Comprehensive Watershed Evaluation, Planning and Management

Evolution of Water Quality BMP Accountability & Effectiveness

29TH Annual Environmental Permitting Summer School
Florida Chamber Foundation

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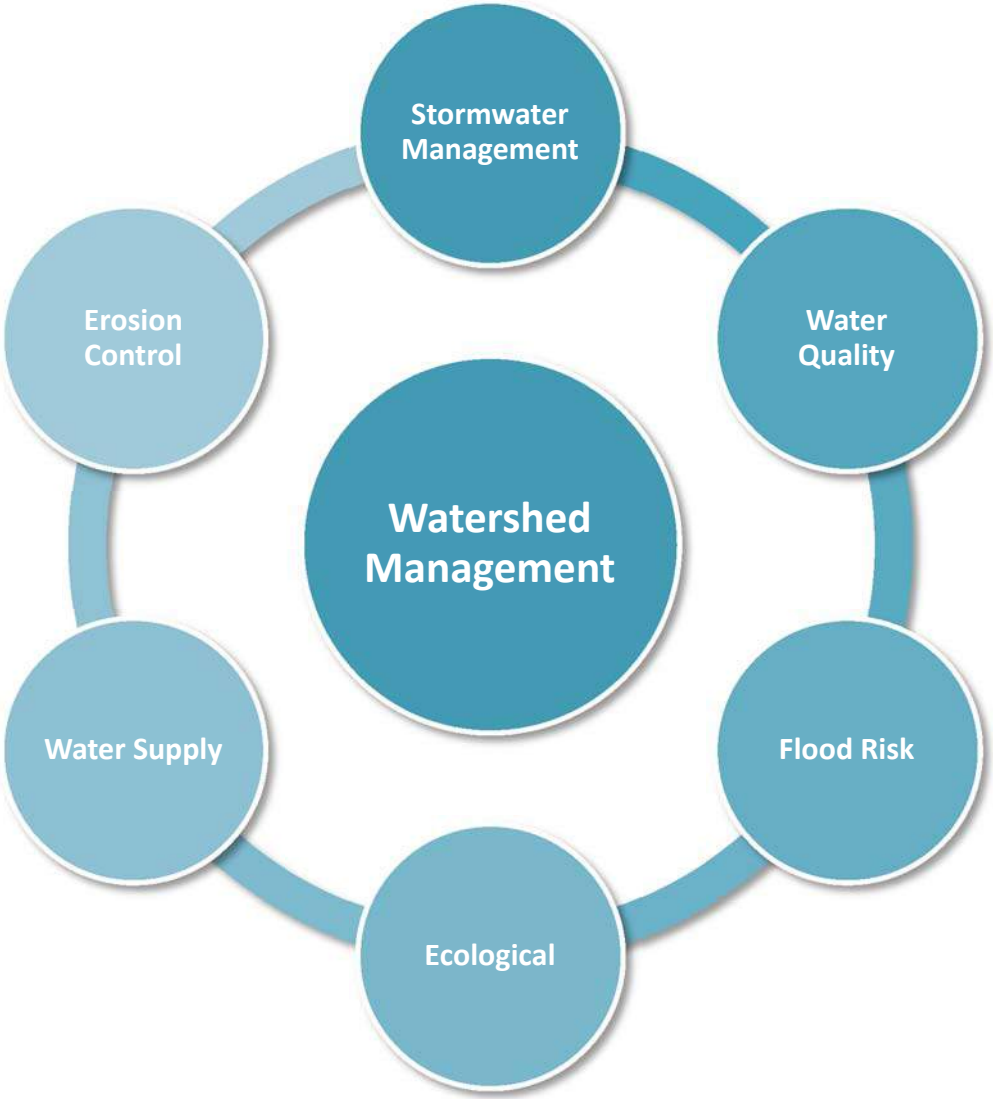
Watershed Management



Clean Water Act

NPDES

Section 404 Wetlands

TMDL/ NNC

FEMA Floodplains

Watershed Management

Water Quality

- **Best Management Practices (BMPs)**
  - **Accountability**
  - **Effectiveness**
  - **Enhancements**
  - **Monitoring**

Watershed Management

Best Management Practice = BMP

- **Term originated circa 1972 with the Clean Water Act**
- **EPA's Common Definition with Regard to Stormwater:**
  - ***A BMP is a technique, process, activity, or structure used to reduce the pollutant content of a storm water discharge.***
  - ***BMPs include simple nonstructural methods, such as good housekeeping and preventive maintenance. BMPs may also include structural modifications, such as the installation of bioretention measures. BMPs are most effective when used in combination with each other, and customized to meet the specific needs (drainage, materials, activities, etc.) of a given operation. The focus of EPA's general permits is on preventive BMPs, which limit the release of pollutants into storm water discharges. BMPs can also function as treatment controls.***

Accountability

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Accountability

- **Design of wet detention ponds for treating stormwater runoff in the State of Florida is dictated by rules established by the Florida Department of Environmental Protection (FDEP) and the State's Water Management Districts.**

- **Specifically Chapter 62-40 provides for surface water management regulation "Water Resource Implementation Rule", and Chapter 62-25 titled "Regulations of Stormwater Discharge" provides minimum design and performance standards for stormwater management systems.**

- **Chapter 62-25.025 stipulates that <u>no discharge from a stormwater management facility shall cause or contribute to a violation of water quality standards</u> in waters of the state.**

- **However, Chapter 62-25.025 also states that the <u>design standards provided may not result in compliance</u> with Chapter 62-302 – "Surface Water Quality Standards".**

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Accountability

- **The rules provide for a "presumption" of compliance with water quality standards. Chapter 62-40.432(2)(a) conveys that if BMPs such as wet detention ponds are designed and built according to established design and performance criteria, then there is a *"rebuttal presumption" that they are assumed to treat stormwater runoff to the extent that the discharges will comply with state water quality standards*.**

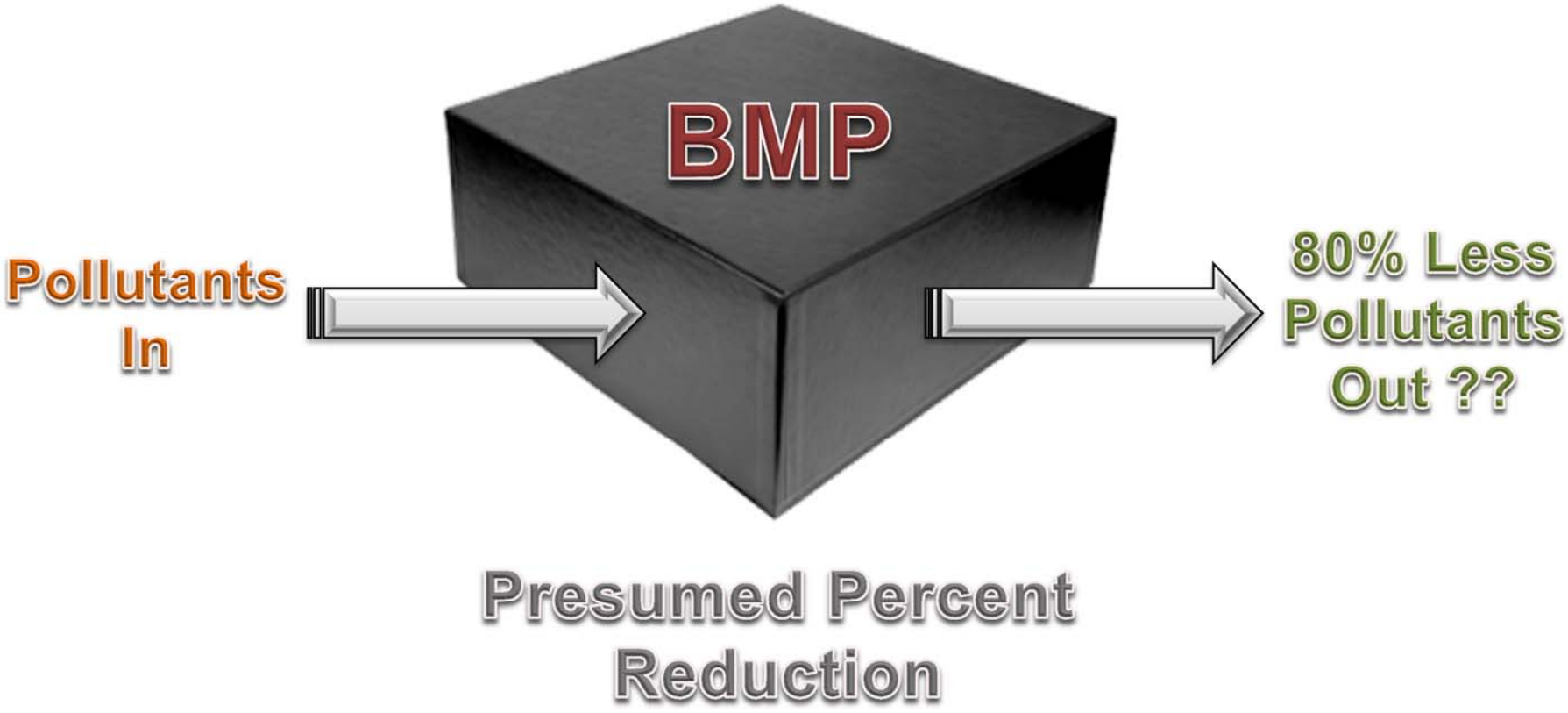
- **The performance criteria for stormwater management systems is, according to Chapter 62-40.432(2)(a)1&2, to achieve at least 80% reduction in annual pollutant loads that would cause or contribute to violations of water quality standards, or 95% reduction in the case of discharges to designated Outstanding Florida Waters.**

- **No actual sampling of effluent from BMPs is required by the State rules to verify the BMPs are meeting the presumed performance criteria.**

Presumptive Criteria

Accountability

Proverbial Black Box



Accountability

- **Better BMP Selection**
  - **Site-Specific Evaluation Required**
  - **Single BMP (i.e., wet pond) will not do the trick**
  - **Treatment Train Encouraged**
  - **Dry Retention Volumes Determined by Site-Specific Rainfall (by zone), Curve Number, and Percent DCIA**
  - **Wet Detention Volumes Determined by Residence Time**
  - ***Opens toolbox to other BMPs***
    - ***Green Infrastructure (GI)***
    - ***Low Impact Development (LID)***

Accountability

Open Tool Box

BMPs, Treatment Train, GI, LID, Etc.

Pollutants In

More Accurate Accounting of Pollutants Reduction

Pollutant Reduction Based on Better Characterization & Monitoring

Accountability

- **Numeric Nutrient Criteria**
  - **Concentration vs. Loads**
  - **BMP Solutions….**
    - **Will Require More Creativity**
    - **Will Require More Innovative Science**
    - **Will Require Thorough Characterization of Water Bodies**
    - **Need for Enhanced Effectiveness**
    - **Increased Need for Confirmation Monitoring**
  - ***For now use TMDL load reduction allocations…***

Effectiveness

Effectiveness

- **Issues with Estimating Pollutant Loads**
  - **All pollutant models are estimates**
    - **Approximations of land use, soils, EMC characteristics**
  - **Over estimation of annualized runoff (underestimation of current attenuation) leads to over estimation of loads**
  - **Failure to consider other non-runoff load impacts**
    - **Baseflow can sometimes exceed runoff inputs on annualized basis**
    - **Upstream Treatment (swales, ditches, etc.)**

Effectiveness

Central and North Indian River Lagoon (IRL) Basin Management Action Plans (BMAPs) Best Management Practice (BMP) Efficiencies (August 2010)

Standard Best Management Practices (BMPs)	TP % Reduction	TN % Reduction	Data Source
Retention BMPs (includes basins, exfiltration trenches, etc.)	Based on percent reduction from appropriate table in Appendix F using project's percent directly connected impervious area (DCIA), non-DCIA curve number (CN), and rainfall zone	Based on percent reduction from appropriate table in Appendix F using project's percent DCIA, non-DCIA CN, and rainfall zone	Appendix F Draft Stormwater Treatment Applicant's Handbook (Florida Department of Environmental Protection)
Wet detention ponds	Reduction from Figure 13.2 given the project's residence time, which is based on the flow from the model	Reduction from Figure 13.3 given the project's residence time, which is based on the flow from the model	Figures 13.2 and 13.3 in Draft Stormwater Treatment Applicant's Handbook
BMP treatment trains using a combination of BMPs	Use BMP Treatment Train (TT) equation: BMP TT Efficiency = $Eff_1 + ((1-Eff_1)*Eff_2)$	Use BMP Treatment Train (TT) equation: BMP TT Efficiency = $Eff_1 + ((1-Eff_1)*Eff_2)$	Draft Stormwater Treatment Applicant's Handbook
Dry detention	10	10	Harper, H. & D. Baker. 2007. Evaluation of Current Stormwater Design Criteria within the State of Florida.
Baffle box	2.3	0.5	Final Report Contract S0236 Effectiveness of Baffle Boxes
Nutrient baffle box (2nd generation)	15.5	19.05	Final Report Contract S0236 Effectiveness of Baffle Boxes
Catch basin inserts/inlet filters	Evaluated on a case-by case basis	Evaluated on a case-by case basis	Case-by-case
Grass swales with swale blocks or raised culverts	Use retention BMPs above	Use retention BMPs above	Draft Stormwater Treatment Applicant's Handbook
Grass swales without swale blocks or raised culverts	50% of value for grass swales with swale blocks or raised culverts	50% of value for grass swales with swale blocks or raised culverts	Draft Stormwater Treatment Applicant's Handbook
Alum injection	90	50	Evaluation of Harper data

Note: The Draft Stormwater Treatment Applicant's Handbook is located at: http://www.dep.state.fl.us/water/wetlands/erp/rules/stormwater/docs/ah_rule_draft_031710.pdf

