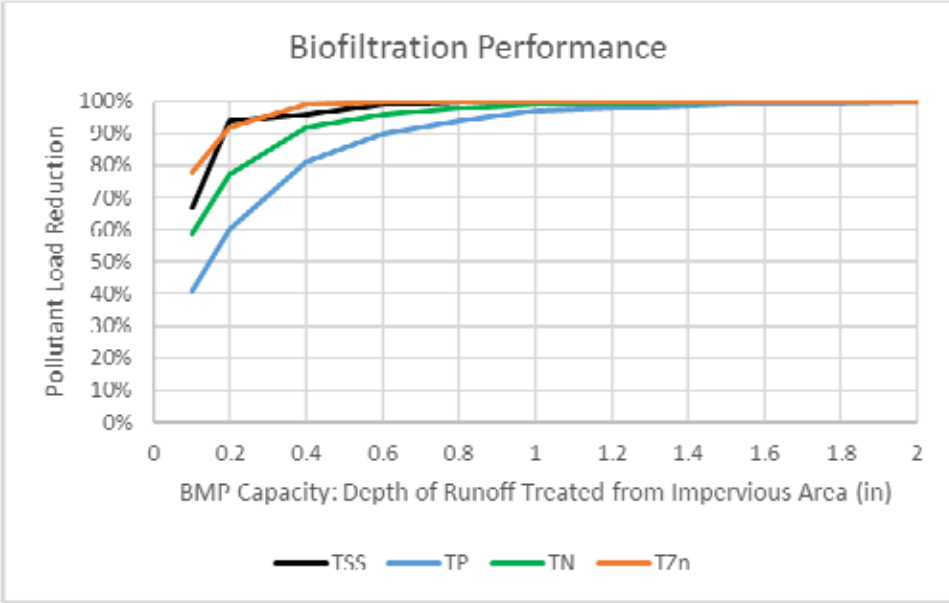


System	TSS	TN	TP
Durham Bioretention (23% IBSC)	81%	27%	45%
Subsurface Gravel Wetland (10% SGWSC)	75%	23%	53%



System	TSS	TN	TP
Conv. Bioretention Average (4)	91%	36%	34%
Durham Bioretention (23% IBSC)	81%	27%	45%
Conv. Subsurface Gravel Wetland	96%	54%	58%
Subsurface Gravel Wetland (10% SGWSC)	75%	23%	53%





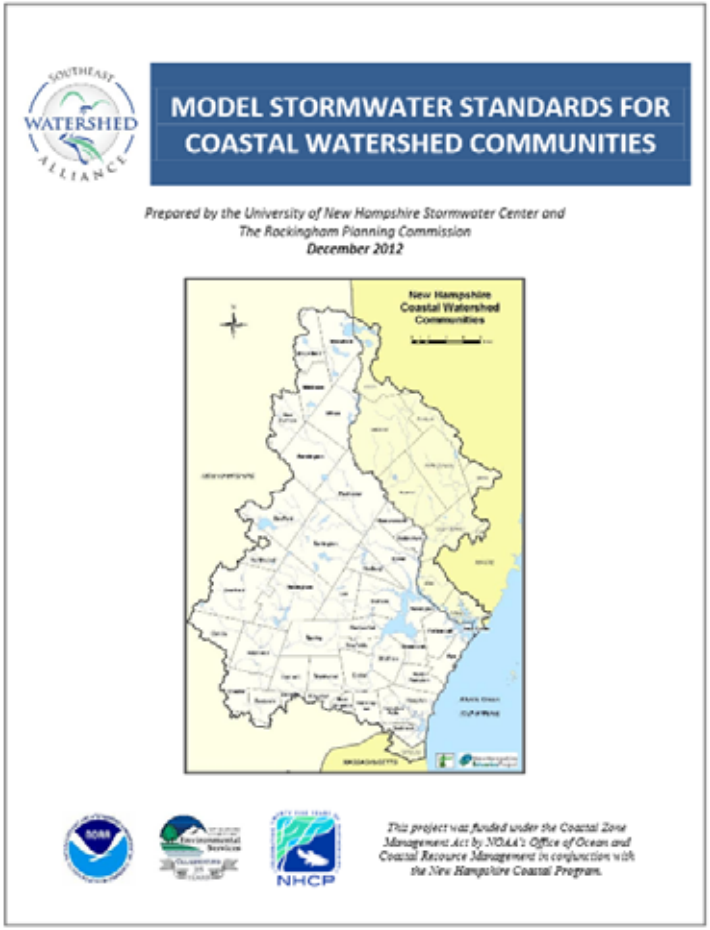
physical storage capacity - runoff depth from IA (in)