Effectiveness

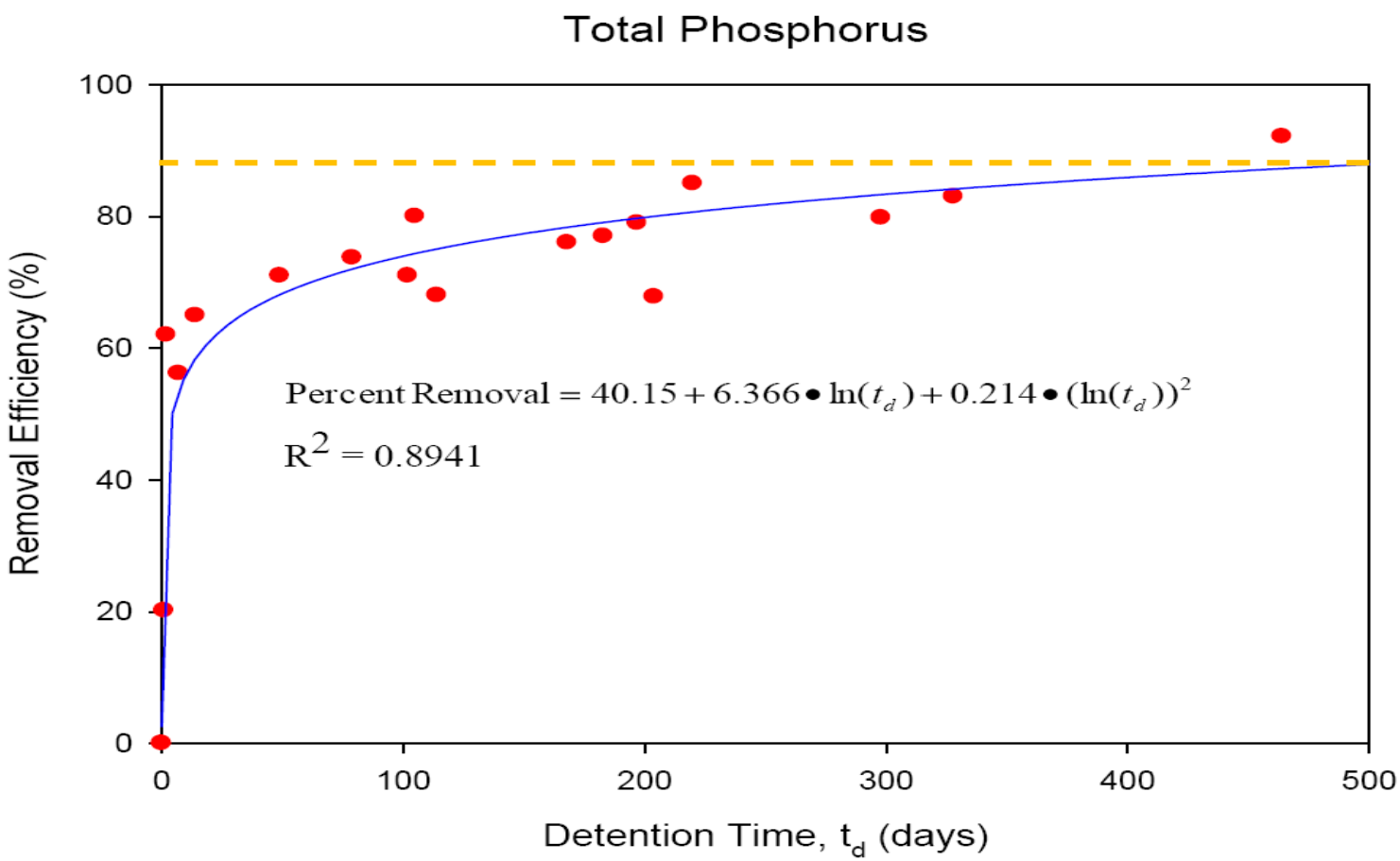
Central and North Indian River Lagoon (IRL) Basin Management Action Plans (BMAPs) Best Management Practice (BMP) Efficiencies (August 2010)

Standard Best Management Practices (BMPs)	TP % Reduction	TN % Reduction	Data Source
Street sweeping	Determine pounds of materials removed and multiply by values to be provided by the Florida Stormwater Association (FSA) University of Florida (UF) municipal separate storm sewer system (MS4) BMP project	Determine pounds of materials removed and multiply by values to be provided by FSA UF MS4 BMP project	Final Report of FSA UF MS4 BMP Project
Floating islands	20	20	Chapter 14 Draft Stormwater Treatment Applicant's Handbook
Stormceptor	13	2	Final Report Contract S0095 Sanford Stormceptor project
Continuous deflective separation (CDS) units	10	Not applicable	Final Report Contract WM793 Broadway Outfall Project
Public education	1-6, depending on extent of program	1-6, depending on extent of program	Evaluation of Center for Watershed Protection (CWP). 2002. Watershed Treatment Model Version 3.1. See separate calculation spreadsheet.

Note: The Draft Stormwater Treatment Applicant's Handbook is located at: http://www.dep.state.fl.us/water/wetlands/erp/rules/stormwater/docs/ah_rule_draft_031710.pdf

Effectiveness

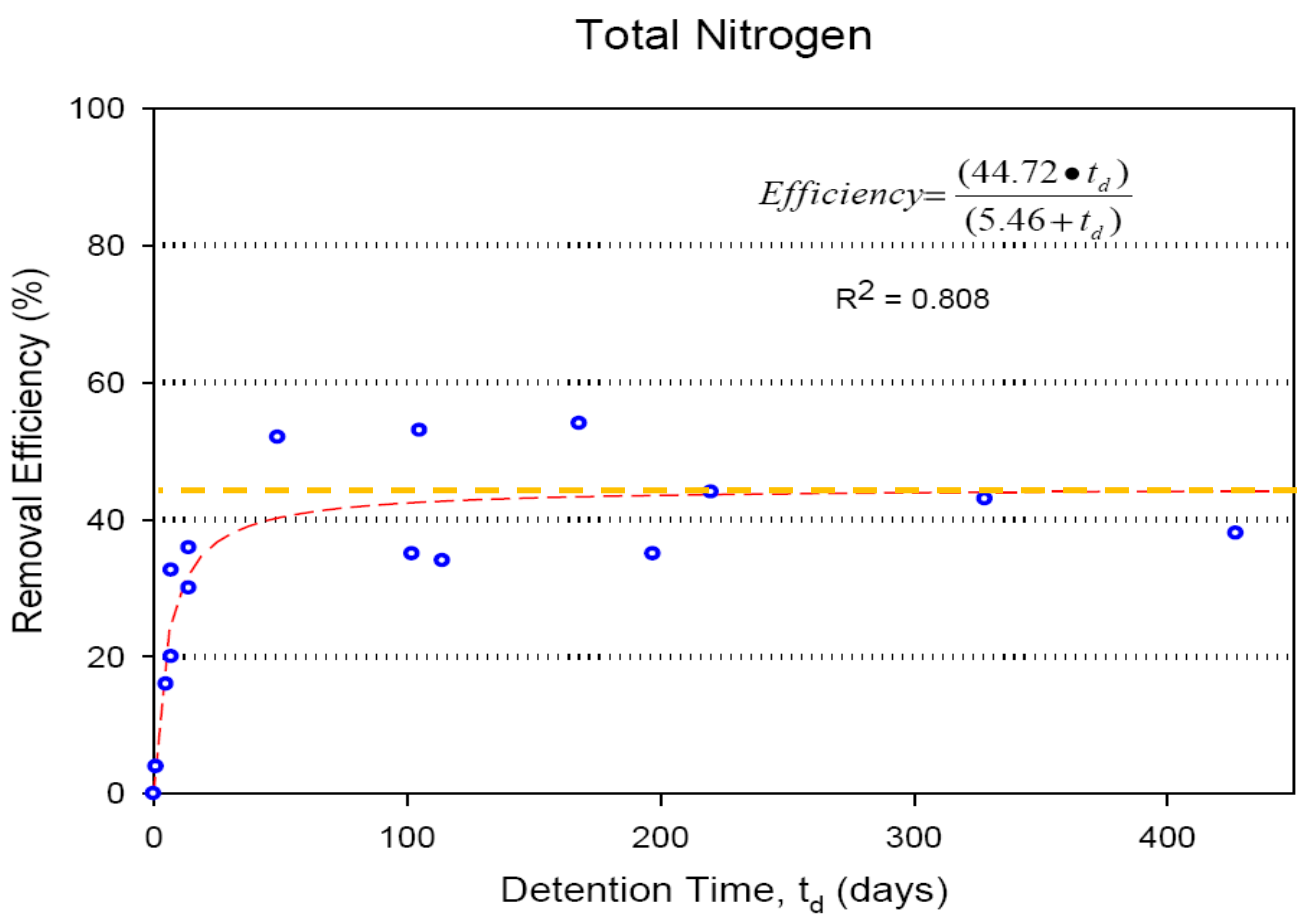
Wet Detention Removal Efficiency



Source: Draft Stormwater Quality Applicant's Handbook, DEP & WMDs, 2010:
http://www.dep.state.fl.us/water/wetlands/erp/rules/stormwater/docs/ah_rule_draft_031710.pdf

Effectiveness

Wet Detention Removal Efficiency



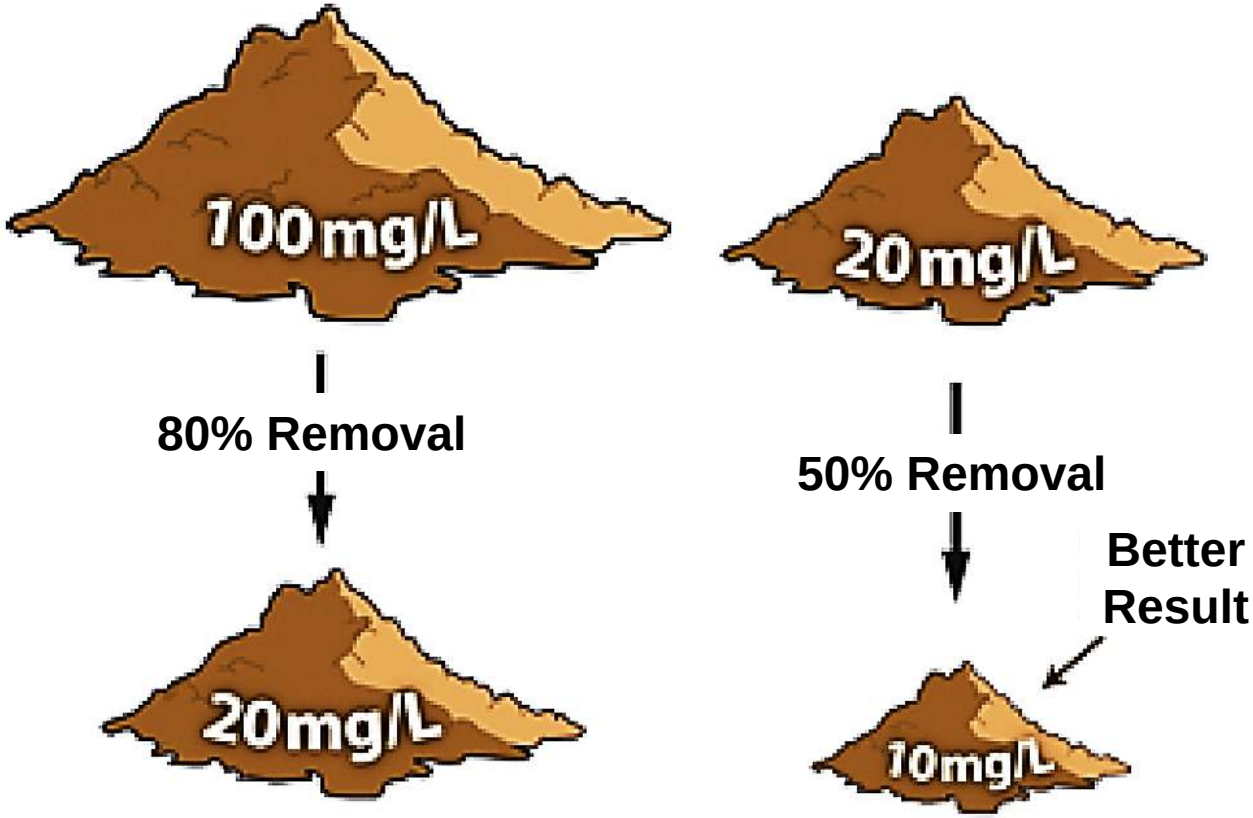
Source: Draft Stormwater Quality Applicant's Handbook, DEP & WMDs, 2010:
http://www.dep.state.fl.us/water/wetlands/erp/rules/stormwater/docs/ah_rule_draft_031710.pdf

Effectiveness

- **Issues with Percent Removal vs. Concentrations**
  - **Percent removal varies depending on influent concentration**
  - **Higher percent removals achieved with higher influent concentrations**
  - **Lower influent concentrations may approach irreducible levels**
  - **BMPs with high percent removal can still have unacceptable effluent concentrations**
  - **BMPs with low percent removals can still meet receiving water numeric targets depending on influent concentration**

Effectiveness

Better results with only 50% removal.
It all depends on the input.



% Removal – Doesn't Tell the Whole Story of Measure of BMP Performance

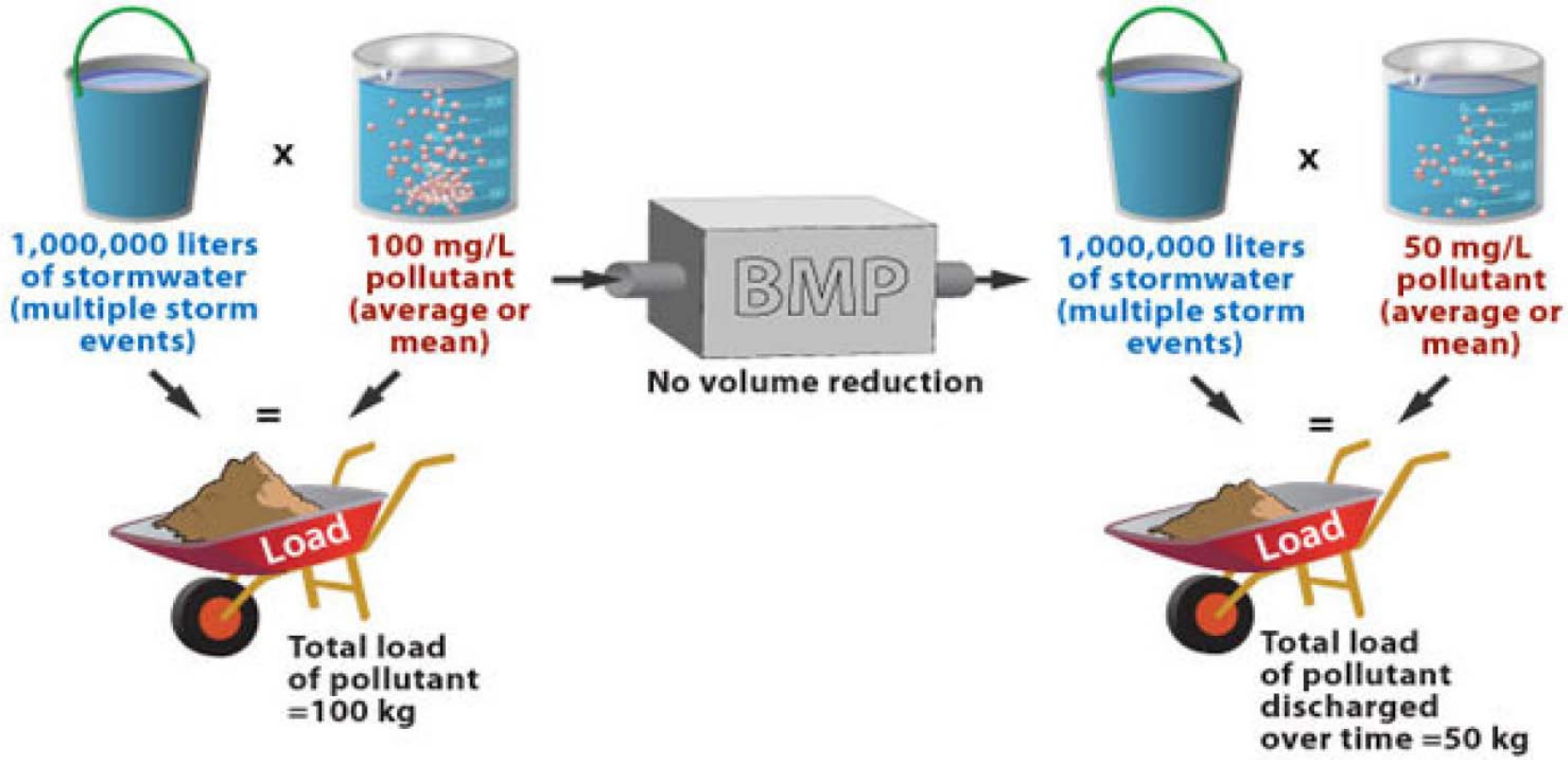
Source: Three Keys to BMP Performance - Concentration, Volume and Total Load, EPA, 2009: http://cfpub.epa.gov/npdes/stormwater/urbanbmp/bmptopic.cfm