Analyte	Depth txt	Modeled RE	Measured RE
TSS	0.1	48	75
TZn	0.1	57	75
TN	0.1	55	23
TP	0.1	19	53

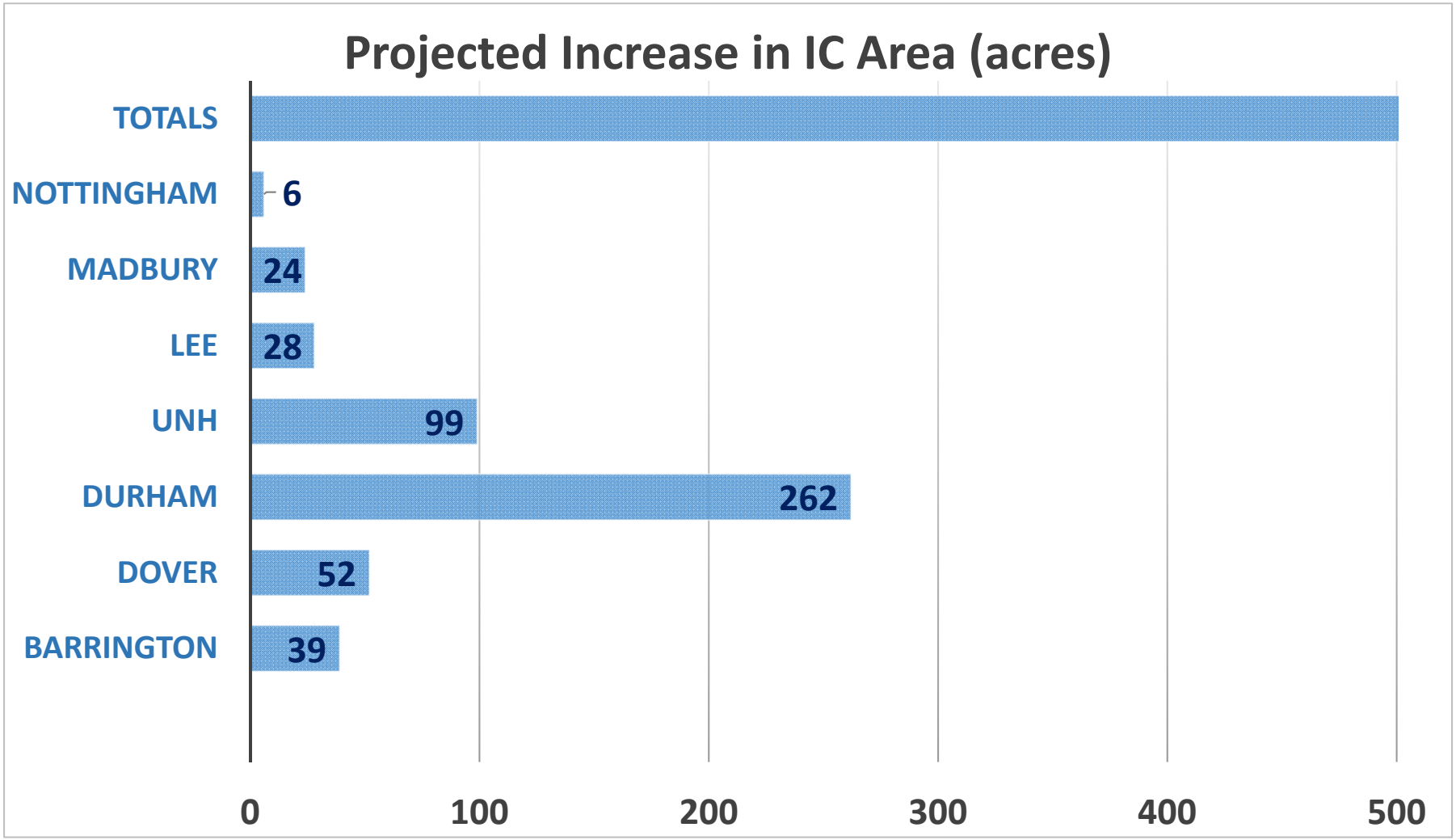
Analyte	Depth txt	Modeled RE	Measured RE
TSS	0.23	70	81
TZn	0.23	88	86
TN	0.23	60	27
TP	0.23	35	45

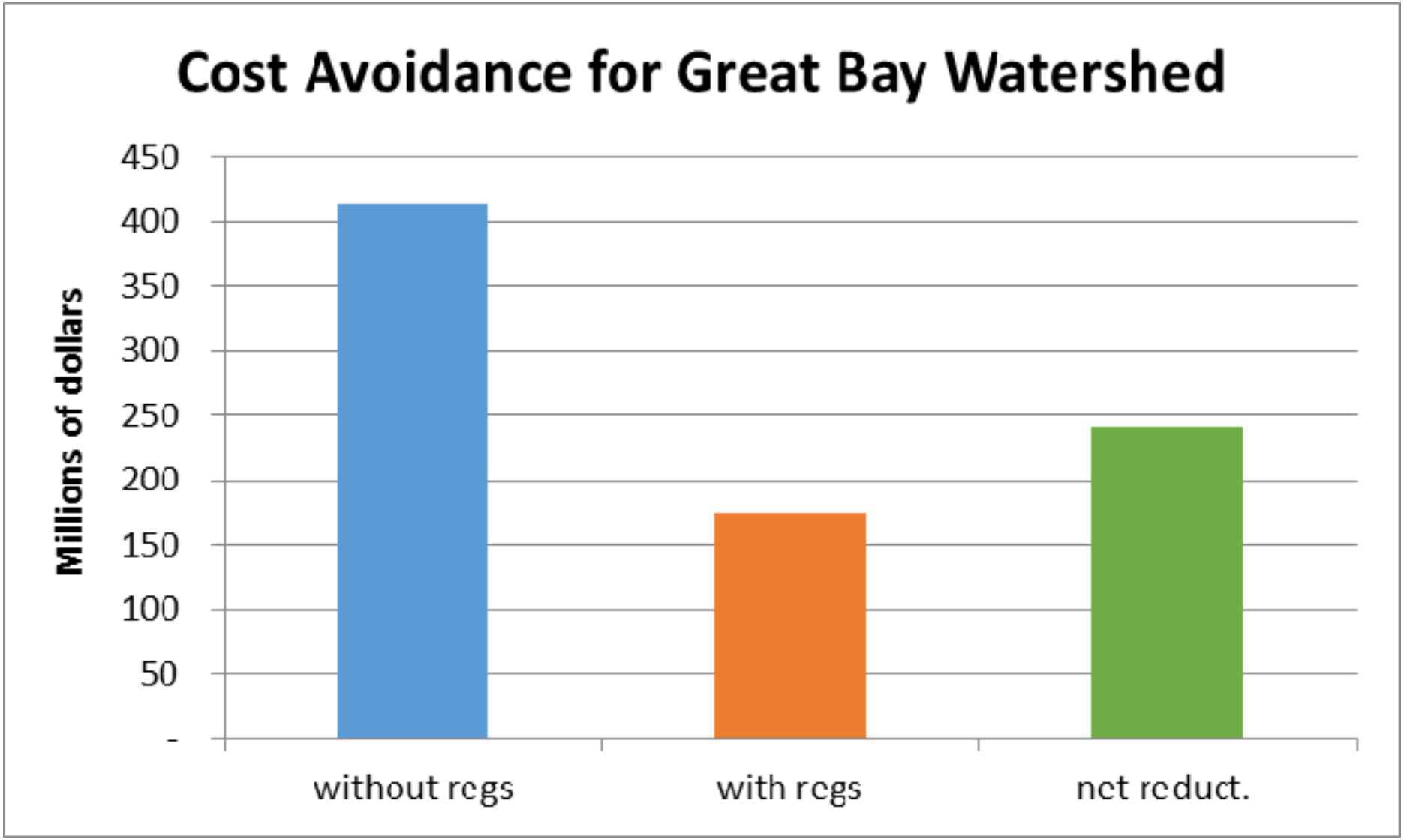
up-to-date code

2013 Model Regulations



Projected Future IC Area by 2040





Assumes Oyster River Watershed Ratios are consistent throughout the GB

Social: Elements pertaining to efforts that relate to public involvement and civic support for a cultural approach or common social responsibility.