Effectiveness

- **Volume & Total Load**
  - **Volume Reduction Also Important in Addition to Treatment (Physical, Biological, Chemical) in BMPs**
    - **Addresses Increase in Runoff Volume from Urbanized Areas**
    - **Reduce Downstream Impacts such as Streambank Erosion, Channel Deformation, Habitat Impacts, etc.**
  - **Simply Comparing IN vs. OUT <u>Concentration</u> Does Not Properly Account for Relative Impact of Volume Reduction**
  - **Should Evaluate BMPs Based on Overall Load Reduction**
    - **BMP Treatment, and**
    - **Volume Reduction**

Effectiveness

BMP Pollutant Reduction but No Volume Reduction

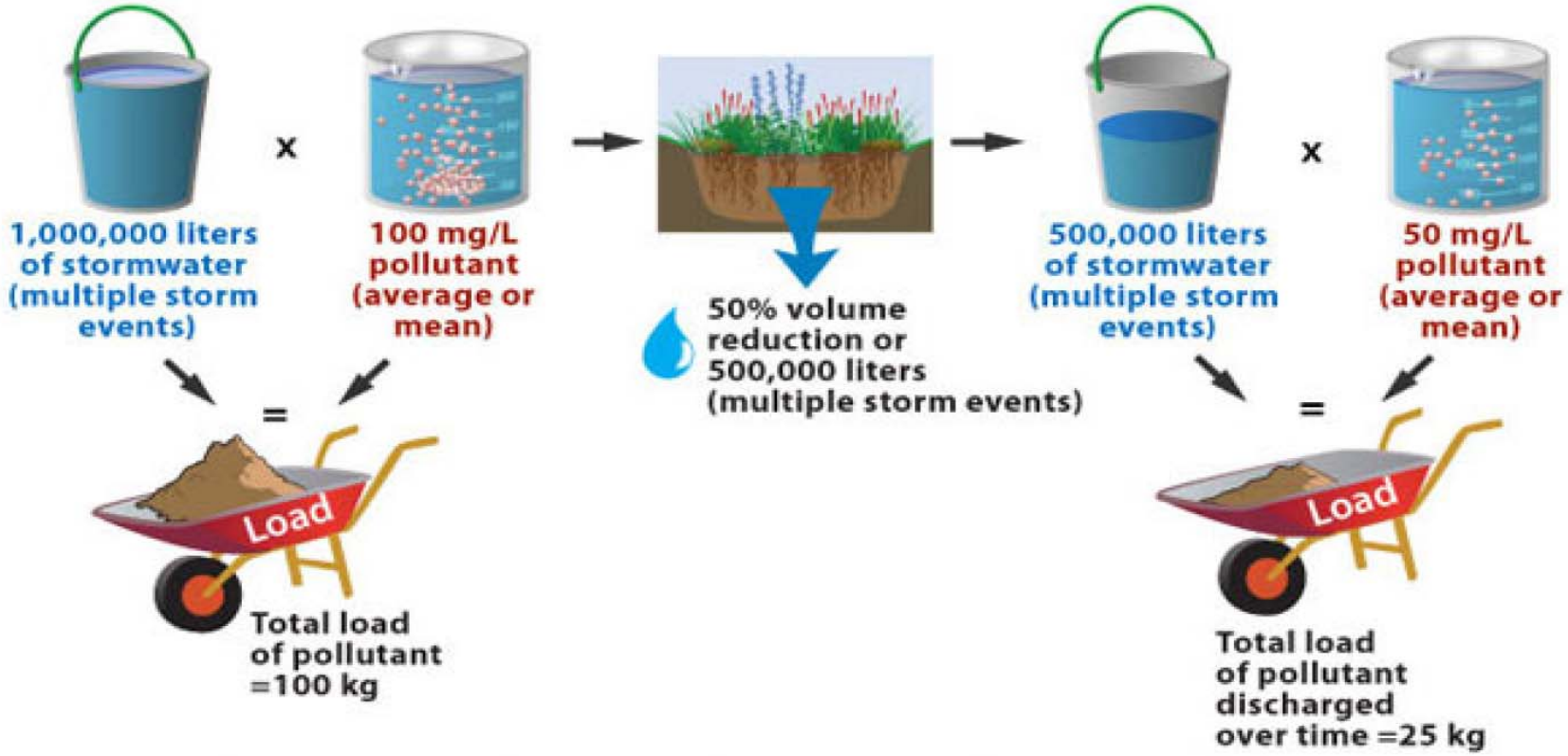


In this example, the BMP removes 50 kg or 50% of the "total load" of this pollutant.
It does not reduce the volume of stormwater discharged.

Source: Three Keys to BMP Performance - Concentration, Volume and Total Load, EPA, 2009: http://cfpub.epa.gov/npdes/stormwater/urbanbmp/bmptopic.cfm

Effectiveness

BMP Pollutant Reduction With Volume Reduction



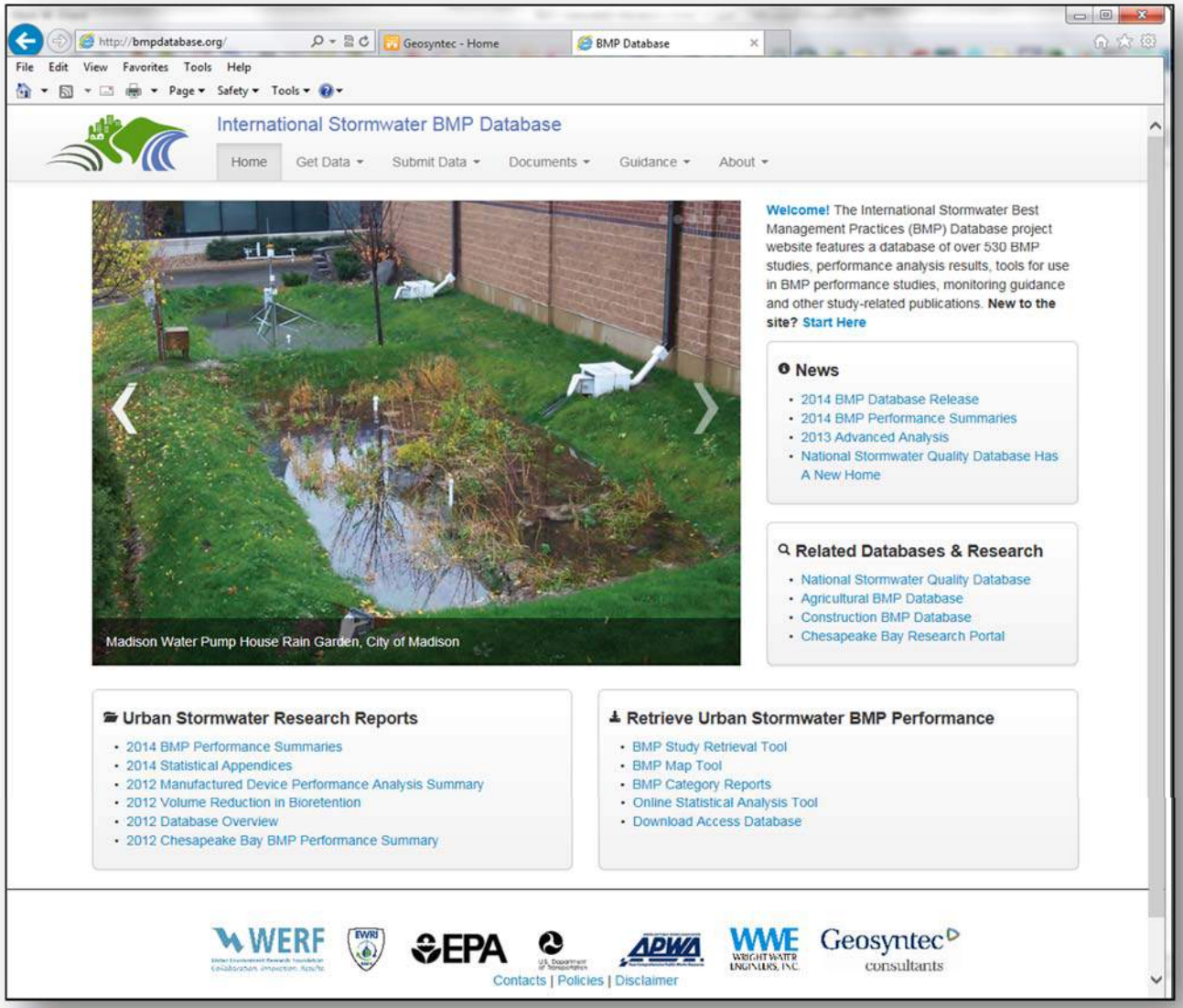
In this example, the BMP removes 75 kg or 75% of the "total load" of this pollutant. The "true" performance of this BMP is only apparent when we factor in the impact of volume reduction and calculate the total load of the pollutant.

Source: Three Keys to BMP Performance - Concentration, Volume and Total Load, EPA, 2009: http://cfpub.epa.gov/npdes/stormwater/urbanbmp/bmptopic.cfm

Effectiveness

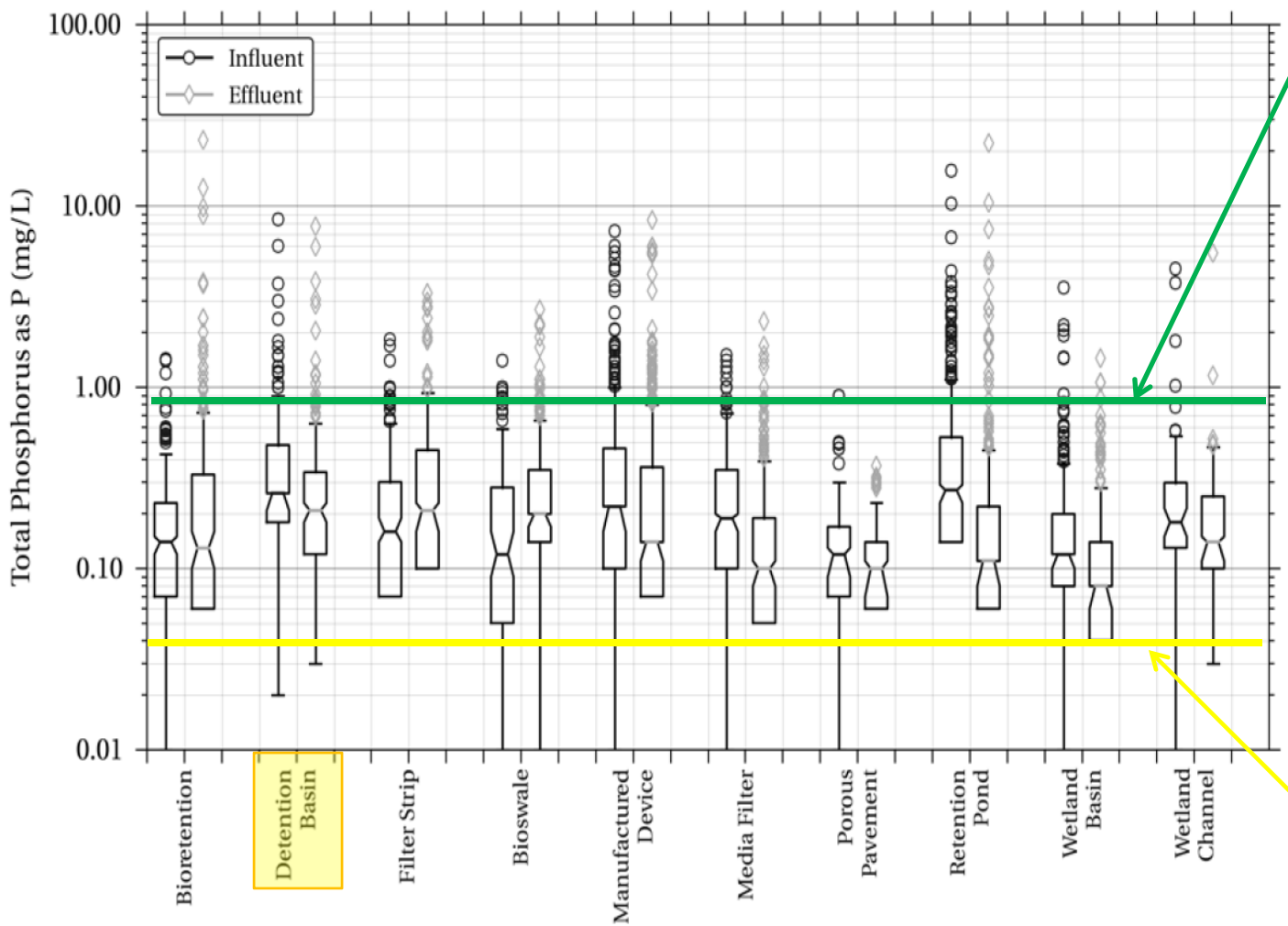
International BMP Database

(www.bmpdatabase.org)



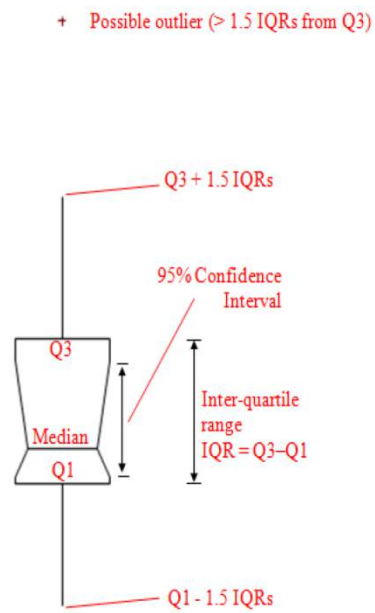
Effectiveness

Figure 4. Box Plots of Influent/Effluent Total Phosphorus Concentrations by BMP Type.