Daisey Field

Stormwater Management Design - 70.5 acre Ultra-Urban Drainage Area			
Sizing Comparison of Capital Costs and Relative Phosphorus Load Removal Efficiency			
Best Management Practice Size	Depth of Runoff Treated from Impervious Area (in)	*Storage Volume Cost ($/ft^3)	**Total Phosphorus Removal Efficiency (%)
Subsurface Gravel Filter - Minimum Size	0.35	$1,016,912	62%
Subsurface Gravel Filter - Moderate Size	**0.5**	**$1,452,732**	**80%**
Subsurface Gravel Filter - Full Size	1.0	$2,905,463	96%
*Storage Volume Cost estimates provided by EPA-Region 1 for Opti-Tool methodology, 2015-Draft			
**Total Phosphorus %RE based on Appendix F Massachusetts MS4 Permit			

TOWN OF NEWFIELDS

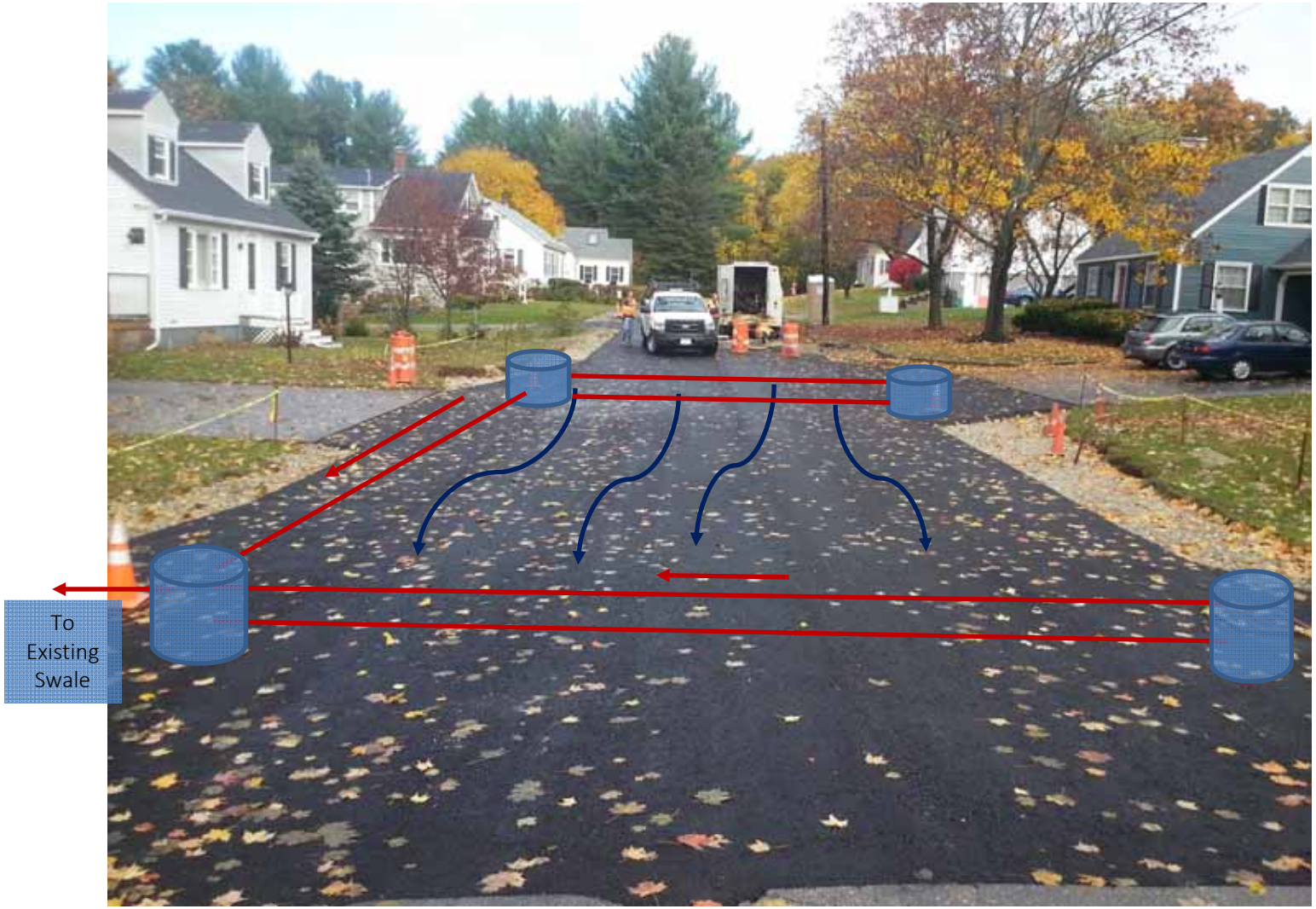
SITE PLAN REVIEW REGULATIONS

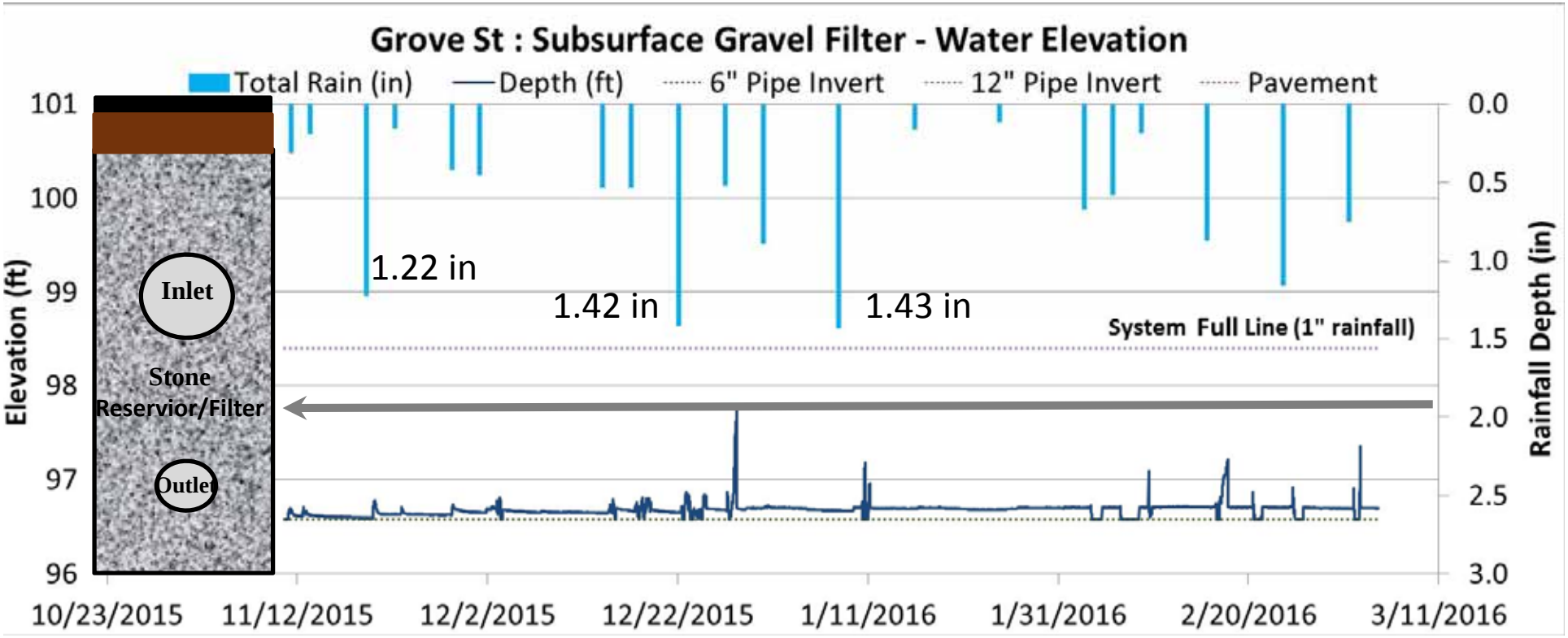
Adopted: June 20, 2013

Amended to June 20, 2013

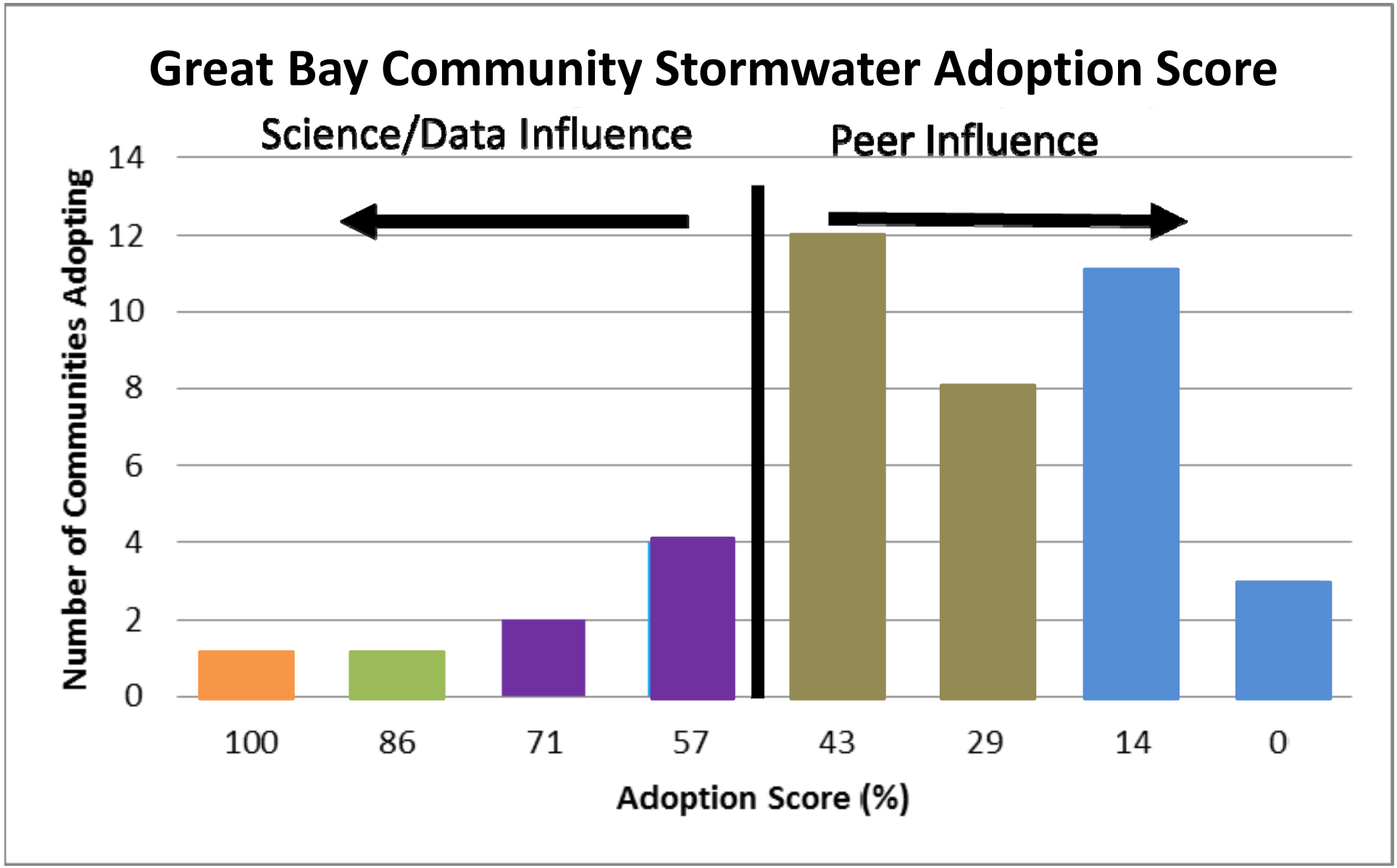
Cite as:
Newfields Site Plan Regulations, Section 10.1.1.1 et seq.