Instream NNC

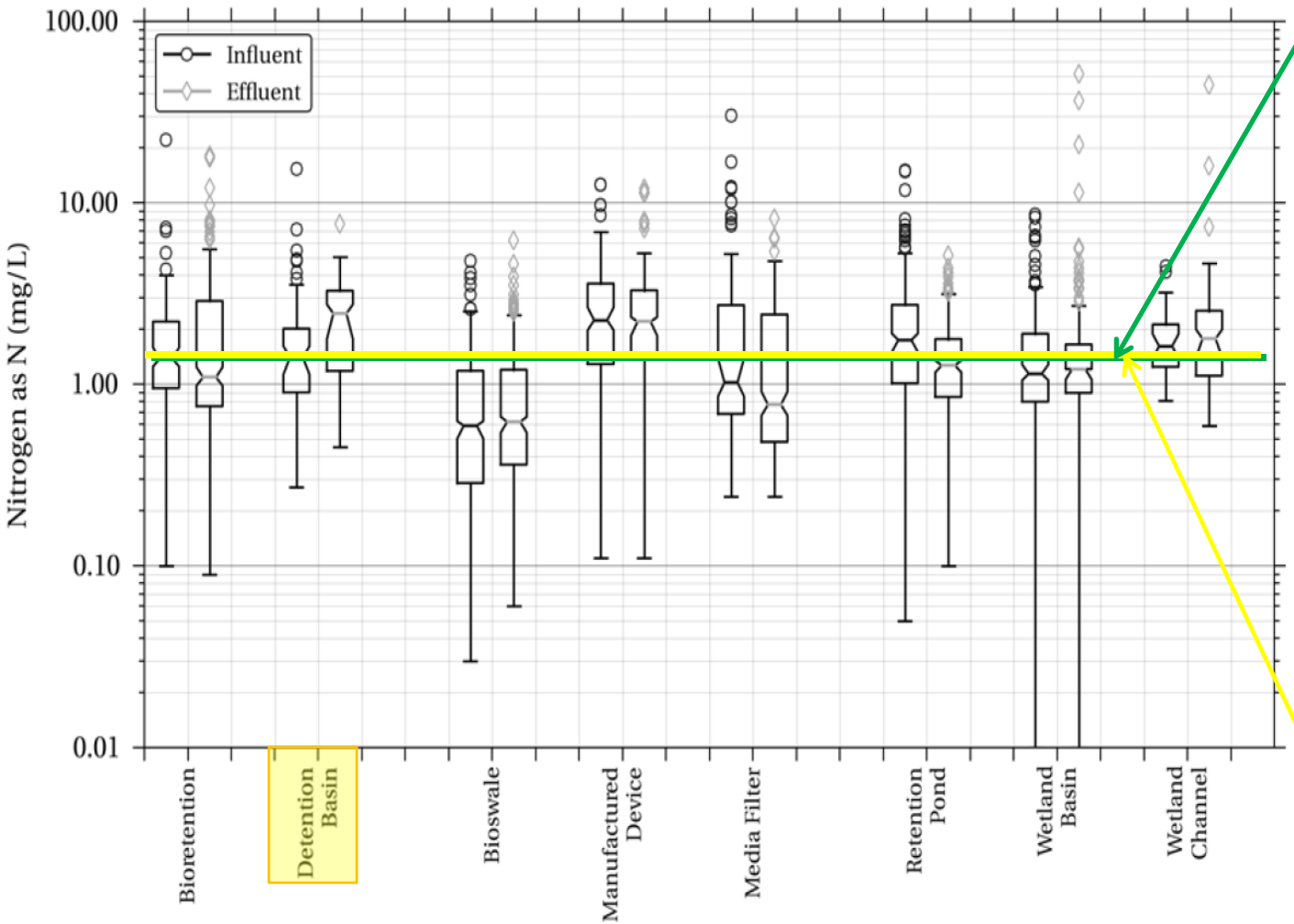
Figure 3. Box Plot Key



Lake NNC (clear lake)

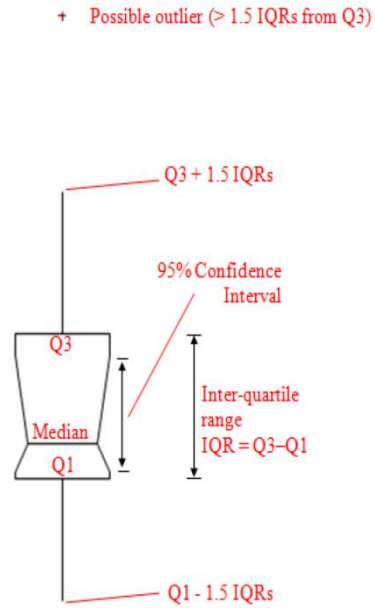
Effectiveness

Figure 7. Box Plots of Influent/Effluent Total Nitrogen Concentrations by BMP Type.



Instream NNC

Figure 3. Box Plot Key



Lake NNC (clear lake)

Enhanced BMP Practices

Enhanced BMP Practices

What is Low Impact Development (LID) ?

- **Low Impact Development (LID) is an approach to land development that works with nature to manage stormwater as close to its source as possible.**
- **EPA Definition (Coffman, 2000)**
  - ***LID is a site design strategy with a goal of maintaining or replicating the predevelopment hydrologic regime through the use of design techniques to create a functionally equivalent hydrologic landscape.***

Enhanced BMP Practices

What is Green Infrastructure (GI) ?

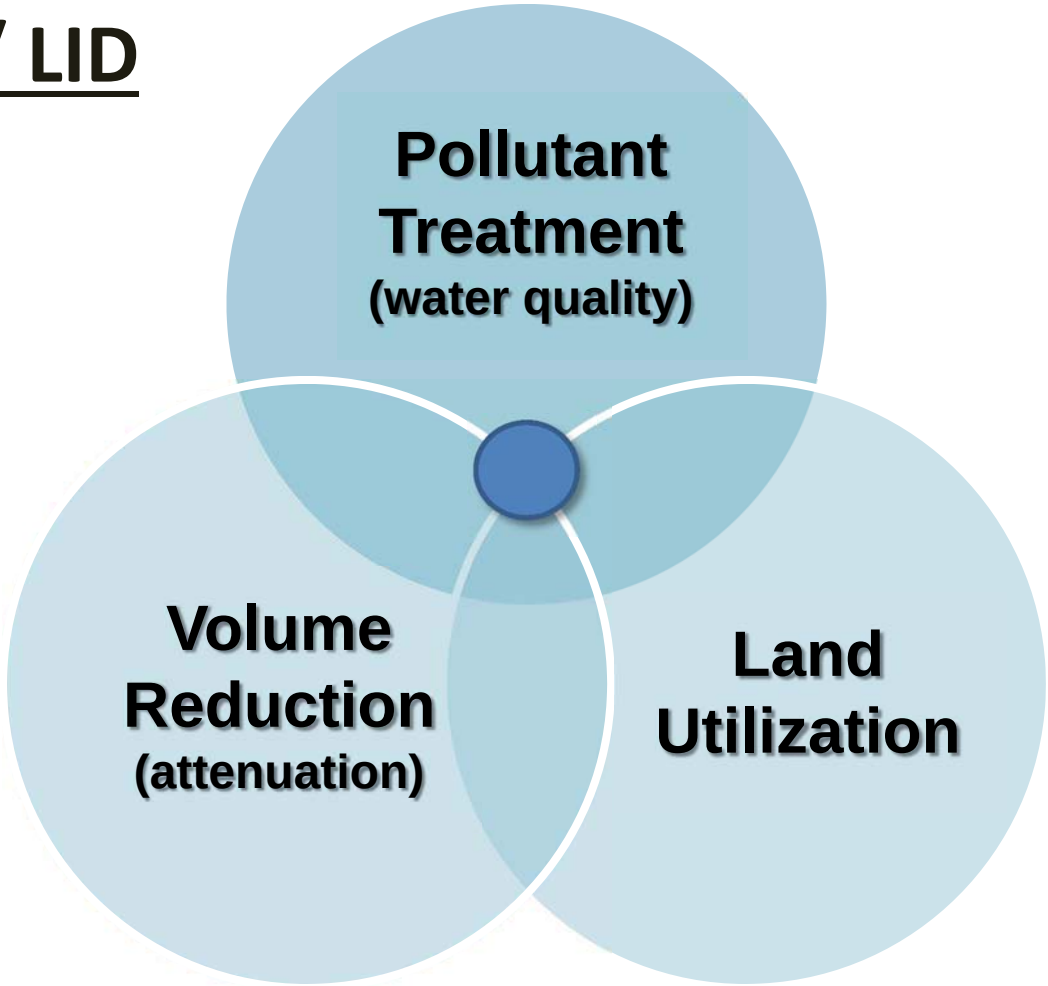
– **EPA Definition** **(http://water.epa.gov/infrastructure/greeninfrastructure/gi_what.cfm)**

- ***Green infrastructure uses vegetation, soils, and natural processes to manage water and create healthier urban environments. At the scale of a city or county, green infrastructure refers to the patchwork of natural areas that provides habitat, flood protection, cleaner air, and cleaner water. At the scale of a neighborhood or site, green infrastructure refers to stormwater management systems that mimic nature by soaking up and storing water.***

Enhanced BMP Practices

Benefits of GI / LID

Focus on ***stormwater*** *as a resource*



Enhanced BMP Practices

GI / LID Stormwater Practices:

- Pervious pavement
- Bioretention Areas/ Bioswales
- Rain Gardens
- Planter Box
- Tree Box Filters
- Stormwater Harvesting – Cisterns
- Curb Cuts & Inverted Medians

Enhanced BMP Practices

Challenges of GI / LID

- Effective integration with traditional practices
- Lack of familiarity by city/county engineers
- Lack of familiarity by regional permitting authorities
- Lack of familiarity of local contractors
- Lack of experience with maintenance procedures

Enhanced BMP Practices

Cost Impacts of GI/LID:

- **Capital Costs**
  - Reduced infrastructure (↓)
  - Potentially smaller ponds (↓)
  - More vegetation/plantings (↑)
  - Contractor certifications (↑)
- **Maintenance Costs**
  - Training/certifications for personnel (↑)
  - Replace typical landscaping – offset overall BMP maintenance area (↓)
  - Infiltration/media testing (↑)

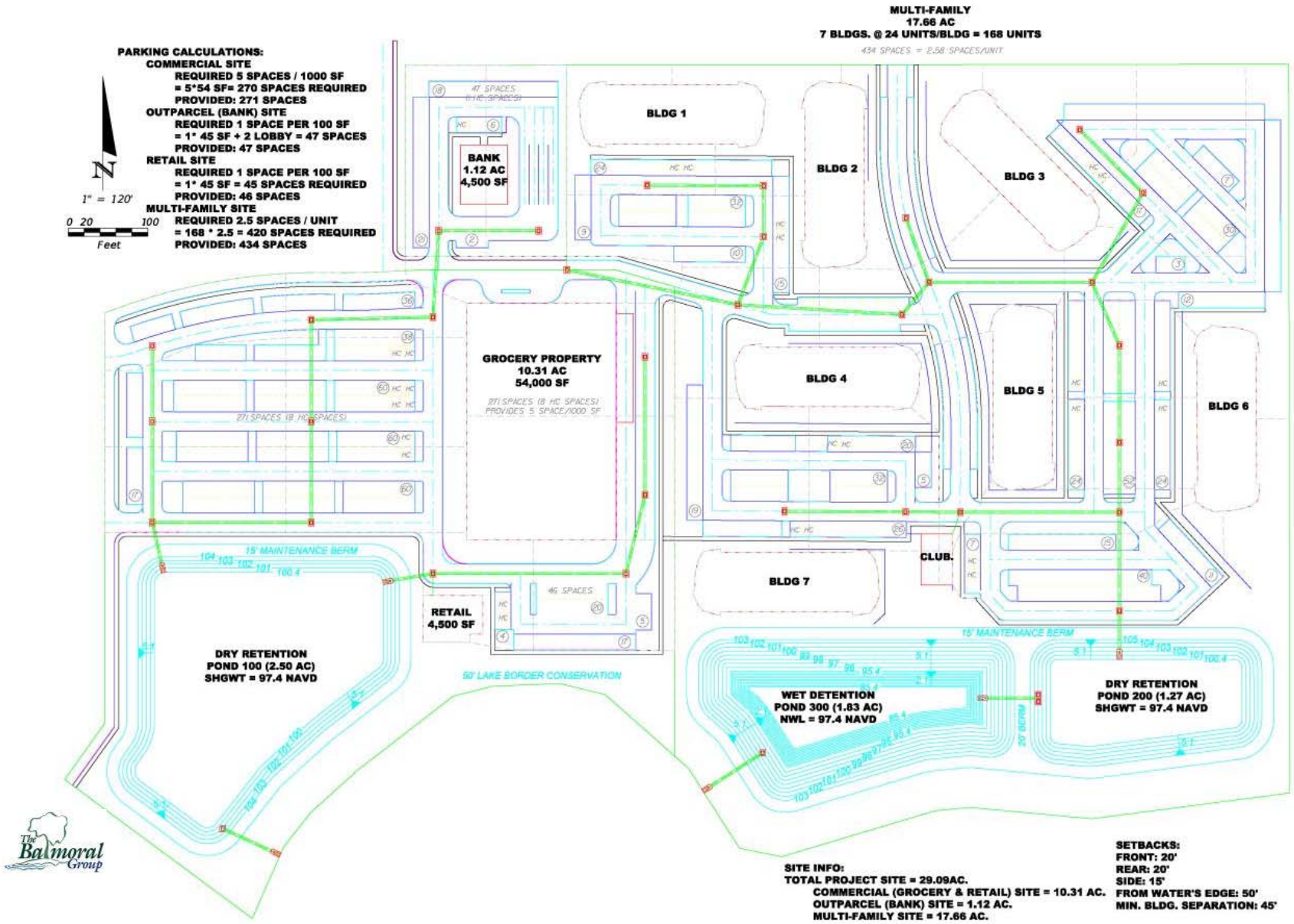
Enhanced BMP Practices

Concept Plans Comparison

- **Purpose**
  - **Show LID techniques can accommodate equivalent density/intensity development as traditional methods;**
  - **Provide alternatives to structural stormwater facilities;**
  - **Provide additional opportunities for infiltration; and**
  - **Illustrate that water quality, water quantity, and nutrient loading criteria can be met or exceeded using LID practices.**

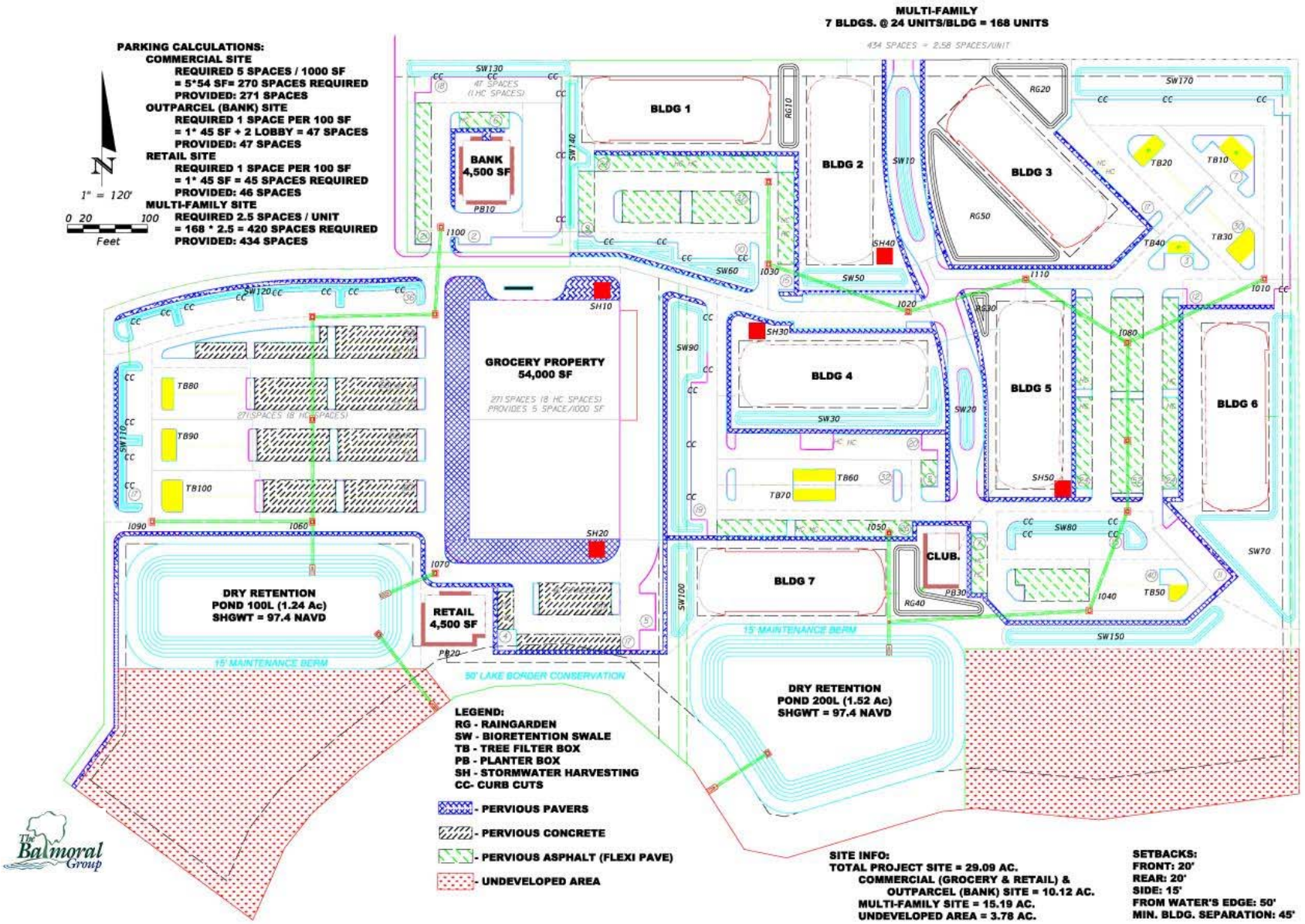
- **Project Site (29.09 acres): portion of Hamlin PD**
  - **Commercial:** - **Grocery store – 54,000 sq. ft.**
    - **Bank (Outparcel) – 4,500 sq. ft.**
    - **Retail – 4,500 sq. ft.**
  - **Residential:** - **168 MF units (7 buildings at 24 units/building)**

Enhanced BMP Practices



Traditional Concept Site Plan

Enhanced BMP Practices



LID Concept Site Plan

Enhanced BMP Practices

Comparison Results

- The LID Concept provides the same commercial and residential sq. ft. and parking
- LID Utilizes 25.31 acres of the original 29.09 acres – a reduction of 3.78 acres (13%).
- The LID concept plan meets or exceeds the Traditional concept plan in all stormwater management criteria.

Table 1: Comparison of Traditional and LID Results

Criteria	Traditional	LID
Treatment Volume [1]	4.40 ac-ft	5.83 ac-ft
Volume to Ponds [2]	17.7 ac-ft	11.7 ac-ft
Site Discharge Rate [3]	8.46 cfs	8.05 cfs
Pollutant Loading Removal	95.95%	96.69%
Outflow Mass Loading	1.19 kg/yr	0.86 kg/yr

(1): Treatment Volume is controlled by the retention depth needed for nutrient removal
(2): Total Inflow volume for the 25yr/24hr (Orange) storm event to Ponds 100/100L and 200/200L
(3): Peak Discharge to Lk Hancock for the 25yr/24hr (Orange) storm event

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Enhanced BMP Practices

Cost Comparison Results with Land Savings (Preliminary)

Pay Item	LID Cost	Traditional Cost	LID Description	Traditional Description
Pavement	$ 741,323.67	$ 586,532.87	Pervious Pavement, Pervious Asphalt, and Pavers	Asphalt and Concrete Sidewalk
Bioretention Swale	$ 645,387.05	$ 290,941.07	Bioretention Swale	Landscaping
Raingarden	$ 408,062.24	$ 104,400.34	Raingarden	Landscaping
Planter Box	$ 47,296.75	$ 9,645.40	Planter Box	Landscaping
Tree Box Filter	$ 128,730.00	$ 6,307.27	Tree Box Filter	Landscaping
Curbing and Medians	$ 86,326.45	$ 86,886.83	Valley Gutter, Type D curb, and Pavement	Type D Curb and Pavement
Stormwater Harvesting	$ 212,621.14	N/A	Stormwater Harvesting	No item correlates
Primary Storm System	$ 398,769.82	$ 818,139.65	Two Dry Retention Ponds	Two Dry Retention Ponds and One Wet Detention Pond
Secondary Storm System	$ 354,529.42	$ 644,946.81	36-inch Pipe, Manhole, DBI C, 36-Inch MES	12-inch & 36-inch Pipe, DBI C, 36-Inch MES
Undeveloped Land	N/A	$ 849,000.00	No item correlates	$200k/acre multi-family; $250k/ acre retail
Totals:	$ 3,023,047	$ 3,396,800		

Enhanced BMP Practices

Maintenance Costs Projections

- Project maintenance costs for each of the LID practices:
  - frequency
  - inspection activity
  - maintenance activity
  - labor/equipment/materials
  - costs of similar traditional stormwater management activities
- Compare example project data
- Compare to national data

Example 10-Year Maintenance Cost Projection

Table PP-2 - Pervious Pavement Projected 10-Year Maintenance Costs*

LID Practice Maintenance Cost Projection

Orange County, Florida

Inflation Rate:	3%	*User input inflation rate. The base rate of inflation is 3%.*

Maintenance Activity	Year										Totals
	1	2	3	4	5	6	7	8	9	10	
Monthly Trash and Debris Removal	$300	$309	$318	$328	$338	$348	$358	$369	$380	$391	$3,439
Triannual Minor Inspection, Cleaning, and Restoration	$405	$417	$430	$443	$456	$470	$484	$498	$513	$528	$4,643
Annual Inspection and Maintenance	$208	$214	$220	$227	$234	$241	$248	$255	$263	$271	$2,379
Annual Compliance Report	$300	$309	$318	$328	$338	$348	$358	$369	$380	$391	$3,439
										Total 10 Year Maintenance Cost:	$13,900

Green shading indicates cell can be manually edited.

Purple shading indicates cell result of formula calculation and should not be manually edited.

Notes:

*Costs are projected to the specific year from 2013 (year 1) dollars using a base inflation rate of 3%.

**Refer to Table PP-1 for annual maintenance cost assumptions.

Traditional vs. LID Maintenance Cost

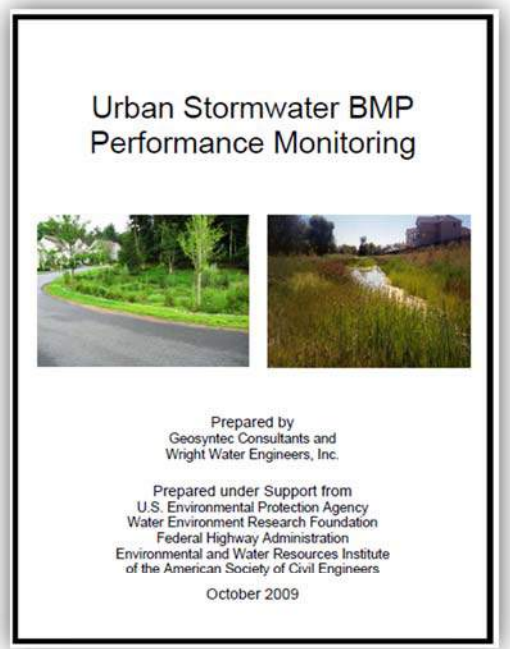
Maintenance Scenario	Design Practice Size	Estimated Annual Maintenance (2013 Dollars)	Estimated 10-Year Maintenance (3% inflation)
Pervious Pavement	36792 sf	$1,333	$15,278
Bioretention	73846 sf	$11,367	$130,311
Rain Garden	26498 sf	$5,877	$67,377
Planter Box	2448 sf	$1,804	$20,684
Tree Box Filter	10 boxes	$1,586	$18,722
Curb Cuts / Inverted Medians	N/A	N/A	N/A
Stormwater Harvesting (w/ Cisterns)	134528 gal	$9,120	$104,548
Dry Retention Pond	92522 sf	$11,303	$133,462
	Totals:	**$42,390**	**$490,382**

Maintenance Scenario	Design Practice Size	Estimated Annual Maintenance (2013 Dollars)	Estimated 10-Year Maintenance (3% inflation)
Dry Retention Pond	132,675 sf	$15,880	$187,512
Landscaped Area	30,546 sf	$5,889	$69,542
Swale	73,843 sf	$8,779	$103,663
Wet Detention Pond	63,319 sf	$4,451	$49,095
	Totals:	**$34,999**	**$409,812**

Monitoring

Monitoring

- **Importance of Monitoring**
  - **Establish Baseline**
  - **Compare influent to effluent concentrations**
  - **Account for Volume Reduction**
  - **Confirm pollutant loading estimates**
  - **Compare effluent concentrations to receiving water standards (numeric nutrient criteria)**
  - **Long Term Monitoring Ideal – the More Data the Better**



Urban Stormwater BMP
Performance Monitoring

Prepared by
Geosyntec Consultants and
Wright Water Engineers, Inc.

Prepared under Support from
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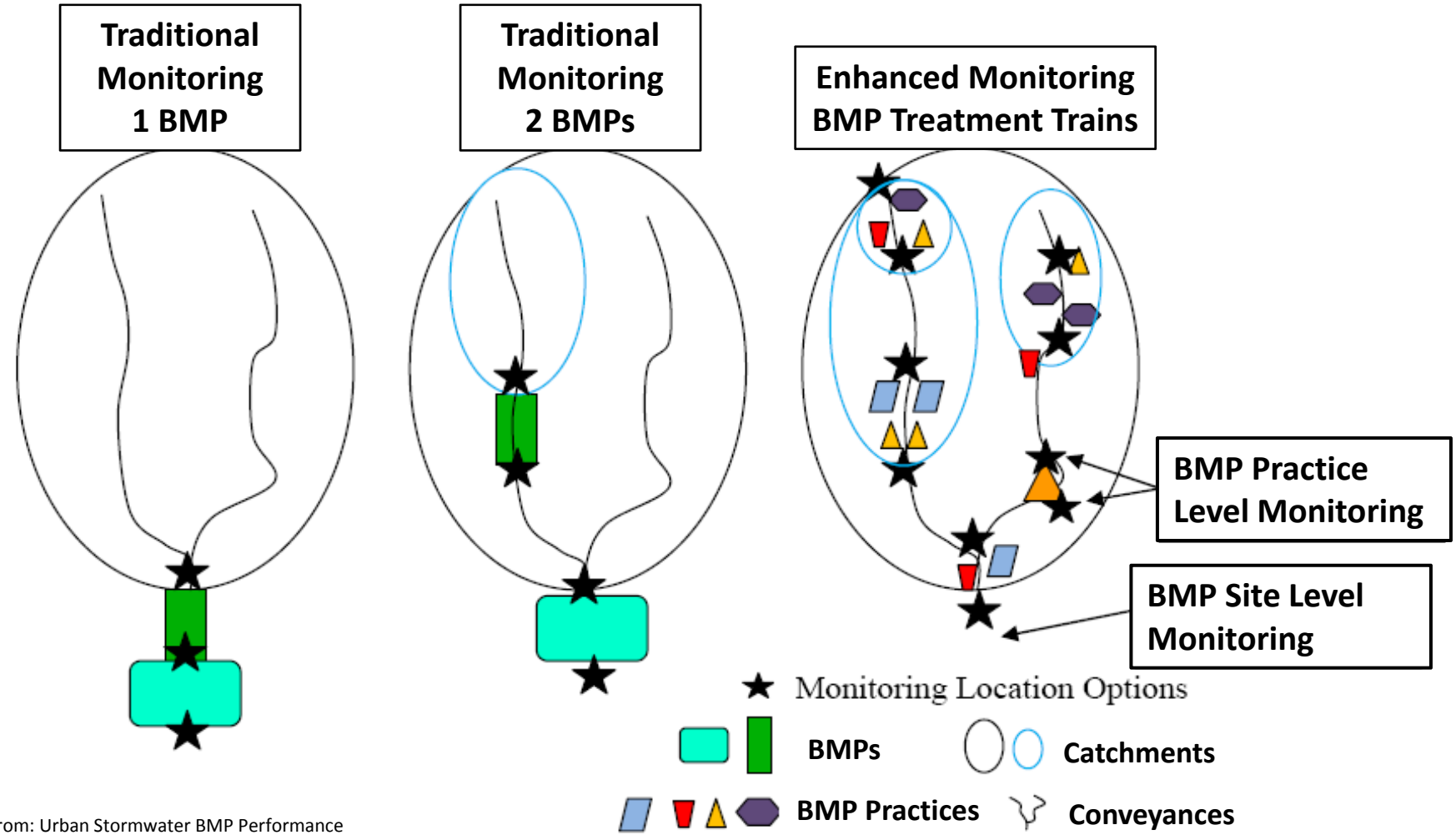
Water Environment Research Foundation
Federal Highway Administration
Environmental and Water Resources Institute
of the American Society of Civil Engineers