GI: Subsurface Gravel Filter

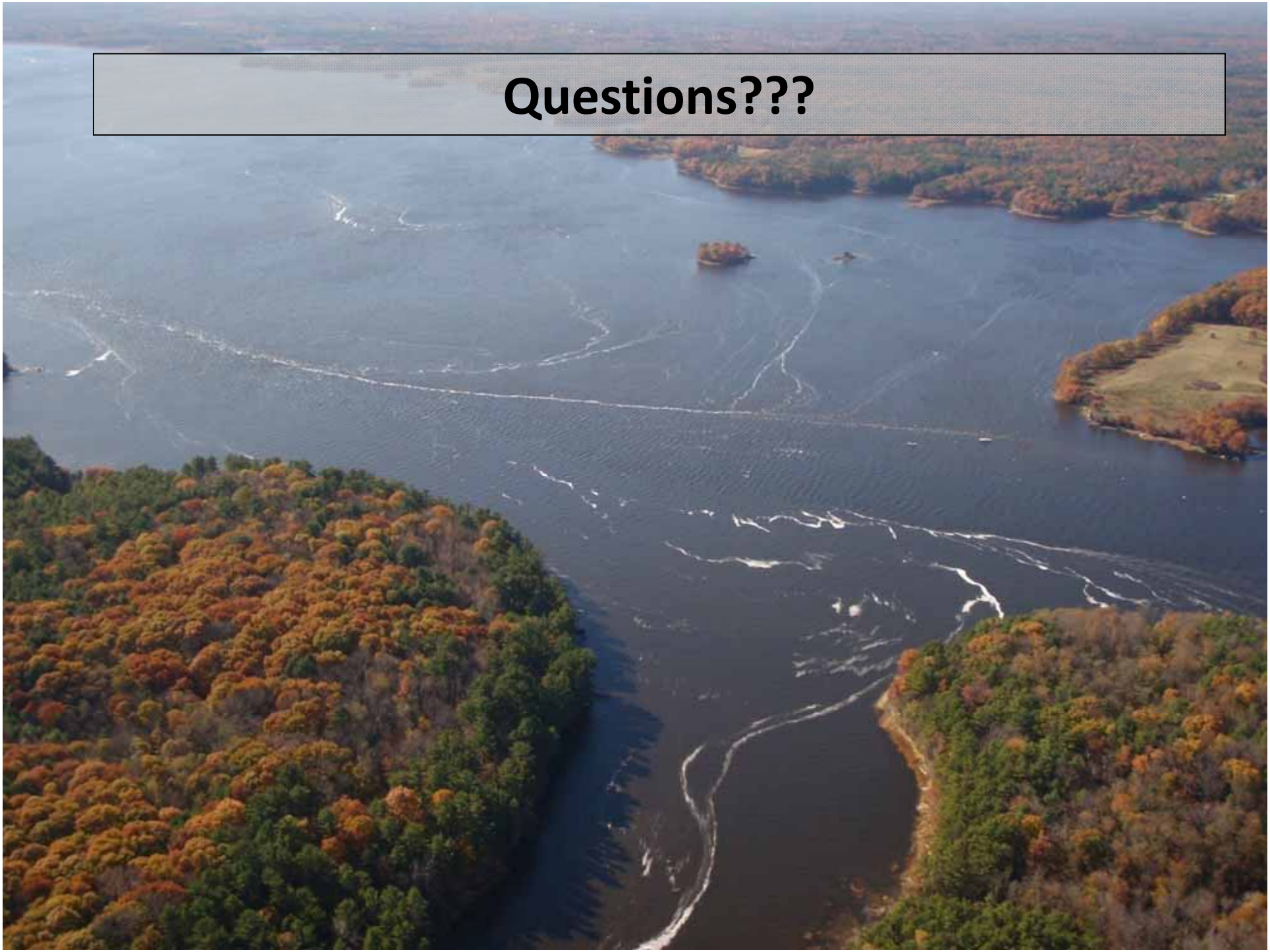



Grove St : Subsurface Gravel Filter - Water Elevation
Total Rain (in)
Depth (ft)
6" Pipe Invert
12" Pipe Invert
Pavement
Elevation (ft)
Rainfall Depth (in)
Inlet
Stone Reservior/Filter
Outlet
1.22 in
1.42 in
1.43 in
System Full Line (1" rainfall)
101
100
99
98
97
96
0.0
0.5
1.0
1.5
2.0
2.5
3.0
10/23/2015
11/12/2015
12/2/2015
12/22/2015
1/11/2016
1/31/2016
2/20/2016
3/11/2016

Situational: Elements that are largely out of the control of any municipality or occur according to an external probability, such as an event or regulation.


Great Bay Community Stormwater Adoption Score
Science/Data Influence
Peer Influence
Number of Communities Adopting
14
12
10
8
6
4
2
0
100
86
71
57
43
29
14
0
Adoption Score (%)

- Much more emphasis on the social and situational elements of DOI should be considered, as these are responsible for the majority of the metrics that influence adoption. At face value, this means that having strategic, audience-based communication strategies may be more critical to successful elements of innovation adoption than getting the science right. This is a sobering finding, particularly for professionals who may have biases in more technical fields.


Questions???