October 2009

Monitoring

Example of Traditional vs. Possible Enhanced BMP Monitoring with Treatment Trains



Adapted from: Urban Stormwater BMP Performance Monitoring, Geosyntec/WWE, 2009

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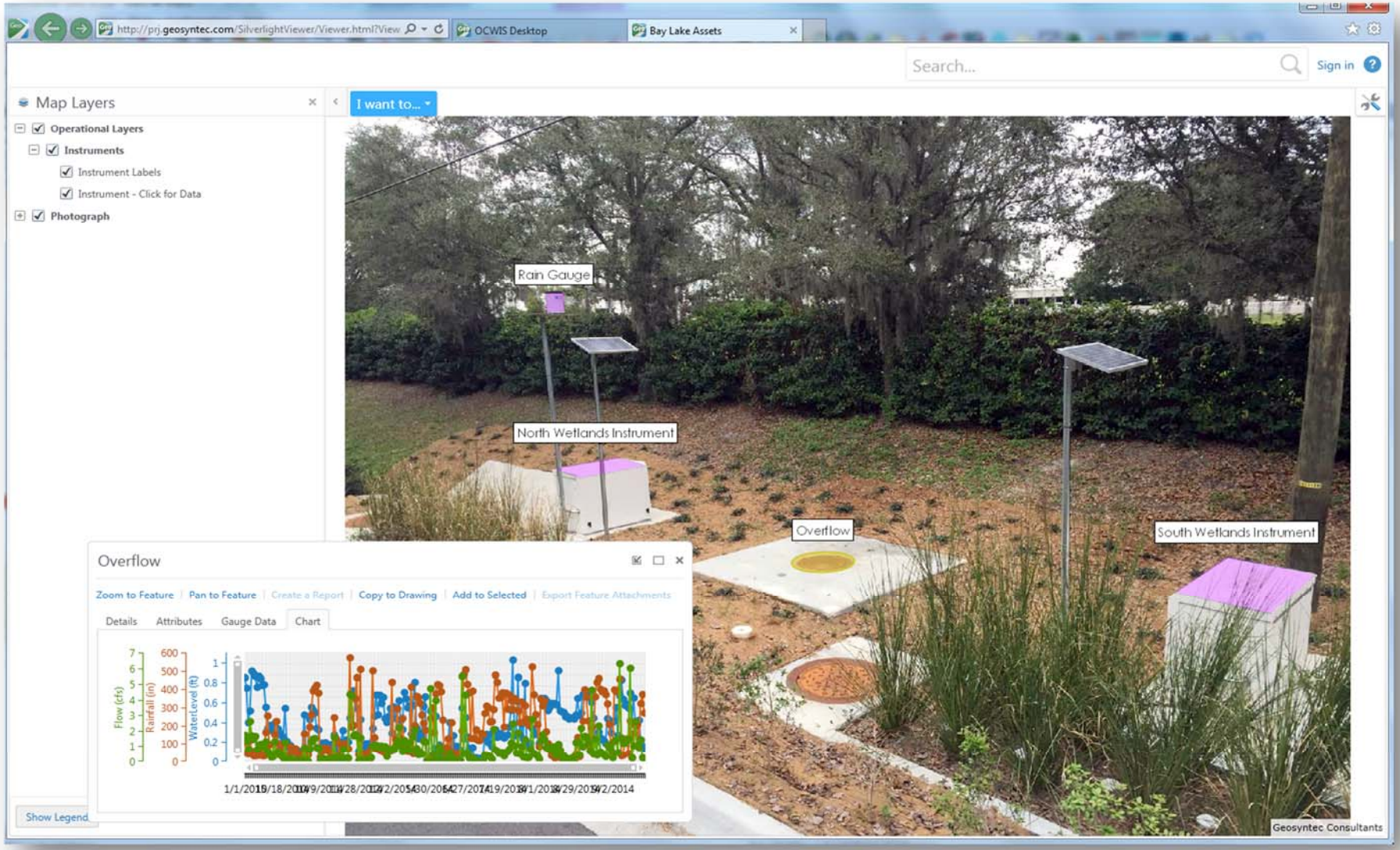
Monitoring



Monitoring

- **Impact of not Monitoring**
  - **Rely on presumptive performance**
  - **Actual concentrations not quantified**
  - **Irreducible Concentrations not identified**
  - **Actual Mass Loadings not quantified**
  - **Other Load Sources not Accounted for (baseflow, septic, industrial, etc.)**
  - **Numeric Limits not Addressed**

Monitoring

- **Significant Cost**
  - **Accurately Project Receiving Water Requirements**
  - **Accurately Project Long Term Needs**
  - **Allocate Budget During Design Estimates**
  - **Outside Funding**
    - **Research Grants**
    - **Academic Partnerships**

Thank You !

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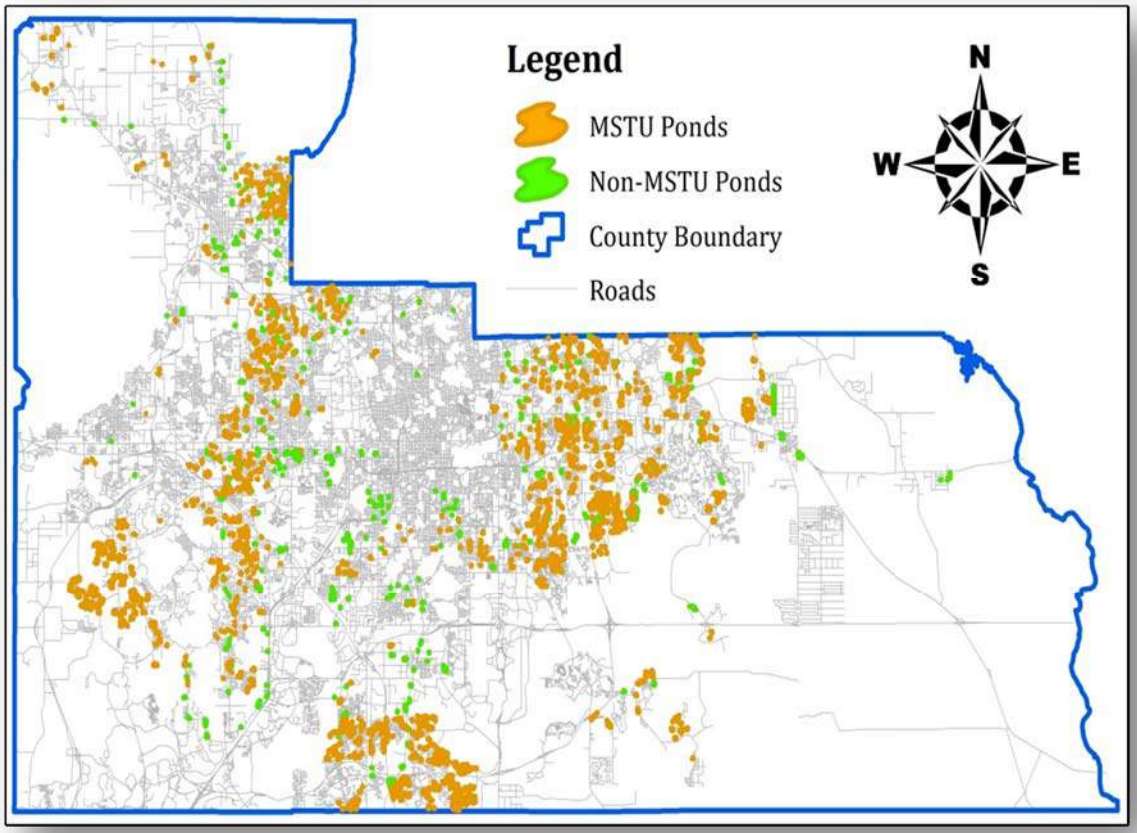
Sustainability

Sustainable Pond Maintenance

- **Pond Sustainability Study**
  - Paradigm of traditional BMP maintenance
  - Millions spent annually on mowing, spraying, etc.
  - Can sustainability save money ?
  - What if grass replaced with vegetation requiring no/little maintenance ?
  - Can Pond Functionality be Maintained ?
  - Public Acceptance ?

Sustainable Pond Maintenance

- **Over 1600 stormwater ponds maintained**
  - **Wet and Dry**
  - **Varying Soil Types**
  - **Varying Landuses**
  - **Varying Demographics**
- **Choose Example Ponds to Evaluate Concept and Estimate Benefit-Cost**



Sustainable Pond Maintenance

Typical Orange County Stormwater Ponds

Dry Retention Pond

Wet Detention Pond

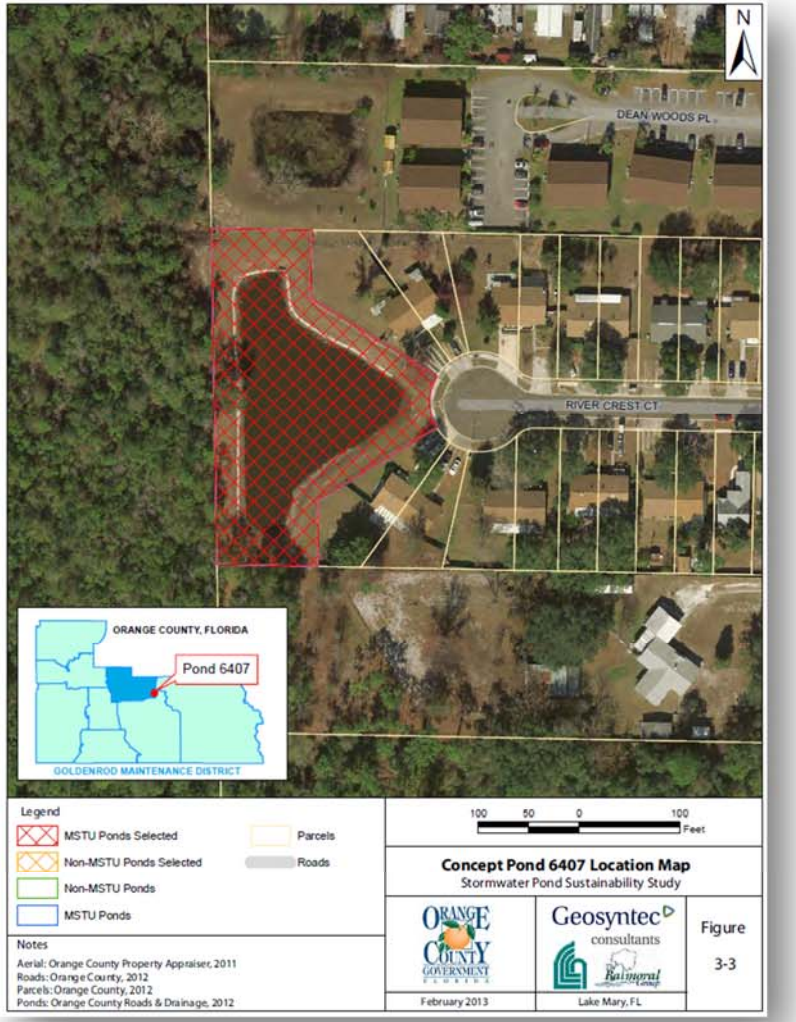
Sustainable Pond Maintenance

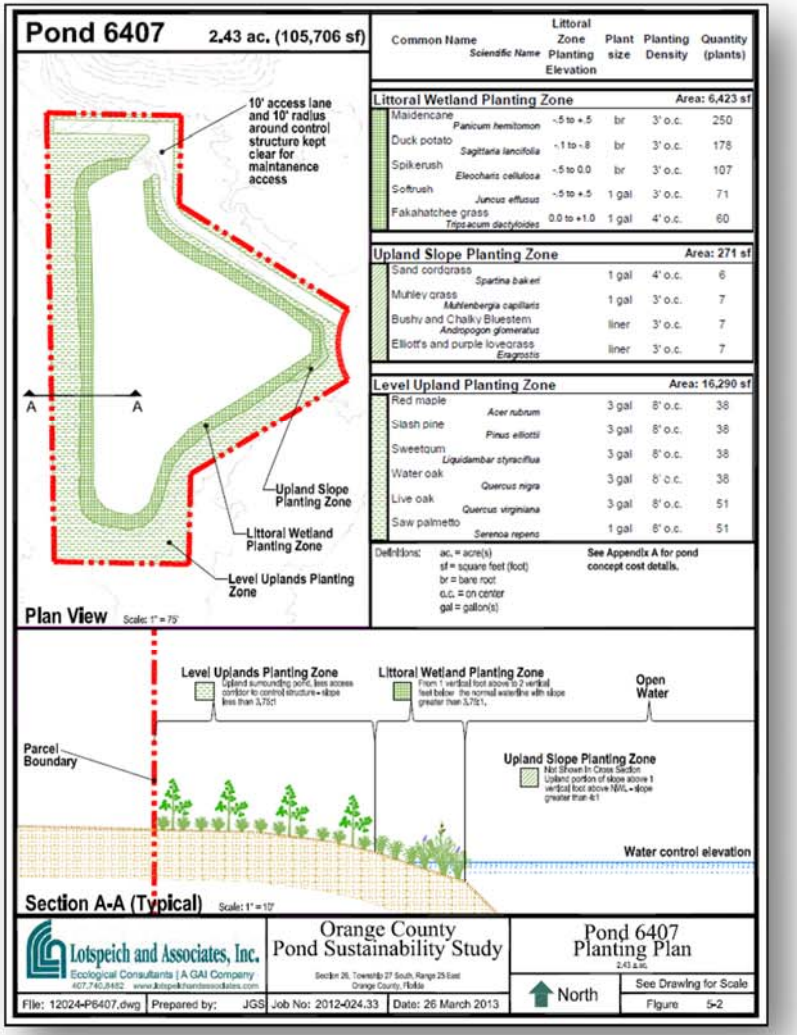
Typical Vegetated Stormwater Ponds

Dry Pond

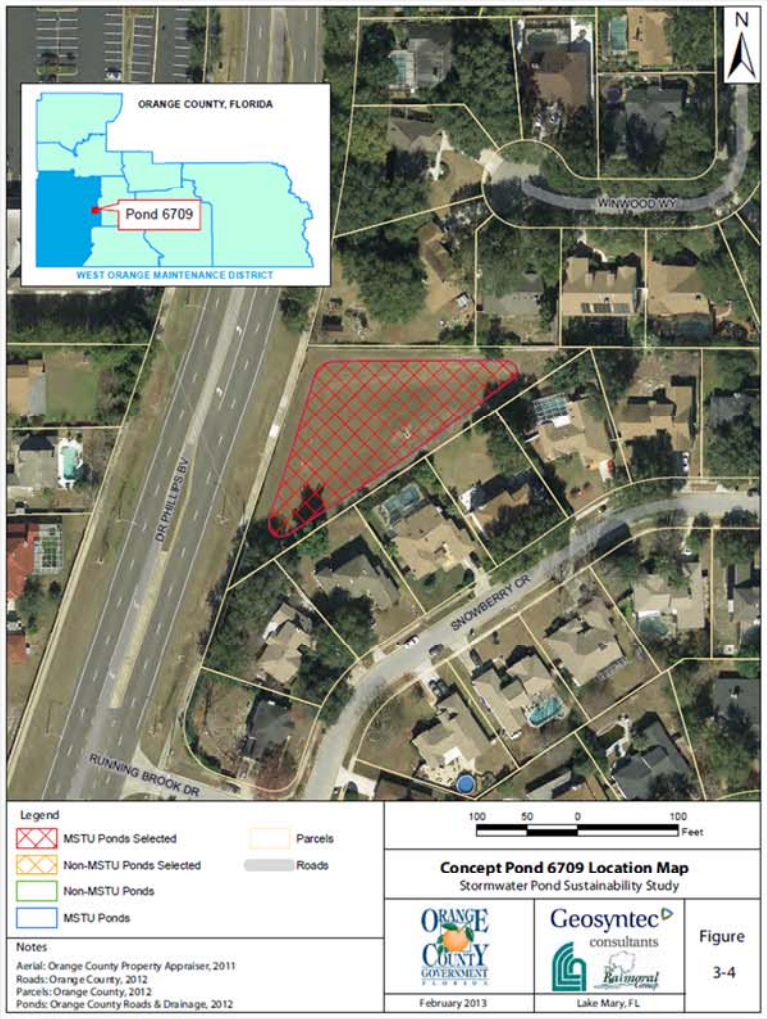
Wet Pond

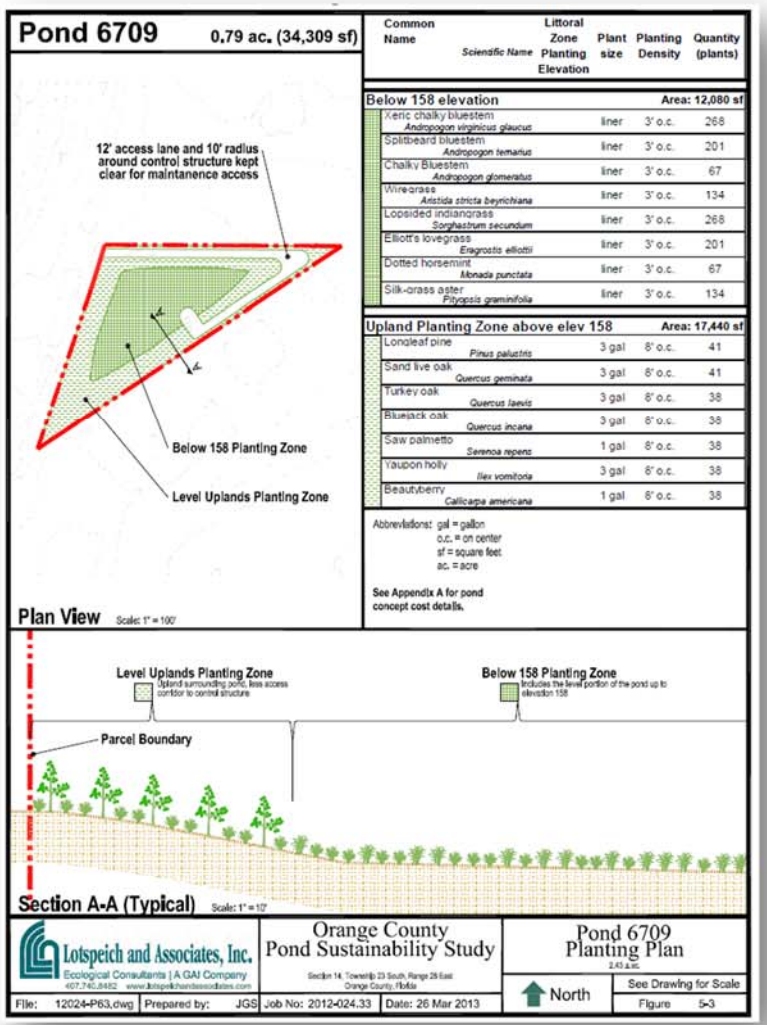
Sustainable Pond Maintenance





Sustainable Pond Maintenance





Sustainable Pond Maintenance

Summary of Benefit Cost Analysis of Concept Ponds – 10 Year Projection

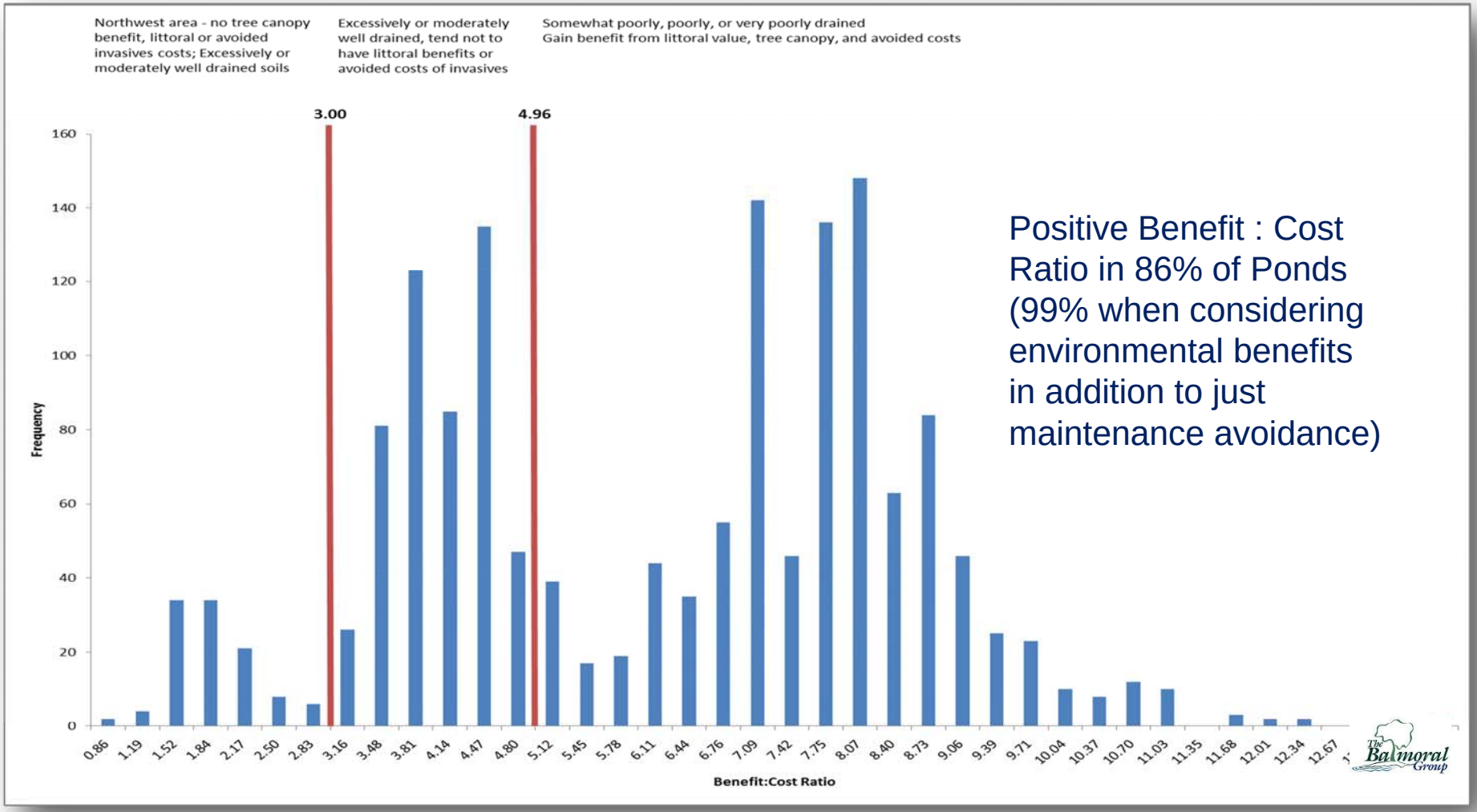
Pond ID		Concept Pond Physical Characteristics							Total Estimated Cost of Vegetative Plantings Concept	Scenario 1 Avoided Maintenance Cost Only			Scenario 2 Avoided Maintenance Cost with Environmental Factors Included		
	Total Acreage (GIS)	Total Planting Acres	Wet or Dry	Irregular or Uniform Shape	Soil Type	MSTU or Non-MSTU	Slope > 4:1?	Adjacent Residential?		Total Benefits	Difference	Benefit-Cost B:C Ratio *	Total Benefits	Difference	Benefit-Cost B:C Ratio *
0063	8.62	7.40	Dry	Uniform	Poorly Drained	Non-MSTU	No	Yes	$82,290	$62,084	-$20,206	0.75	$85,424	$3,135	1.04
6407	1.13	0.53	Wet	Irregular	Poorly Drained	MSTU	No	Yes	$14,659	$26,152	$11,493	1.78	$46,571	$31,913	3.18
6709	0.76	0.68	Dry	Uniform	Moderately Well Drained	MSTU	No	Yes	$15,410	$17,237	$1,827	1.12	$35,278	$19,868	2.29
6942	2.39	1.18	Wet	Uniform	Somewhat Poorly Drained	Non-MSTU	No	Yes	$21,275	$24,146	$2,871	1.13	$58,563	$37,289	2.75
7157	41.78	21.29	Wet	Uniform	Poorly Drained	Non-MSTU	No	Yes	$169,925	$308,274	$138,349	1.81	$1,036,899	$866,974	6.10
7536	1.68	0.79	Wet	Irregular	Poorly Drained	MSTU	No	Yes	$17,328	$16,525	-$803	0.95	$39,877	$22,549	2.30

Notes:
* B:C ratio > 1.0 indicates feasibility of concept.

Environmental Benefits Included:
Water Quality Improvement, Increased Habitat Value,
Increased Tree Canopy (Carbon Sequestering)

Sustainable Pond Maintenance

County-wide Benefit : Cost Ratio Results for Orange County Stormwater Ponds



Positive Benefit : Cost Ratio in 86% of Ponds (99% when considering environmental benefits in addition to just maintenance avoidance)

Sustainable Pond Maintenance

Potential Countywide Cost Savings Summary – 10 Year Period

Lower Bound	Pond Count	1179
Expected Benefit	**Cost**	**Difference (Savings)**
$44,006,795	$21,188,062	**$22,818,733**

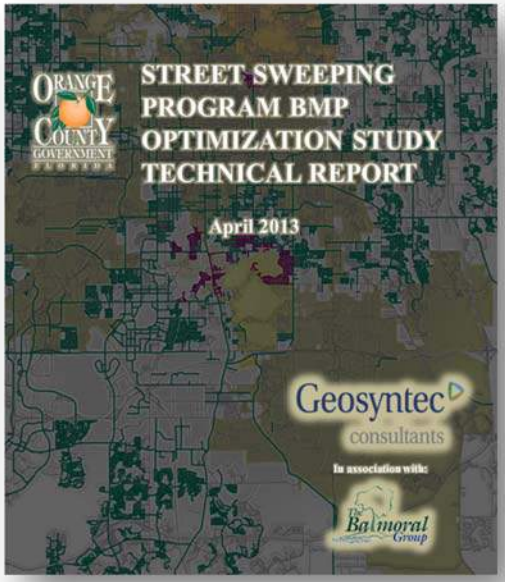
Upper Bound	Pond Count	1355
Expected Benefit	**Cost**	**Difference (Savings)**
$50,233,061	$23,858,240	**$25,743,166**

Note that this projected savings based on a County-wide implementation under "steady state" conditions. Actual implementation of a comprehensive program would be expected to be applied over 10+ year period. Pond would require some increased maintenance during early years until vegetation fully established.

Maintenance BMPs

Maintenance BMPs

- **Street Sweeping BMP Optimization**
  - **Maintenance Related BMPs**
    - **Street Sweeping**
    - **Catch Basin / Storm Inlet Cleaning**
    - **BMP Unit Cleaning (Baffle Boxes, Hydrodynamic Separators, etc.)**
  - **Current Contract just based on frequency and curb miles**
  - **Where to optimize?**



Maintenance BMPs

Maintenance BMPs: Street Sweeping, Catch Basin/Inlet Cleaning, Baffle Box/Hydrodynamic Separator Units

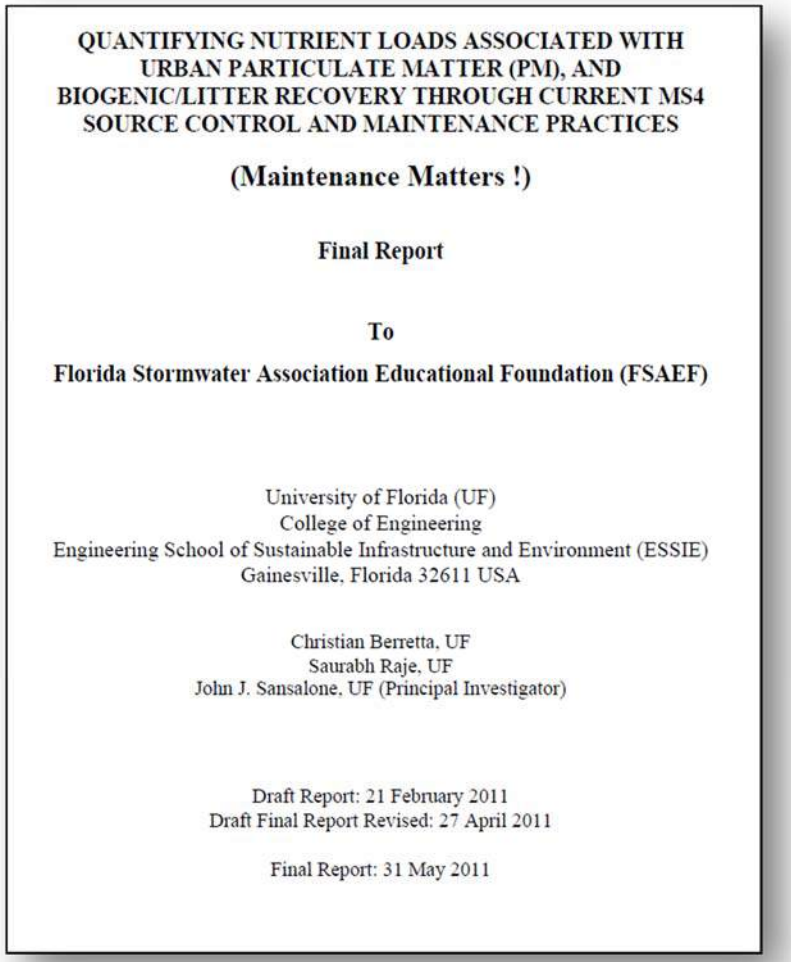





Photo Source: Presentation - *Use of the FSA MS4 Assessment Tool*, FSA, July 2012

Maintenance BMPs

- Quantifying Nutrient Reduction Credit for Maintenance BMPs
- Approved for TMDL Pollutant Load Reduction Allocations
- Assumed Nutrient Removal Based on Statewide Sampling
- The More Material Removed the more Credit
- Question – How to Maximize Material Removed ?



QUANTIFYING NUTRIENT LOADS ASSOCIATED WITH URBAN PARTICULATE MATTER (PM), AND BIOGENIC/LITTER RECOVERY THROUGH CURRENT MS4 SOURCE CONTROL AND MAINTENANCE PRACTICES

(Maintenance Matters !)

Final Report

To

Florida Stormwater Association Educational Foundation (FSAEF)

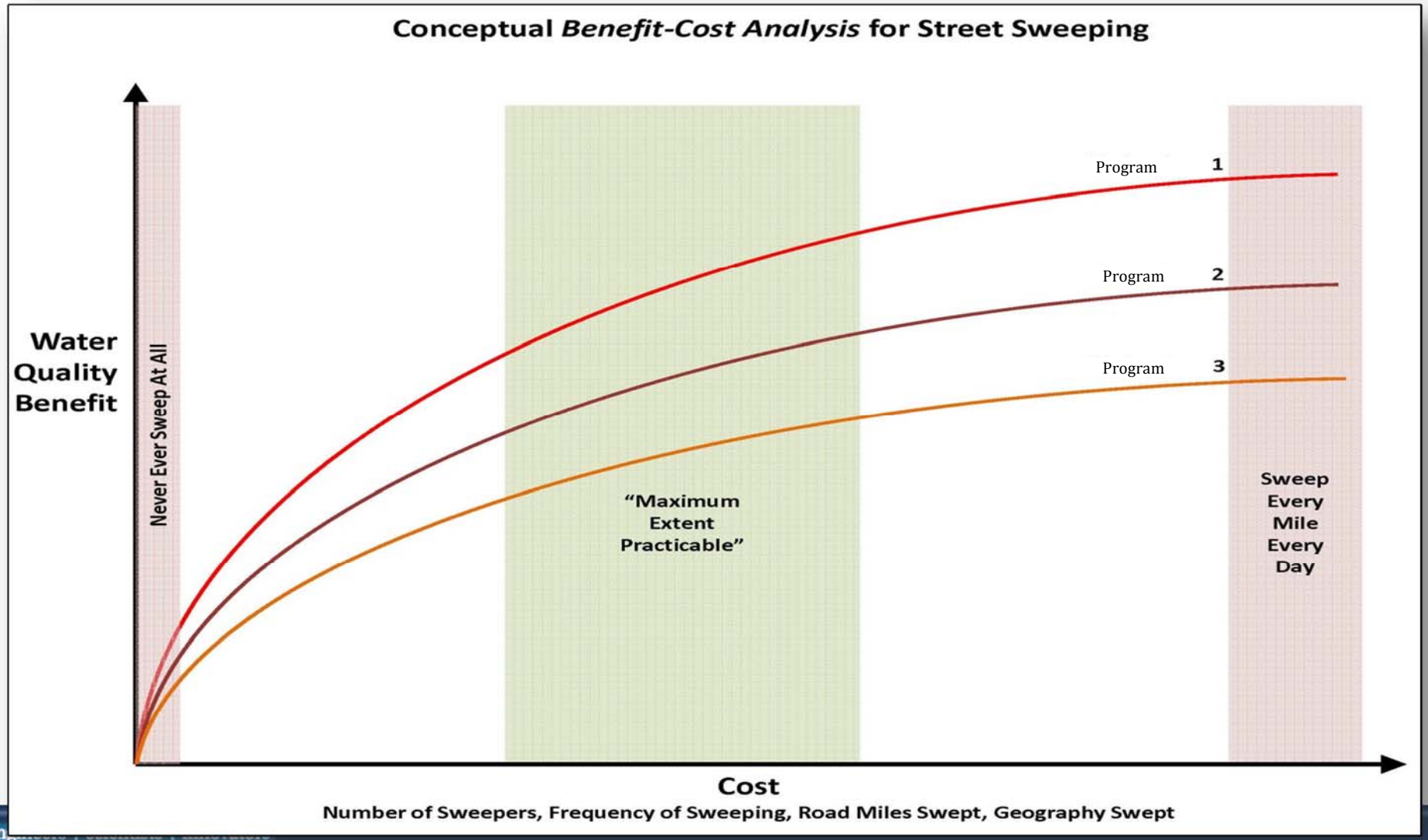
University of Florida (UF)
College of Engineering
Engineering School of Sustainable Infrastructure and Environment (ESSIE)
Gainesville, Florida 32611 USA

Christian Berretta, UF
Saurabh Raje, UF
John J. Sansalone, UF (Principal Investigator)

Draft Report: 21 February 2011
Draft Final Report Revised: 27 April 2011

Final Report: 31 May 2011

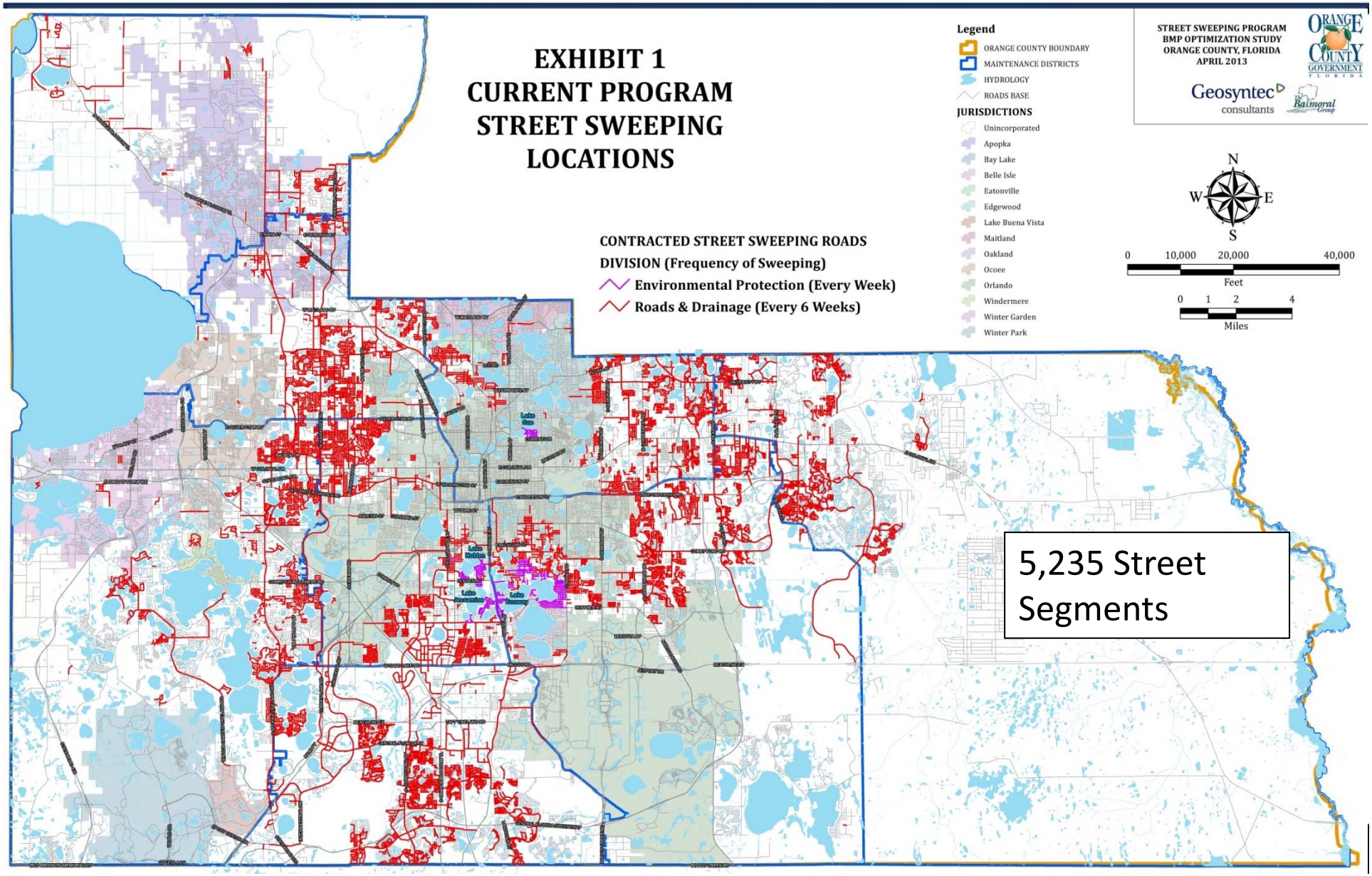
Maintenance BMPs



Maintenance BMPs

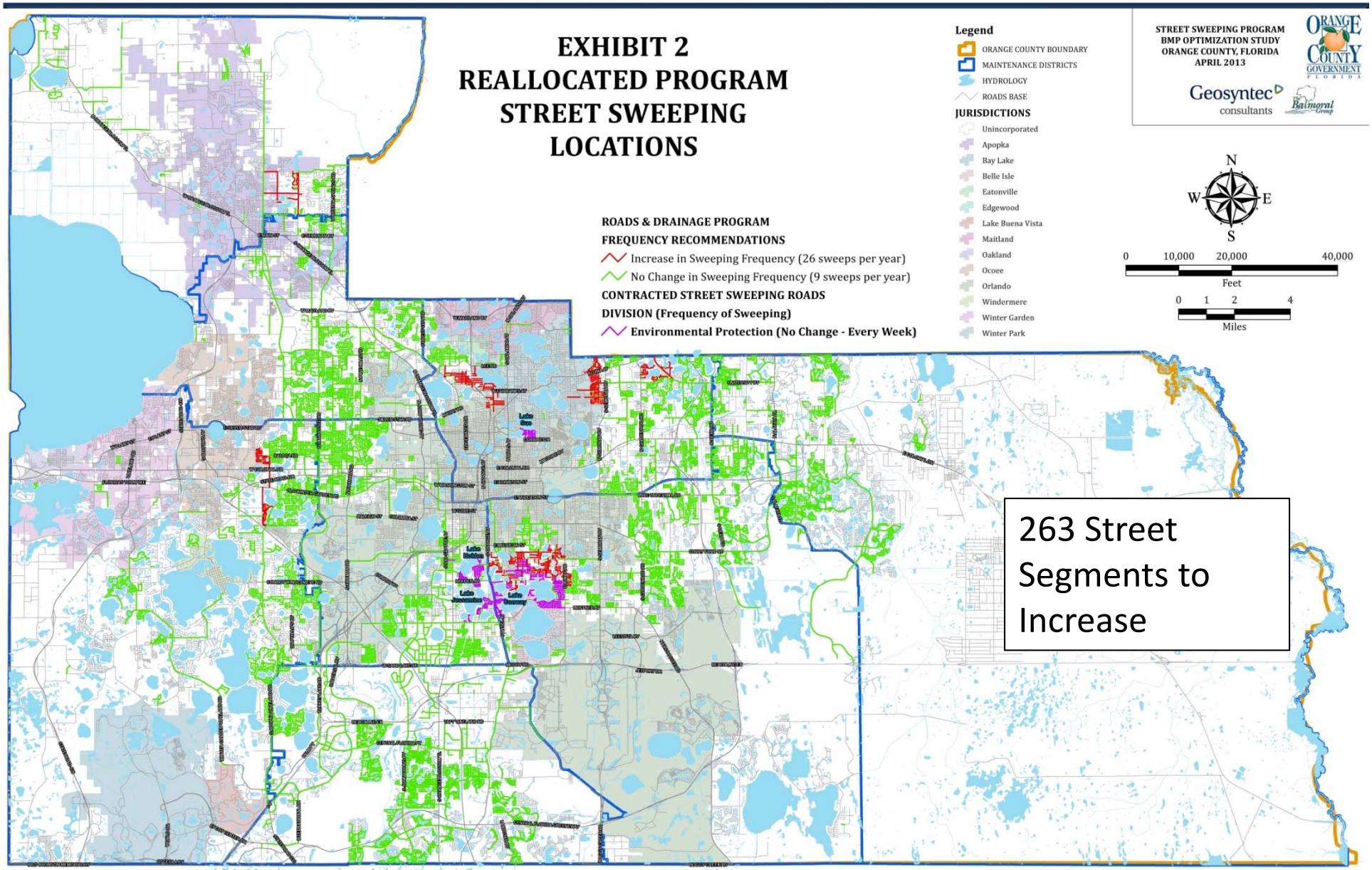
- **Data Needs – How to do Better Analysis ?**
  - **Geography - Track Where Street Sweeping Loads Come From**
    - **GPS Tracking**
    - **Impaired Waters**
  - **Frequency Analysis**
    - **Tree Canopy Coverages**
    - **Seasonality**
  - **Micro-manage Analyticals**
    - **Segregate Based on Particle Size**
    - **Bulk Density**
    - **Moisture Content**

Maintenance BMPs



5,235 Street Segments

Maintenance BMPs



263 Street Segments to Increase

Maintenance BMPs

Estimated Average Removal Costs:
$1,900/lb for TN
$10,500/lb for TP
Source: TMDL database for Florida Best Management Practices, 2009

- **Cost Impact**
  - **Existing Street Sweeping Program = ~$1.9 million Annually**
  - **Optimized Street Sweeping Program**
    - **Increase Phosphorus Removal of 28 tons**
    - **Increase Nitrogen Removal of 97 tons**
  - **Cost to Remove Nutrients**
    - **FDEP - Remove 1 ton phosphorus from waterways at $63 million**
    - **FDEP - Remove 1 ton nitrogen from waterways at $18 million**
    - **Tampa Bay Nitrogen Management Consortium - $200k per ton Nitrogen**
  - **Possible Cost Offset ~$19+ million ?**